1

INTRODUCTION

Background

Capra hircus (Goat) is one of the important domestic livestocks as a source of dairy, meat and manure. Goats are primarily reared for meat and manure and regarded as the second important animal species (first being buffalo) for generating their cash income by farmers (Gatenby *et al*., 1990). Goats are supposed to be the first farm animals domesticated (Zenuer, 1963 and Devendra, 1998) and is believed that domestication of goats occured in western Asia (Harris, 1962) and gradually reached the Indian sub-continent and later to South East Asia (Nazawa, 1991).

Goats are widely distributed from arid semi-desert to humid rainforest regions. The world population of goats in 2000 has been estimated 820 million of which 123 millions (15 percent) are in India alone (FAO production year book, 2000).

Livestock farming is an integral part of the farming system and goat contributes substantially in the livestock sector of Nepal. Goat, in Nepal has been acclimatized and adopted to a wide range of environmental conditions. It can maintain itself in a harsh environment (Devendra *et al*.). The identified breeds of goats in Nepal are Chyangra, Sinhal, Khari and Terai (Kharel, 1997).

The ruminant livestock population in Nepal in the year 2004/05 is 816,727 goats and every rural household keeps an average 0.19 goats (VEC: National Information, 2005). The population of goats in 2006 increased up to 7,421,623 with an average 0.57 goats per rural household (VEC: National Information, 2006). The national production is unable to fulfill the need of Nepal, hence significance number of goats are imported from neighboring countries. About 74 percent of goats are brought from India and 26 percent from different parts of Nepal in the Kathmandu market (3rd NASc Conv., 1998/1999). In the year 2006, Nepal imported 351,105 goats through the main routes Nepalgunj, Kakarvitta, Bhairahawa, Janakpur, Birgunj and Mahendranager. However, a small

number of goats are exported every year. In 2006, 5385 goats were exported (IELA and LP Nepal, 2006).

Traditionally, meat and meat products originating from all domestic animals except cattle are consumed in Nepal. Animal slaughter is a common practice not only for consumption but also for religious sacrifices and traditional ceremonies.

Meat production in Nepal is largely based on small holder subsistence production system except for some recently developed units of commercial poultry in few pockets of the country. Among the farm livestock reared by the farmers in Nepal, goats are reared for the outputs to contribute for meat supply.

The population of goat and meat production is estimated to be 6.6 million and 0.4 metric ton respectively, which contributed 19.4 percent to the total meat production of the country (MOAC, 2002). Nepal produced about 42,320 metric tons goat meat in the year 2006 (VEC: National Report, 2006) and the annual production of meat per household was 51.54 Kg in the year 2006.

Goats are relatively resistant to many diseases compared to the other livestock species. At present internal parasites, Peste des Petits Ruminants (PPR) and contagious Caprine Pluro-Pneumonia (CCPP) are the diseases that can be major threats in unmanaged farming systems. Gastro-intestinal parasitic diseases are regarded as the most important constraint to reduce the productivity of sheep and goats in Nepal. Lohani and Rasaili (1995) calculated the economic loss due to animal diseases to be about 885 million rupees (Equivalent to 17.7 million US$) (based on a survey data from six districts of the country). In sheep and goats, the losses due to parasitic diseases was estimated to be about 1.5 million US$ and 0.25 million US$ respectively at a price level of 1995. Joshi (1996) reported that the total annual loss due to parasitic gastroenteritis alone would be about 9.2 million US$.

Among different parasitic infections, helminth diseases are most varied and of common occurrence. Different grades of infections with fluke, tapeworms and

roundworms, are responsible for marked deleterious effects that tend to lower overall production both by the way of morbidity and mortality.

Infection with gastrointestinal nematodes is regarded as one of the important factor causing productivity loss (Shrestha, 1994). The most important and widely prevalent nematodes are *Haemonchus, Ostertagia, Trichostrongylus, Cooperia, Mecistocirrus, Nematodirus, Oesophagostomum* and *Bunostomum.* These nematodes in the small intestine may cause severe damage to the intestinal mucous membrane. *Toxocara* sp, *Dictyocaulus* sp (filarial nematodes) has the worldwide distribution and the prevalence is higher in cattle and buffaloes (Karki, 2005).

Cestodes found in gut and acquired by eating contaminated food or water found to be largely affecting the ruminants. This group comprises the genera *Moniezia* which are cosmopolitan is distribution and *Taenia* which are commonly found in the rumen of the domesticated and wild carnivores. They have reported from Asia and Africa (Karki, 2005).

Trematodes commonly known as flukes, often live in the bile duct or small intestine and may also affect the lungs. Their eggs are passed with the faeces of the host. Some are ingested but some burrow into the skin after hatching for access. Trematodes especially include *Faciola* sp, *Dicrocoelium* sp, *Schistosoma* sp and *Paramphistomum* species.

Fascioliasis is a well known parasitic infection of herbivorous animals. It has worldwide distribution on the animal reservoir host. The different local names of this disease such as namle, mate, lew etc in different regions are the proof of its continued existance for many years in the animal population of the country. Infection of *Fasciola* sp. causes significant loss estimated at over US$ 2000 million per annum to the agriculture sector worldwide with over 600 million animals affected (Boray, 1985, Hillyer and Apt, 1997). The economic loss due to fascioliasis in Nepal was estimated to be Rs. 14.2 corer (Lohani and Rasaili, 1995). Infection of the human host was very sporadic until the last two decades when clinical cases and outbreaks were reported. It

has now become an important emerging food borne trematode of increasing concern (Chen and Mott, 1990). The largest numbers of infected people have been reported in Bolivia, China, Ecuador, Egypt, France, Islamic republic of Iran, Peru and Portugal (WHO, 1995).

The pathogenic effects of gastro-intestinal parasites may be sub-clinical or clinical. Young animals are most susceptible. The effect of these parasites is strongly dependent on the number of parasites and nutritional status of the animal they are infecting. The clinical sign comprise of weight loss, reduced feed intake, diarrhea and reduced yield. Severe blood and protein loss into abomasums and intestine due to damage caused by the parasite often results in oedema in the sub-mandibular region. Some nematode species especially *Haemonchus* is most pathogenic among blood suckers and infections with large number of this parasite often results in severe anemia in the host. Bloodloss from *Bunostomum* and *Oesophagostomum* infections may add to the severity of the anemia. Infections with gastrointestinal nematodes usually occur by the ingestion of eggs by the young kids. These nematodes damage the mucous membrane of the small intestine, migrating larvae may cause damage to the liver and lungs and cause severe anemia and diarrhea to the host. Mixed infections with gastro-intestinal nematodes are very common.

The important *Lymneae* species of snail involved in the transmission of fascioliasis, vary in their geographical distribution in the world. Man and herbivorous animals (sheep, goat, cattle, buffalo etc.) acquire infection by the ingestion of moist and raw aquatic plants such as water grass, harbouring infective metacercariae. The metacercariae mature to become adult worms and lay eggs which are passed in the faeces. On coming in contact with water, they mature and invade the molluscan host, the freshwater snail and undergo development. The mature cercariae emerge out of the snail and encysted on aquatic grasses, plants and develop into metacercariae which is the infective stage of the parasite. Similarly, Dicrocoeliasis is caused by the liver fluke *Dicrocoelium* spp, a common parasite of biliary passages of sheep and other herbivorous and omnivorous animals. Most of the human infections occur by the ingestion of liver of infected sheep goat. Taeniasis, a zoonotic infection caused by the cestode *Taenia* sp, is an

intestinal infection of man, acquired by the ingestion of uncooked or inadequately cooked beef or pork containing the infective cysticcrei. Trichostrongyliasis is an infection of the gastro-intestinal tract of herbivorous animals and man is the accidental host, caused by the members of the genus *Trichostrongylus.* The infection is acquired by the ingestion of contaminated vegetables or drinks with the third stage larvae. Strongyloidiasis is an intestinal infection of man caused by the penetration of the skin by the filariform larvae of *Strongyloides stercoralis.* Toxocariais (visceral larva migrans) in human is widely distributed throughout the world, in both temperate and tropical countries. Man acquires infection accidentally by the ingestion of the larvae of this nematode in the inadequately cooked food of paratenic host.

Significance of the Study

There is insufficient information to the people, describing the pathogenecity of helminth parasites of livestock in different parts of globe. Public and butchers are not aware of the meat borne diseases and zoonotic diseases.

In this study, entitled "Intestinal Helminth Parasites of Goats", an effort has been made to identify the prevalence of different helminth parasites of goats. Scanty work has been done previously in Nepal on this issue.

This study will also form a base for the future investigators, those working on livestocks.

2

OBJECTIVES

General Objective

- To study the intestinal helminth parasites of goat brought to Khasibazar, Kalanki (Kathmandu) for slaughter purpose.

Specific Objectives

- To identify intestinal helminth parasites.
- To determine the general prevalence of intestinal helminth parasites.
- To determine the prevalence percentage of trematodes, cestodes and nematodes.
- To determine the intensity of infections.

3

LITERATURE REVIEW

Parasitic zoonoses are distributed world wide and constitute an important group of diseases affecting both the human and animals. Many of the parasitic zoonoses produce significant mortality and morbidity in the human and are responsible for the major economic loss by affecting the animal health. Most of the papers have been presented and published largely after the outbreak of helminthic diseases among human and animals. Literatures exist in helminth parasites as the diseases continued to survive with new threats. Major research efforts that have been directed towards helminth parasites, the portions of the work and reports related to the epidemiology of helminth parasite have been mentioned here.

In Global Context

Tembely *et al*., (1983-1985) conducted an investigation of helminth parasites in 284 sheep and 318 goats in Mali. They reported 9 nematode species *Trichostrongylus columbriformis, Strongyloides ovis, Haemonchus contortus, Gaigeria pachyscelis, Strongyloides papillosus, Oesophagostomum colombianum, Trichostrongylus axei, Cooperia pectinata and Cooperia punctata;* 3 terematode species: *Fasciola gigantica, Dicrocoelium nospes, Paramphistomum* spp and *Carmyerius* spp,one larval *(Cesticercus tenuicollis)* and three cestodes *Moniezia, Stilesia and Avitellina*.

Muimo (1988) conducted a study on seasonal fluctuations of Trichostrongylid infection in 30 adult female and 30 kids of Boer goats on two commercial farms in Lusaka Zambia. Observations included faecal egg counts in every 14 days and larval culture and haematological indices every month. Eggs per gram in adults and kids peaked in February (rainy season) and in March and began to fall at the start of dry season, in May. Larval differentiation from faecal cultures showed that *Strongyloides papillosus, Haemonchus contortus, Oesophagostomum columbianum* were the most prevalent species.

Jithendran and Krishna (1990) conducted a study on prevalence of helminthiasis in small ruminants in Palampur (Himanchal Pradesh, India). Faecal examination of 325 goats was done and 93 percent goats were found to be infected with *Strongyloides* and species of *Fasciola.*

Ndao *et al*., (1991) conducted an epidemiological survey on gastrointestinal helminthiasis in 51 sheep and 51 goats on Senegal from October 1990 to September 1991. All the animals examined were infected with at least one helminth species. Three trematodes (*Fasciola gigantica, Schistosoma bovis, Amphistomum* spp), 2 cestodes (*Moniezia, expansa, Cysticercus tenuicollis)* and 9 nematodes were identified. The most important parasite in goat was *Trichostrongylus colubriformis,* while *Haemonchus contortus* in sheep.

Jithendran (1993-1997) examined the status of helminth parasites in goats and sheep in Palampur (Himanchal Pardesh) by using standard coprologic parasitological procedure and recorded the prevalence of predominant nematode species of *Strongyloides, Trichostrongylus, Haemonchus* and *Oesophagostomum, Fasciola, Dicrocoelium* and *Schistosoma* among the trematodes and *Moniezia* among the cestodes.

Faizal, Rajapaksha & Rajapaksha (1999-2000) conducted a study on comparative weight gains in Anthelmintic treated crossbred goats turned out in the rainy and dry seasons in the dry zones of Srilanka. During this study, *Haemonchus* (72 percent), *Trichostrongylus* (15 percent) and *Oesophogostomum* (13 percent) were the genera of nematodes present in the untreated goats.

Silvestre *et al.,* (2000) studied the relationship between helminth species diversity, intensity of infection and breeding management in dairy goat farms of South Western France. A total of 17 helminths, among which 14 nematodes, one cestode (*Moniezia* sp) and two trematodes (*Paramphistomum* and *Dicrocoelium)* were recorded.

Mondal *et al.,* (2002) conducted a study of gastrointestinal helminth in livestock grazing is grassland of Bangladesh. They released two cow calves and two goats in a grassland used for commonal grazing of livestock. After slaughtering of the tracer

animals, their gastrointestinal examination revealed six species of nematode and one cestode. The nematode species were *Haemonchus contortus, Trichostrongylus axei, Mecistocirrus digitaus, Oesophagostomum* sp, *Trichuris* sp and *Bunostomum* sp. The cestode was one of the genus *Moniezia*. With this study, grasslands are thought to be one of the main sources of gastrointestinal parasitic diseases of livestock in Bangladesh.

Wanjala *et al.,* (2002) conducted a research on prevalence of parasitic infections in small ruminants in a post oral community in Narok district, Kenya. The investigation was done in 150 sheep and 150 goats during wet season (May - June) and dry season (August - September) and the findings showed that 52 percent of the animals were infected. The most prevalent genera of helminthes identified were Strongyle group.

Woldemariam (2002-2003) conducted a study on 57 lamb and 53 kid tracers during different seasons in the Mid-Rift valley of Ethiopia. In this study, the predominant worms recovered from 57 lambs were *Haemonchus contortus* (91-100 %) and *Trichostrongylus colubriformis* (90-100 %), followed by *Oesophgostomum columbianum* (33-83%) and *Trichuris ovis* (8-33%). Similarly, *Haemonchus contortus* (95-100%) and *Trichostrongylus colubriformis* (83-100%) were predominant in the 53 kid tracers, followed by *Oesophagostomum columbianum* (58-83%) and *Trichuris ovis* (41-74%). A significant different in eggs count was observed within seasons and sites.

Besier and Love (2003) conducted a study on intestinal parasites in sheep and goats in Australia. In this study, *Haemonchus* spp, *Trichostrongylus* spp and *ostertagia* spp. were predominant helminth parasites.

Regasa *et al*., (2003-2004) were conducted a study on epidemiology of gastro-intestinal parasites of ruminants in western Oromia, Ethiopia. This study showed that the overall prevalence of gastrointestinal parasites were 84.1 percent in goats. Nematodes of group Strongyle and *Eimeria* were the most prevalent parasites encountered in this area.

Yadav *et al.,* (2005) reported the highest incidence of gastro-intestinal nematodiasis in goats followed by buffalo and cattle in India. *Haemonchus,*

Trichostrongylus, Bunostomum, Oesophagostomum and *Strongyloides* species were the main parasites recovered from the intestine of sheep, goats and buffaloes.

Waruiru, Otieno and Mutune (2005) conducted a study on gastrointestinal parasitic infections of sheep and goats in semi-arid area of Machakos district, Kenya. The overall prevalaence were *Strongyloides* (51.6%), *Fasciola* spp (31.5%), *Coccidia* (28.0%), *Moniezia* spp (2.5%) *Haemonchus* (58.0%) was the most prevalent nematode followed by *Trichostrongylus* (29.0%) and *Oesophagostomum* (13 %).

Opara, Nwaobasi, and Okoli (2005) Conducted a study on occurrence of parasitic helminthes among small ruminants rared under traditional husbandry system in Owerri, South East Nigeria. In this study, out of 2,550 small ruminants examined 71.4 percent were goats which have helminth infection rates of 90.1 percent. Nematode infection was consistently high and gave infection rate of 78.4 percent, while trematodes and cestodes were recorded 13 percent and 8.7 percent respectively. Among trematodes, *Paramphistomum* inflection is 86.7 percent, among nematodes *Strongyloides* 62-2 percent and among cestodes *Moniezia* 50 percent were the highest.

In Context of Nepal

The preliminary work on parasitic diseases of farm livestock in Nepal initiated during 1970-72 under a Swiss associated project. Surveys on common parasitic diseases were undertaken in the Kathmandu Valley and in few other districts representing hills, Terai and high mountains (Singh *et al*., 1973). This study determined the prevalence of parasitic diseases (Liverfluke) and carried out the identification of nematode parasites, snail species and some ectoparasites. Following this study, prevalence of parasitic diseases were carried out by other workers in different parts of the country but most of these studies were limited to the examination of dung samples for Liver fluke in buffaloes and cattle (commonly) and very rarely studied the gastro-intestinal parasites of sheep and goats.

Morel (1985), reported the common GI nematode parasites of goats in Pakhribas Agriculture Centre (PAC) and in the Koshi hill regions in the eastern Nepal. These

workers reported *Haemonchus contortus, Trichostrongylus* species, *Nematodirus* species, *Oesophgostomum* spp, *Ostertagia* spp, *Strongyloides* and *Trichuris* as the major nematode parasites present in the animals.

Ghimire (1987) analyzed the incidence of common diseases of livestock in Surkhet Veterinary Hospital and recorded the percentage of parasitic disease to be about 82 percent of the total goat case reported in the hospital of which fascioliasis is the most prevalent (83 %).

Dhakal and Kharel (1988) analyzed the hospital cases at Chitwan Veterinary Hospital and reported the incidence of liver fluke in sheep and goats to be 26 percent and 58 percent and incidence of nematodes to be 14 percent and 5 percent respectively.

Thakur and Thakuri (1992) reported that the prevalence of the parasitic infection was 100 % in goats during the month of July in western Nepal.

Jha *et al.,* (1993) analyzed the autopsy record of 266 goats carried out at Pakhribas Agricultutre Centre, Dhankuta and attributed 6.4 percent mortality in goats due to GI nematodes and 3.7 percent and 1.2 percent mortality due to fascioliasis and paramphistomiasis respectively.

Joshi (1994) recorded 28 percent mortality in goats due to gastro-intestinal nematodes in a sedentary flock at low hill village of western Nepal in which *Haemonchus contortus* was the main worm species involved.

Thakuri (1994) found that the major clinical problem in goat was parasitic diseases which accounted for about 74 percent of the total treated cases of the 20,499. Helminth parasites recorded in the hill district were 34 percent trematodes, 65 percent nematodes and 1 percent cestodes.

Joshi (1995) carried out a detailed study on sheep and goats in western hills of Nepal. In this study during 12 months period, a total of 4090 faecal samples were

analyzed from both migratory and sedentary systems. Prevalence of worm infection ranged between 60-100 percent in ewes, 7-97 percent in lambs, 15-100 percent in adult goats and 6-100 percent in goat kids.

Dhakal, Jha and Basnet (1996) reported the prevalence of GI nematodes in sheep and goats in Pathivara VDC of Sankhuwasawa district to be 100 percent and 85 percent respectively.

Mahato, Harrison and Hammond (1997-2000) reported an epidemiological basis of the control of fascioliosis in Nepal. Despite increased awareness of the diseases and massive increase in the use of anthelmintics, they found no impact of on the prevalence of the diseases in the last 2 decades. Failure to control the disease were mainly due to lack of information about it's epidemiology in the country.

Joshi (1997) carried out a detailed survey on GI parasites of sheep and goats raised under sedentary and migratory management in western Nepal and identified the parasites at the species level. He recorded a total of 20 nematode species in these animals.

Sharma (1998-1999) conducted a study on parasitic infection in animals of Panchthar district. Ascariasis (43.69%) was found to be the most common followed by fascioliasis (40.12%) and paramphistomiasis (16.20%).

Acharya (1999) carried out a study on GI parasites of goat and sheep of IAAS livestock farm and recorded *Haemonchus*, *Ostertagia*, *Chabertia*, *Strongyloides*, *Trichostrongylus*, *Oesophogostomum* and *Cooperia*.

Joshi (2000) conducted a study for a period of one year on the epidemiology and clinical significance of gastro-intestinal nematodes on the health and production of goats raised under the sedentary and migratory managements in the hills and mountains in Nepal. The findings showed that the worm burden in the migratory goats was considerably higher than that in the sedentary (management) goats throughout the year. *Ostertagia* was the predominant nematode genus present in migratory system followed

by *Trichostrongylus* species with a low proportion of *Haemonchus.* In sedentary system, however, the predominant genus was *Trichostrogylus* followed by *Haemonchus.*

Nirmal (2000) conducted a study of major diseases of goats in far western region Nepal. In the study, 71 percent cases were found as parasitic diseases, among which 54.6 percent due to *Strongyloides* and 61 percent due to coccidians.

Kushwaha (2000) conducted an investigation of goat diseases under commercial rearing system from May 1999 to April 2000 in Surkhet. In this study, the prevalence percent age of parasitic disease was 44 percent of which 88 percent due to *Strongyloid* species, 2 percent due to *Ostertagia* species, 7 percent due to *Haemonchus* species and 1 percent due to *Coccidia* species.

Devekota (2005/06) conducted a study on outbreak of parasitic gastroenteritis in goats under sedentary management in a low hill village of western Nepal. In this study, *Haemonchus contortus* was the most prevalent species.

Jaiswal (2006) carried a study on fascioliasis in ruminants at Dhanusa district based on the examination of faecal sample brought to DLSO Janakpur from June 15th to November 15th 2005. Total of 2655 faecal samples were examined out of which 70.70 percent were positive for overall parasitic infestation. Among these, prevalence of fascioliasis was found to be 43.43 percent followed by paramphistomiasis 38.09 percent and round worms 13.43 percent. The prevalence of *Fasciola* infection was found in goat is 31.25 percent in cattle 49.36 percent and in buffalo is 56.02 percent.

Dhital (2006) conducted a study to determine the prevalence of gastro-intestinal parasites in goats at the IAAS livestock farm and Maglapur VDC-2, Chitwan. A total number of seven gastro-intestinal parasites were found from goats. Among them, strongyles types (*Haemonchus, Trichostrongylus, Bunostomum, Cooperia* and *Ostertagia*) and *Nematodirus* were the commonest parasites, where as *Trichuris, Moniezia* and *Oesophagostomum* spp were less common. The faecal sample examination showed that out of 20 samples collected from goats of IAAS farm, 90 percent were positive for eggs of one or more types of GI parasites, where as out of 30 samples collected form Manglapur VDC-2, 76.66 percent were positive for eggs of these parasites.

4

MATERIALS AND METHODS

Study Area

Nepal is one of the richest countries in the world in terms of biodiversity due to unique geographical position and latitudinal variation. Geographically, it is 80^0 4" to 88^0 12" East longitude and 26^0 22" to 30^0 27" North latitude. It is an independent, sovereign and landlocked country bordered by China to the North and India to the East, West and South. It is approximately 885 km in length and it's mean width is 193 km with a total land area of 147,181 sq. km.

The Kathmandu Valley, located in the kingdom of Nepal is the capital city. It stands at an elevation of approximately 4,265 ft (1,300 m). The cities of Kathmandu, Patan and Bhaktapur located in this valley, present a high style of Nepalese art and architecture.

Goats are most demanded common livestock species because of their wide acceptance as a source of animal protein (meat) for all religious and ethnic groups. The population of goat and meat production is estimated to be 6.6 million and 0.4 metric tons respectively which contributed 19.4 percent to the total meat production of the country (MOAC, 2002).

Kalanki of Kathmandu metropolitan city is surrounded by Sitapaila and Balkhu in east and west respectively. The study area ward.no.14 is located near the Kalanki Chouk. The dealing and distribution of goat is done at Khasibazar (Kalanki) for entire places of Kathmandu. Goats are brought to Khasibazar for slaughter purpose from almost all parts of Nepal and boarder area of India like Lucknow, Bahraich (UP) mainly on Sunday, Tuesday and Thursday. In these days, 7-10 trucks carrying 200-250 goats on each are brought.

This study is carried out for the prevalence rate of helminth infection in goats. The stool samples were collected from the study area and brought at Central Veterinary Laboratory, Tripureshwor for laboratory diagnosis.

Study Design

The study is based under laboratory examination.

Study Period

November, December 2006 and May 2007.

Sample Size

A total of 222 stool samples of goats were collected from Khasibazar (Kalanki) ward no. 14 of Kathmandu metropolitan city, which were non symptomatic samples. Mostly the goats brought were from almost all parts of Nepal and boarder areas of India like Lucknow and Bahraich (UP).

To ensure better condition during sample collection, the following precautions were taken.

a) The fresh stool samples were taken.

b) The samples were collected in airtight container to prevent desiccation.

c) 3-4 drops of 10 percent formalin were used to preserve stool samples.

Laboratory Equipments and Materials

i) Cotton
ii) Refrigerator
iii) Slides
iv) Glass rod
v) Cover slip
vi) Centrifuge machine
vii) Volumetric flask
viii) Gloves
ix) Electronic weight machine
x) Centrifuge tube
xi) Tea strainer
xii) Microscope
xiii) Pasteur pipette
xiv) Test tube
xv) Rack
xvi) Dropper
xvii) Motor & Pistle

Chemicals

i. Distilled water

ii. Zinc sulphate solution (33%)

iii. Methylene blue

iv. Formalin (10%)

Stool Examination

The stool samples were collected and brought to laboratory in preservatives and refrigerated. The stool samples were examined by differential floatation technique, sedimentation technique and stoll's counting method.

Floatation Technique

The floatation technique is widely used for the detection of nematode and cestode eggs. Eggs of cestodes and nematodes are relatively small and light. This technique ensures the eggs to float in the floatation liquid.

Three gram of stool sample was taken in a beaker and 42 ml of 33% zinc sulphate solution was added. With the help of motor and pistle, the sample was grinded lightly and filtered with a tea strainer. The filtered solution was poured into a plastic tube of 15 ml and centrifuged at 1000 rpm for 5 minutes. More zinc sulphate solution was added so that convex surface is formed at the top of the tube. A cover slip was placed over the top of the tube so that zinc sulphate touches the cover slip for a few minutes and then cover slip was placed on a slide and examined at 10X.

Sedimentation Technique

The technique is used for the detection of trematode eggs. It provides good results as the eggs of the trematode are bit heavier than the other eggs and deposited at the bottom of the test tube after the centrifugaton with zinc sulphate solution.

A drop of deposited materials was taken out from the test tube with the help of pipette and placed on the slide, added a drop of methylene blue into it and examined under the microscope at 4X and 10X.

Stoll's Counting Method

It is the easiest quantitative method to count the number of eggs present in the microscopic field without the help of Mcmaster (According to Dr. Tom Nola, University of Pennsyivania, 2004)

Three gram of faeces was taken in a beaker and 42 ml of water was added. Using a tongue depressor, 3 gm of faeces was pushed through a sieve into the water. Then the sive was lifted and hold over the dish. Then the remaining water was pushed out from the faeces. After stirring the water-faeces mixture, 0.15 ml of the suspension was taken and spread over two slides. Each slide was covered with a long cover slip. Then both slips were examined for eggs. The total amount of eggs counted multiplies with 100 represents the number of eggs per gram of faeces.

Key for trematodes, cestodes and nematodes

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5

RESULTS

The study has been divided into three parts:

I. Identification of eggs of helminth parasites

II. General prevalence of helminth parasites

III. Intensity of infections

I. IDENTIFICATION OF EGGS OF HELMINTH PARASITES

Out of 222 total samples examined with the help of sedimentation and floatation technique, 181 (81.53%) samples were found to be positive.

Altogether 21 genera were observed; trematodes belonging to 3 genera, nematode belonging to 16 genera and cestode belonging to two genera (Table 1).

The genera of various eggs of helminth parasites have been identified according to their characters and morphology.

Table 1: Types of genera observed in different classes

S.N.	Class	Identified Helminthes (genera)
1.	Trematoda	*Dicrocoelium*
2.		*Fasciola*
3.		*Paramphistomum*
4.	Cestoda	*Moniezia*
5.		*Taenia*
6.	Nematoda	*Haemonchus*
7.		*Trichostrongylus*
8.		*Chabertia*
9.		*Ostertagia*
10.		*Oesophagostomum*
11.		*Bunostomum*
12.		*Ascaris*
13.		*Capillaria*
14.		*Trichuris*
15.		*Cooperia*
16.		*Nematodirus*
17.		*Toxocara*
18.		*Dictyocaulus*
19.		*Dioctophyma*
20.		*Strongyloides*
21.		*Oxyuris*

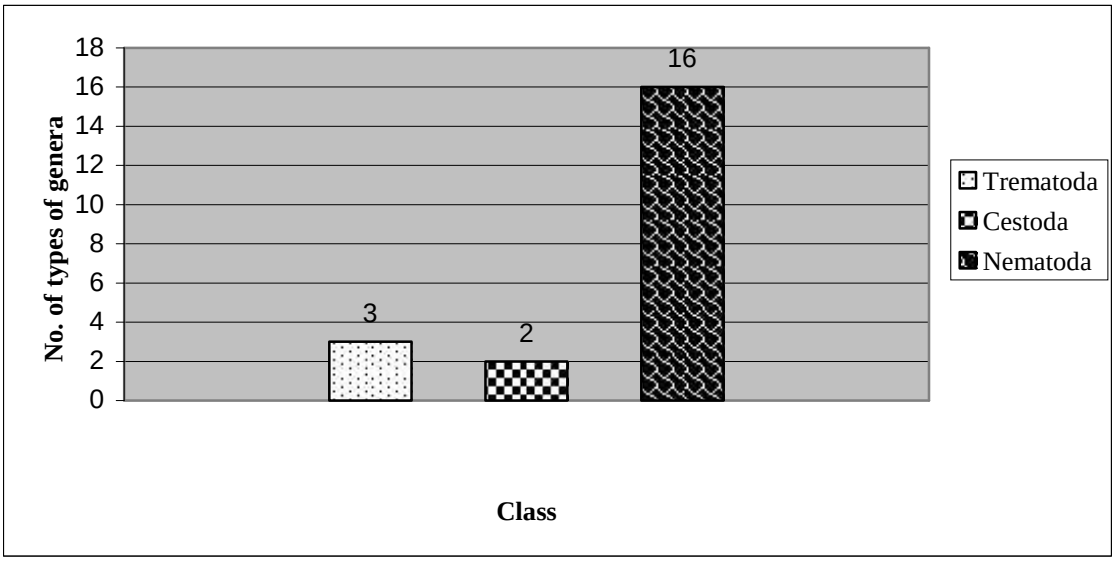

Figure 1: Types of genera observed in different classes

TREMATODES

Fasciola sp

Classification

Class	-	Tremetoda
Subclass	-	Digenea
Family	-	Fasciolidae
Genus	-	*Fasciola*

Description of the eggs

Eggs are 130-197 by 63-104 μm in size, oval shaped, yellowish in colour, consists of embryonic mass and shell, operculum usually indistinct. (Photograph no. 1).

Discussion

In 1758, Linnaeus reported *Fasciola hepatica* from the bile ducts of sheep and other ruminants.

From Nepal,

In 1967-92, Parajuli reported *Fasciola* sp 56.75 percent in buffaloes from Surkhet district.

In 1981-82, Lohani and Jaeckle reported *Fasciola* sp from Palpa district.

In 1987, Ghimire reported *Fasciola* sp in cattle, buffaloes and goats from Surkhet district.

In 1993, Jha *et al.,* reported 3.7 percent mortality in goats due to fascioliasis from Dhankuta.

In 1998-99, Sharma reported *Fasciola* infection 40.12 percent in animals from Panchthar district.

In 1999, Regmi, Dhakal and Sharma reported *Fasciola* infection 67.66 percent in buffaloes and 62.10 percent in cattle from Thuladihi VDC Syangja.

In 2002, Pandey, Mahato and Gupta reported *Fasciola* infection in *Lymnae* snails and buffaloes from Devbhumi Baluwa VDC of Kavre district.

In 2002-03, Adhikari, Shrestha and Shrestha reported *Fasciola* sp in cattle and buffaloes in Kathmandu valley.

In 2003, Rabwin *et al.*, reported *Fasciola* sp in yaks from Chandanbari, Langtang.

In 2006, Jaisawal reported *Fasciola* infection 56.02 percent in buffalo, 49.36 percent in cattle and 31.25 percent in goat.

In 2007, Mukhiya reported *Fasciola* infection 32.06 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Paramphistomum sp

Classification

Class	-	Trematoda
Subclass	-	Digenea
Family	-	Paramphistomatidae
Genus	-	*Paramphistomum*

Description of the eggs

Eggs are 114-176 by 73-100 μm in size, oval in shape, whitish to transparent in colour with distinct operculum knob-like thickening at the acetabular end of shell, embryonic cells distinct. (Photograph no. 2).

Discussion

In 1790, Zeder reported *Paramphistomum cervi* from the caecum of Indian patient.

From Nepal,

In 1967-92, Parajuli reported *Paramphistomum* 35.13 percent in buffaloes from Surkhet district.

In 1982, ADPCD reported *Paramphistomum* sp in cattle and buffaloes from Kathmandu.

In 1987, Ghimire reported *Paramphistomum* sp in cattle, buffaloes and goats from Surkhet district.

In 1993, Jha *et al.,* reported *Paramphistomum* sp in goats.

In 1998-99, Sharma reported *Paramphistomum* 16.20 percent in animals from Panchthar district.

In 2002-03, Adhikari, Shrestha and Shrestha reported 43 percent *Paramphistomum* sp in cattle from areas of Kathmandu valley.

In 2006, Jaisawal reported 38.09 percent paramphistomiasis in ruminants from Janakpur district.

Dicrocoelium sp

Classification

Class	-	Trematoda
Subclass	-	Digenea
Family	-	Dicrocoelidae
Genus	-	*Dicrocoelium*

Description of the eggs

Eggs are 36-45 by 23-30 μm in size, dark brown in colour, operculated, usually with a flattened side, contains miracidium when passed in the faeces. (Photograph no. 3).

Discussion

In 1899, Looss reported *Dicrocolium lanceatum* from bile ducts of the sheep, goat and cattle.

From Nepal,

In 2007, Mukhiya reported *Dicrocoelium lanceatum* infection 20.61 percent among buffaloes brought to Satungal (Kathmandu) for slaughter purpose.

CESTODES

Moniezia sp

Classification

Class	-	Eucestoda
Order	-	Anoplocephalidea
Family	-	Anoplocephalidae
Genus	-	*Moniezia*

Description of the eggs

Eggs are 56-75 μm in size; triangular, globular or quadrangular in shape and contain a well developed pyriform apparatus. (Photograph no. 4).

Discussion

In 1810, Rudolphi reported *Moniezia expansa* from the small intestine of sheep, cattle and other ruminants.

From Nepal,

In 1982, ADPCD reported *Moniezia* sp from calves and sheep.

In 1987, Ghimire reported *Moniezia* sp in cattle, buffaloes and goats from Surkhet district.

In 1989, Gupta first reported *Moniezia expansa* from goat.

In 2007, Mukhiya reported *Moniezia* infection 12.21 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Taenia sp

Classification

Class	-	Eucestoda
Order	-	Dilepididea
Family	-	Taenidae
Genus	-	*Taenia*

Desctiption of the eggs

Eggs are 24-41 μm in diameter, spherical in shape, brown to dark-yellow in colour, thick shelled and contain an onchosphere. (Photograph no. 5).

Discussion

In 1758, Linnaeus reported *Taenia solium* in the small intestine of man.

From Nepal,

In 1998, Paudyal reported Taeniasis 13.6 percent in pigs of Kathmandu and Dharan.

In 2002, Ghimire reported *Taenia* sp 1.42 percent in human from Kathmandu.

In 2003, Parajuli reported *Taenia* sp 1.98 percent from human female and 1.63 percent in human male.

In 2003, Karki reported *Taenia* sp 46.15 percent in Magar community of Barangdi VDC, Palpa.

In 2005, Manandhar reported *Taenia* sp 12.8 percent from stray dogs of Kathmandu.

NEMATODES

Haemonchus sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super family	-	Trichostrongyloidea
Family	-	Trichostrongylidae
Genus	-	*Haemonchus*

Description of the eggs

Eggs are 70-85 by 41-48 μm in size, oval in shape and embryo 16-32 celled when laid. (Photograph no. 6).

Discussion

In 1803, Rudolphi reported *Haemonchus* species from the abomasum of sheep, cattle and other ruminants.

From Nepal,

In 1997, Joshi reported *Haemonchus contortus* in sheep and goat from western hills of Nepal.

In 1999, Acharya reported *Haemonchus Contortus* in sheep and goats of IAAS livestock farm from Central Lab. Tripureshwor.

In 2000, Joshi reported *Haemonchus contortus* in goats of the hills and mountains in Nepal.

In 2006, Dhital reported *Haemonchus* sp in goats of Manglapur VDC-2 and IAAS livestock farm, Chitwan.

In 2007, Mukhiya reported *Haemonchus* infection 1.14 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Ostertagia sp

Classification

Class	-	Nematada
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Trichostrongyloidea
Family	-	Trichostrongylidae
Genus	-	*Ostertagia*

Description of the eggs

Eggs are 80-100 by 40-50 μm in size, elliptical in shape, contain fully developed larva within, when laid. (Photograph no. 7).

Discussion

In 1907, Ranson reported *Ostertagia* sp from the abomasums and small intestine of sheep, cattle and other ruminiants.

From Nepal,

In 1982, ADPCD reported *Ostertagia* sp in pig, cattle and buffaloes from Kathmandu.

In 1997, Joshi, Gibbons and Jacob reported *Ostertagia nianquingtanggulaensis* in goat and sheep from western hills of Nepal.

In 1999, Acharya reported *Ostertagia* sp in sheep and goat of IAAS livestock farm.

In 2000, Joshi reported *Ostertagia* sp in the hills and mountains in Nepal.

In 2006, Dhital reported *Ostertagia* sp in goats of IAAS livestock farm and Manglapur VDC-2, Chitwan.

Strongyloides sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Rhabditida
Super Family	-	Rhabditoidea
Family	-	Strongylidae
Genus	-	*Strongyloides*

Description of the eggs

Eggs are 40-64 by 20-40 μm in size, ellipsoidal, thin shelled, embryonated when laid. (Photograph no. 8).

Discussion

In 1911, Ransom reported *Stongyloides* sp from the small intestine of sheep, goat and cattle.

From Nepal,

In 1996, Dhakal, Jha and Basnet reported *Strongyloides* in goats of Pathivara VDC, Sankhuwasava.

In 1997, Joshi reported *Strongyloides papillosus* from goat and sheep of western hills of Nepal.

In 1999, Acharya reported *Strongyloides papillosus* from goat and sheep of IAAS livestock farm, Chitwan.

In 2002-03, Adhikari, Shrestha and Shrestha, reported 10 percent *Strongyloides* sp among buffaloes from areas of Kathmandu valley.

In 2003, Rabwin *et al.*, reported *Strongyloides* spp in horses from Kyanjin Gompa, Langtang.

Trichostrongylus sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Trichostrongyloidea
Family	-	Trichostrongylidae
Genus	-	*Trichostrongylus*

Description of the eggs

Eggs are 79-118 by 39-52 μm in size, oval in shape and bilaterally symmetrical, shell has a thin and transparent outer chitinous layer and a thin inner lipodial layer, embryonic mass multisegmented and varies from 16-32 in number. (Photograph no. 9).

Discussion

In 1892, Giles reported *Trichostrongylus colubriforms* from small intestine of sheep, goat and cattle.

From Nepal,

In 1996, Dhakal, Jha and Basnet reported *Trichostrongylus* sp in goats from Pathivara VDC, Sankhuwasava.

In 1997, Joshi reported *Trichostrongylus axei* from cattle and goat from western hills of Nepal.

In 1999, Acharya reported *Trichostrongylus* sp in sheep and goat of IAAS livestock farm.

In 2003, Rabwin *et al.,* reported *Trichostrongylus* sp in Yaks from Chandanbari, Langtang.

In 2006, Dhital reported *Trichostrongylus* sp in goats at the IAAS livestock farm and Manglapur VDC-2, Chitwan.

Chabertia sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Strongylidea
Family	-	Trichonematidae
Genus	-	*Chabertia*

Description of the eggs

Eggs are 90-105 by 52-55 μm in size, oval shaped, laid in morula stage. (Photograph no. 10).

Discussion

In 1790, Gmelin reported *Chabertia ovina* from the colon of sheep cattle and other ruminants.

From Nepal,

In 1997, Joshi reported *Chabertia* sp in sheep and goat from western hills of Nepal.

In 1999, Acharya reported *Chabertia ovina* in sheep and goat of IAAS livestock farm.

In 2007, Mukhiya reported *Chabertia* infection 0.38 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Oesophagostomum sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Strongyloidea
Family	-	Trichonematidae
Genus	-	*Oesophagostomum*

Description of the eggs

Eggs are 70-89 by 34-45 μm in size, oval in shape, thin shelled, embryonated when laid. (Photograph no. 11).

Discussion

In 1803, Rudoiphi reported *Oesophagostomum radiatum* from the colon of cattle and water buffalo.

From Nepal,

In 1982, ADPCD reported *Oesophagostomum* sp in pig, cattle and buffaloes from Kathmandu.

In 1996, Dhakal, Jha and Basnet reported *Oesophagostomum* sp in goat of Pathivara VDC, Sankhuwasava.

In 1997, Joshi reported *Oesophagostomum venulosum* in goat from western hills of Nepal.

In 1999, Acharya reported *Oesophagostomum* sp in sheep and goat of IAAS livestock farm, Chitwan.

In 2006, Dhital reported *Oesophagostomum* sp from goats of IASS livestock farm and Manglaour VDC-2, Chitwan.

Cooperia sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Trichostrongyloidea
Family	-	Trichostrongylidae
Genus	-	*Cooperia*

Description of the eggs

Eggs are 68-82 by 34-42 μm in size, elliptical, consist of segmented ovum and a double layered covering. (Photograph no. 12).

Discussion

In 1803, Railliet reported *Cooperia* sp from the small intestine and abomasum of ruminants.

From Nepal,

In 1982, ADPCD reported *Cooperia* spp. in goat, sheep and buffalo from Kathmandu.

In 1997, Joshi reported *Cooperia curticei* in sheep from western hills of Nepal.

In 1997, Joshi reported *Cooperia punctata* in sheep from western hills of Nepal.

In 1999, Acharya reported *Cooperia* sp in goat and sheep of IAAS livestock farm.

In 2006, Dhital reported *Cooperia* sp in goats of IAAS livestock farm and Manglapur VDC-2, Chitwan.

In 2007, Mukhiya reported *Cooperia* infection 0.76 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Trichuris sp

Classification

Class	-	Nematoda
Subclass	-	Adenophorea
Order	-	Enoplida
Super Family	-	Trichuroidea
Family	-	Trichuridae
Genus	-	*Trichuris*

Description of the eggs

Eggs are 70-80 by 30-42 μm in size, brown in colour, contain unsegmented embryo, barrel shaped with transparent plug at either pole. (Photograph no. 13).

Discussion

In 1795, Abildgaard reported *Trichuris ovis* from caecum of sheep, cattle and other ruminants.

From Nepal,

In 1982, ADPCD reported *Trichuris trichiura* in cattle, sheep goat and buffaloes from Kathmandu.

In 1982, ADPCD reported *Trichuris suis* in pig from Kathmandu.

In 1988, Gupta reported *Trichuris trichiura* in human from Kirtipur.

In 1996, Dhakal, Jha and Basnet reported *Trichuris* sp in goats in pathivara VDC, Sankhuwasava.

In 2002, Ghimire reported 5.17 percent *Trichuris vulpis* among dogs of Kathmandu.

In 2006, Dhital reported *Trichuris* in goats of IAAS livestock farm and Manglapur VDC-2, Chitwan.

Capillaria sp

Classification

Class	-	Nemotada
Subclass	-	Adenophorea
Order	-	Enoplida
Super Family	-	Trichuroidea
Family	-	Capillaridae
Genus	-	*Capillaria*

Description of the eggs

Eggs are 30-63 μm in size, barrel shaped, contain unsgmented embryo, colourless shell. (Photograph no. 14).

Discussion

In 1800, Zeder reported *Capillaria* sp from the small intestine of dog and cattle

From Nepal,

In 1982, ADPCD reported *Capillaria* sp in poultry from Kathmandu.

In 2005, Manandhar reported *Capillaria* sp in stray dogs of Kathmandu.

In 2007, Mukhiya reported *Capillaria* infection 0.38 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Dictyocaulus sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Trichostrongyloidea
Family	-	Dictyocaulidae
Genus	-	*Dictyocaulus*

Description of the eggs

Eggs are 82-88 by 30-33 μm in size, ellipsoidal, contain fully developed larva when laid or first stage larva may pass. (Photograph no. 15).

Discussion

In 1809, Rudolphi reported *Dictyocaulus* sp from the bronchi of sheep, goat and wild ruminants from Nepal.

From Nepal,

In 1982, ADPCD reported *Dictyocaulus* sp in goat and sheep from Kathmandu.

In 2007, Mukhiya reported *Dicyocaulus* infection 0.76 percent in buffaloes brought to Satungal (Kathmandu) for slaughter propose.

Ascaris sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Ascaridida
Super Family	-	Ascardoidea
Family	-	Ascarididae
Genus	-	*Ascaris*

Description of eggs

Eggs are 40-90 μm in diameter, sub-globular, laid in morulla stage. (Photograph no. 16).

Discussion

In 1782, Goege reported *et al.* first reported *Ascaris vitulorum* from the small intestine of cattle and buffalo.

From Nepal,

In 1975, Soulsa reported *Ascaris lumbricodes* in human from Pokhara.

In 1982, ADPCD Reported *Neoascaris vitulorum* in buffaloes and Chauri from Kathmandu.

In 1996, Dhakal, Jha and Basnet reported *Ascaris* sp in Pig and *Neoscaris* sp in cattle from Pathivara VDC, Sankhuwasava

In 1998-99, Sharma reported Ascariosis 43.69 percent in animals from Panchthar district.

In 2000, Shrestha reported *A. lumbricoids* 35.7 percent from 10 years old children in Kathmandu and Bhaktapur.

In 2003, Karki reported *A. lumbricoids* in magar community, Palpa.

Toxocara sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Ascaridida
Super Family	-	Ascardoidea
Family	-	Ascarididae
Genus	-	*Toxocara*

Description of the eggs

Eggs are 75-95 by 60-75 μm in size, slightly oval with smooth shell often single celled, occasionally two celled. (Photograph no. 17).

Discussion

In 1902, Linstow reported *Toxocara leonine* from small intestine of dog, cat and wild felines.

From Nepal,

In 1987, Ghimire reported *Toxocara* sp in cattle buffaloes and goats from Surkhet district.

In 2002, Ghimire reported *Toxocara canis* 10.34 percent among dogs of Kathmandu.

In 2007, Mukhiya reported *Toxocara* infection 20.90 percent among buffaloes brought to Santungal (Kathmandu) for slaughter purpose.

Nematodirus sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Trichostrongylidea
Family	-	Trichostrongylidae
Genus	-	*Nematodirus*

Description of the eggs

Eggs are 152-230 by 67-121 μm in size, elliptical, contain an embryo of about eight cells when passed by the host. (Photograph no. 18).

Discussion

In 1802, Rudolphi reported *Nematodirus fiicolis* in the small intestine of sheep, cattle and other ruminants.

From Nepal,

In 1985, Morel reported *Nematodirus* sp from goats of PAC and in the Koshi hill regions in the Eastern Nepal.

In 2006, Dhital reported *Nematodirus* sp in goats at IAAS livestock farm and Manglapur VDC-2, Chitwan.

In 2006, Devkota reported *Nematodirus* sp in goats from western Nepal.

Bunostomum sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Strongylida
Super Family	-	Strongyloidea
Family	-	Necatorinae
Genus	-	*Bunostomum*

Description of the eggs

Eggs are 79-106 by 47-50 μm in size, elliptical, have blunt ends and darkly pigmented embryonic cells. (Photograph no. 19).

Discussion

In 1808, Rudolphi reported *Bunostomum trigonocephalum* in the small intestine of sheep and goats.

From Nepal,

In 1996, Dhakal, Jha and Basnet reported *Bunostomum* from goats of Pathivara VDC, Sankuwashava.

In 1997, Joshi reported *Bunostomum trigonocephalum* from sheep and goats reared under sedentary and migratory management.

In 2006, Dhital reported *Bunostomum* from goats of IAAS livestock farm and Manglapur VDC-2, Chitwan.

Dioctophyma sp

Classication

Class	-	Nematoda
Subclass	-	Adenophoria
Super family	-	Dioctophymatoidea
Family	-	Dioctophymidae
Genus	-	*Dioctophyma*

Description of the eggs

Eggs are 71-84 by 46-52 μm in size, barrel-shaped, brownish yellow in colour and shells are pitted except at the poles. (Photograph no. 20).

Discussion

In 1782, Goeze reported *Dioctophyma renale* in the kidneys and other organs of the dog, fox, mink and other wild carnivores.

From Nepal,

No work on *Dioctophyma* sp was found. So this genus is first time reported from Nepal.

Oxyuris sp

Classification

Class	-	Nematoda
Subclass	-	Secernentea
Order	-	Ascaridia
Super Family	-	Oxyuroidea
Family	-	Oxyuridae
Genus	-	*Oxyuris*

Description of the eggs

Eggs are 90 by 42 μm in size, elongate, slightly flattened on one side, provided with a plug at one pole. (Photograph no. 21).

Discussion

In 1788, Schrank reported *Oxyuris equi* in the large intestine of equines.

From Nepal,

In 1982, ADPCD reported *Oxyuris equi* from horse in Kathmandu.

In 2003, Rabwin, *et al.*, reported *Oxyuris equi* from horse in Kyanjin Gompa, Lantang.

II. PREVALENCE OF HELMINTH PARASITES IN GOATS

General Prevalence

A total of 222 stool samples were collected from the study area Khasibazar, Kalanki which lies in ward no. 14 of Kathmandu metropolitan city where goats are brought from different parts of the country and also from India. The goats are kept for sale for slaughter purpose.

With the help of floatation and sedimentation technique, the collected stool samples were examined. Among them, 181 (81.53%) samples were found to be positive and 41 (18.47%) samples were found negative.

Therefore, the general prevalence of helminth parasites in goats was found to be 81.53 percent. (The overall prevalence of different genera of helminth results statistically significant in goats ($\chi^2 = 196.05$, $P<0.05$, d.f = 20)).

Class-wise Prevalence

Altogether eggs of 21 genera were observed. These are arranged according to their classes. Out of the 181 (81.53%) positive samples, 169 (76.13%) samples were found positive for nematode species, 31 (13.96%) samples for trematode species and 19 (8.56%) samples were found positive for cestode species.

The total number of genera observed are as follows.

Trematoda	-	3 genera
Cestoda	-	2 genera
Nematoda	-	16 genera

Prevalence of Trematode Genera

Out of 31 (13.96%) positive samples for trematodes, 3 genera were observed. Prevalence of *Dicrocoelium* (5.85%) was found to be the highest followed by *Fasciola (*5.40%) and *Paramphistomum* (2.70%). The difference in the prevalence of different genus of trematodes results statistically significant (χ^2 = 2.9, P>0.05, d.f. = 2).

Table 2: **Prevalence of trematode genera**

S.N.	Name of genera	Total samples examined	Positive samples	
			Nos.	%
1.	*Dicrocoelium*	222	13	5.85
2.	*Fasciola*	222	12	5.40
3.	*Paramphistomum*	222	6	2.70

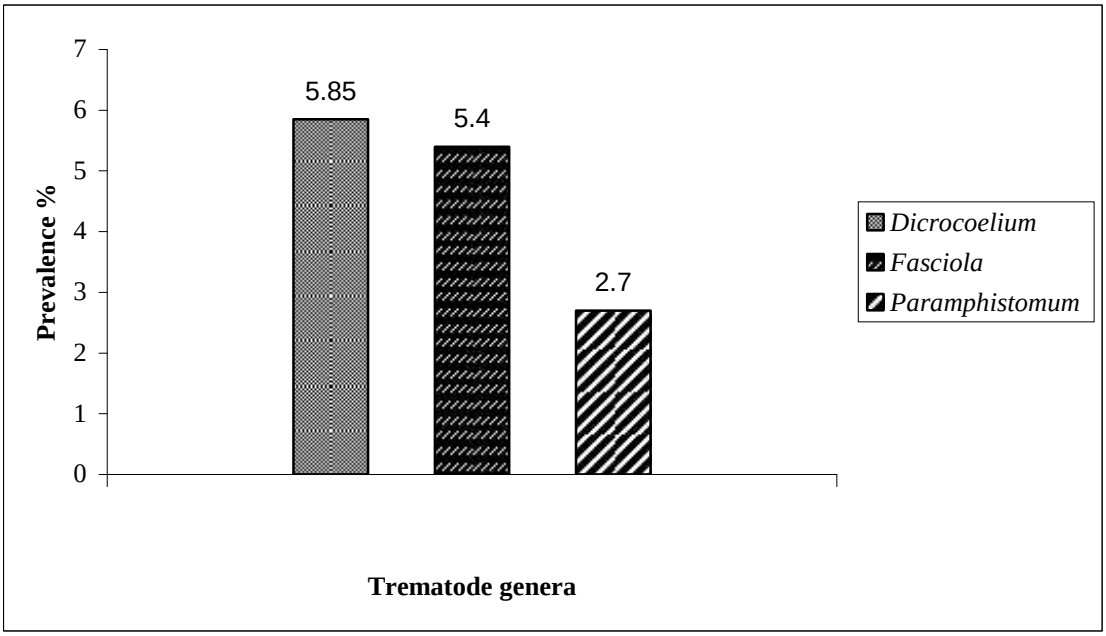

Figure 2: Prevalence of trematode genera in goats

Prevalence of Cestode Geneara

Out of 19 (8.56%) positive samples for cestode, only two genera were observed. Prevalence of *Moniezia* was found to be (5.40%) and *Taenia* (3.15 %). The difference in the prevalence of different genus of cestodes result statistically significant (χ^2 = 1.4, P>0.05, d. f. = 1).

Table 3: **Prevalence of cestode genera**

S.N.	Name of genera	Total samples examined	Positive samples	
			Nos.	%
1.	*Moniezia*	222	12	5.40
2.	*Taenia*	222	7	3.15

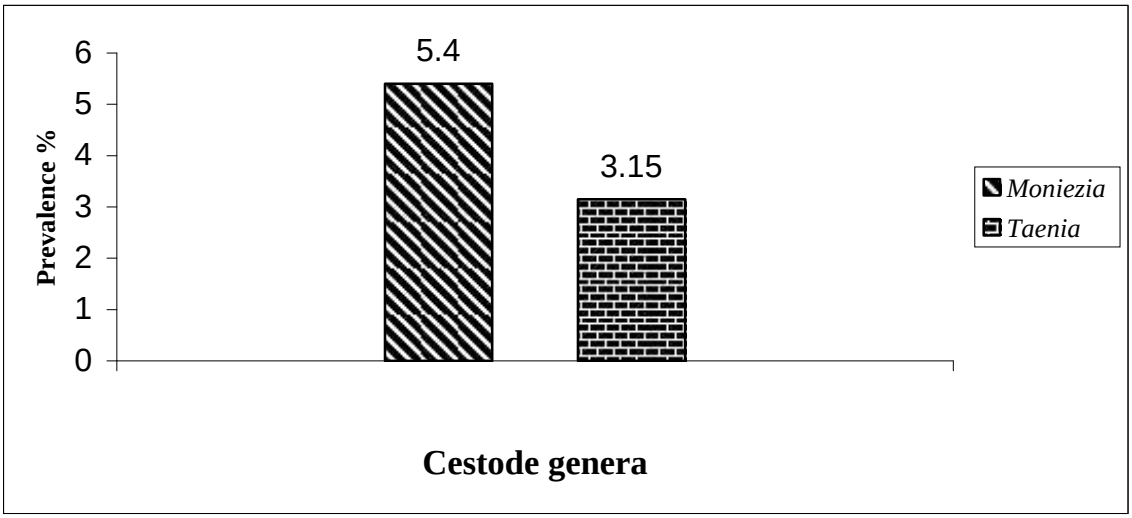

Figure 3: Prevalence of cestode genera in goats

Prevalence of Nematode Genera

Out of 169 (76.13%) positive samples for nematodes, 16 genera were observed. *Haemonchus* sp was found in highest numbers (19.36%) followed by *Trichostrongylus* (17.56%), *Chabertia* (14.86%), *Strongyloids* (9.45%), *Ostertagia* (9.00%), *Oesophagostomum* (8.11%), *Trichuris* (5.85%), *Nematodirus* (5.40%), *Cooperia* (4.05%), *Ascaris* (3.15%), *Dictyocaulus* (2.70%), *Dioctophyma* (2.25%), *Capillaria* (2.25%), *Toxocara* (1.80%), *Bunostomum* (0.9%) and *Oxyuris* species (0.9%). The difference in the prevalence of different genus of nematodes result statistically significant ($\chi^2 = 180.1$, $P<0.05$, d. f. = 15).

Table 4: Prevalence of nematode genera

S.N.	Name of genera	Total samples examined	Positive samples	
			Nos.	%
1.	*Trichuris*	222	13	5.85
2.	*Capillaria*	222	5	2.25
3.	*Haemonchus*	222	43	19.36
4.	*Strongyloids*	222	21	9.45
5.	*Trichostrongylus*	222	39	17.56
6.	*Oestertagia*	222	20	9.00
7.	*Oesophajostomum*	222	18	8.11
8.	*Cooperia*	222	9	4.05
9.	*Nematodirus*	222	12	5.4
10.	*Dioctophyma*	222	5	2.25
11.	*Dictyocaulus*	222	6	2.7
12.	*Chabertia*	222	33	14.86
13.	*Oxyuris*	222	2	0.9
14.	*Ascaris*	222	7	3.15
15.	*Toxocara*	222	4	1.80
16.	*Bunostomum*	222	2	0.9

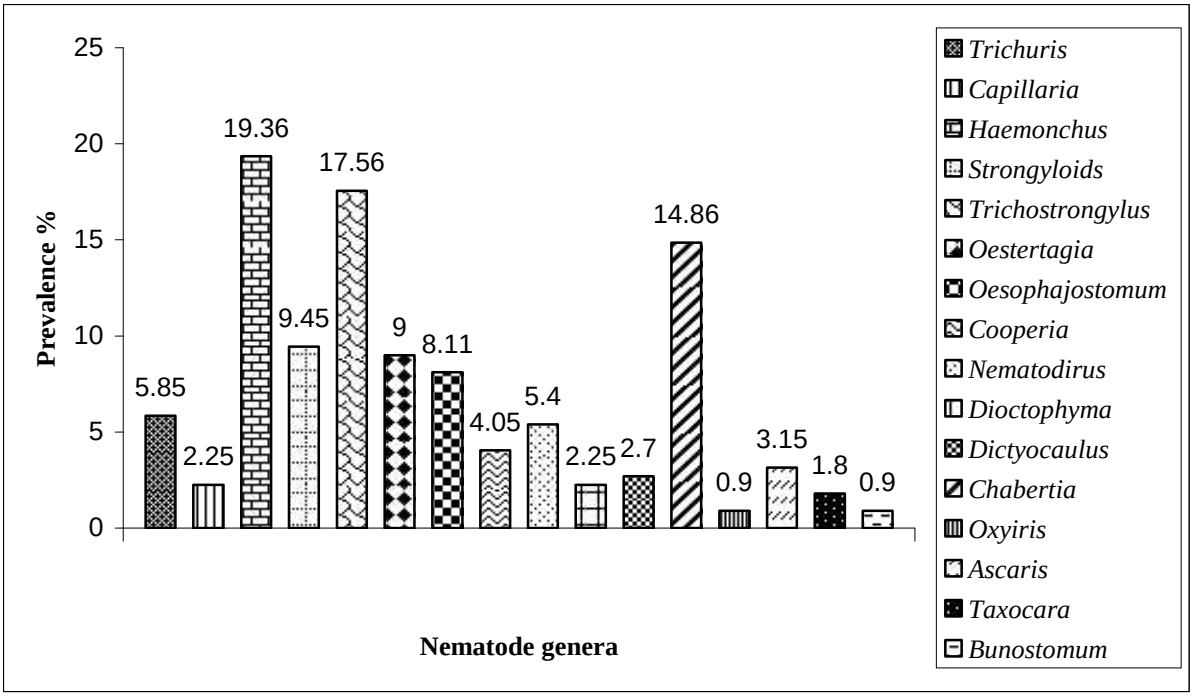

Figure 4: Prevalence of nematode genera in goats

III. INTENSITY OF INFECTIONS

Degree of Infections

Table 5: Degree of Infections

S.N.	Class	Name of the genera	+	+ +	+ + +	+ + + +
1.	Trematoda	*Dicrocoelium*	6	4	3	-
2.		*Fasciola*	2	3	5	2
3.		*Paramphistomum*	4	2	-	-
4.	Cestoda	*Moniezia*	5	5	3	-
5.		*Taenia*	6	1	-	-
6.	Nematoda	*Haemonchus*	19	11	8	5
7.		*Trichuris*	10	1	2	-
8.		*Capillaria*	3	2	-	-
9.		*Strongyloids*	7	6	7	1
10.		*Trichostrongylus*	21	7	4	7
11.		*Oestertagia*	15	-	4	1
12.		*Oesophapostomum*	7	5	6	-
13.		*Cooperia*	6	1	-	2
14.		*Nematodirus*	10	2	-	-
15.		*Dioctophyma*	4	1	-	-
16.		*Dictyocaulus*	3	2	1	-
17.		*Chabertia*	16	5	3	9
18.		*Oxyuris*	2	-	-	-
19.		*Ascaris*	3	3	1	-
20.		*Toxocara*	-	2	2	-
21.		*Bunostomum*	1	1	-	-

Note : The figure in the column is the no. of samples.

\+ = less than 2 ova per field} Light infection
\+ + = 2 - 4 ova per field} Mild infection
\+ + + = 4 - 6 ova per field} Moderate infection
\+ + + + = 6 or more ova per field} Heavy infection

Single Infection

In the present study, out of 181 (81.53%) positive samples, 51 samples were found to have single infection. Among positive samples with single infection the highest 21 (41.17%) samples were due to *Hemonchus* followed by 13 (25.49%) due to *Trichostrongylus,* 7 (13.72%) due to *Ostertagia* and 5 (9.80%) due to *Chabertia* and 5 (9.80%) due to *Fasciola.*

Multiple Infections

In the present study, the rate of mixed infection was also observed. Among 181 (81.53%) positive samples, 130 samples were found to have mixed infection with 2 to 4 species in each microscopic field. Among lightly infected cases, the highest intensity was noted of *Trichostrongylus* i.e 21 (+) positive samples (16.15%). Among mildly infected cases, the highest intensity was noted of *Haemonchus* with 11 (++) positive samples (3.46%). In case of moderately infected cases, the highest intensity was noted of *Haemonchus* with 8 (+++) positive samples (6.15%) and among the heavy infected cases, highest intensity was noted of *Chabertia* with 9 (+++) positive samples (6.92%).

6

DISCUSSION AND CONCLUSION

The aim of the study was to investigate the prevalence of helminth parasites in goats. During this study period (November, December-2006 and May-2007), samples were collected from ward no. 14 (Khasibazar) of Kathmandu metropolitan city. Out of 222 samples examined, 181 (81.53%) samples were found positive. The positive samples for trematode species were 31 (13.96%), whereas 169 (76.13%) for nematode species and 19 (8.56%) samples were found positive for cestode species.

In the present study, 3 genera of trematodes, 2 genera of cestodes and 16 genera of nematodes were found. Among trematodes, *Fasciola, Dicrocoelium* and *Paramphistomum* were found. In cestodes, the observed genera were *Moniezia* and *Taenia*. Among nematodes, *Haemonchus, Ostertagia, Oesophagostomum, Strongyloides, Chabertia, Nematodirus, Trichuris, Capillaria, Cooperia, Dioctophyma, Dictyocaulus, Ascaris, Toxocara, Oxyuris, Trichostrongylus* and *Bunistomum* were found.

Nematode genus *Dioctophyma* is reported for the first time from Nepal. No work regarding this genus from other hosts also has been found.

However, trematode genus *Dicrocoelium*, cestode genus *Taenia* and nematode genera *Capillaria* and *Oxyuris* have been reported from various hosts like cattle pig, poultry, dog, buffalo and horse except goat. Therefore these 4 genera are reported for the first time in the host goat from Nepal.

The prevalence of trematode genera found in goats (Table 2) was *Dicrocoelium* (5.85%), *Fasciola* (5.49%) and *Paramphistomum* (2.70%). Among cestodes (Table 3), *Moniezia* (5.40%) and *Taenia* (3.15%) were found. In nematodes (Table 4), *Haemonchus* (19.36%), *Trichuris* (5.85%), *Capillaria* (2.25%), *Strongyloides* (9.45%), *Trichostrongylus* (17.56%) *Ostertagia* (9.00%), *Oesophagostomum* (8.11%), *Cooperia* (4.05%), *Nematodirus* (5.40%), *Dioctophyma* (2.25%), *Dictyocaulus* (2.70%), *Chabertia* (14.86%), *Oxyuris* (0.9%), *Ascaris* (3.15%), *Toxocara* (1.80%) and *Bunostomum* (0.9%).

High prevalence of *Fasciola* (83%) has been reported from Surkhet among goats (Ghimire, 1987), followed by 58 percent from Chitwan district (Dhakal and Kharel, 1988), 31.5 percent from Kenya (Waruiru, Otieno and Mutune, 2005) and 31.25 percent infection from Dhanusa district (Jaisawal, 2006.) These data show higher infection among goats compared to the present study (5.40%).

Likewise, the prevalence of *Paramphistomum* (86.7%) from South East Nigeria among goats (Opara, Nwaobasi, and Okoli, 2005), 38.09 percent from Dhanusa district (Jaisawal, 2006) and 16.20 percent infection from Panchthar district (Sharma 1998-99) are reported. All these show higher infections compared to the present study (2.70%).

Cestode *Moniezia* has been reported from Kathmandu and Surkhet district (ADPCD, 1982/ Ghimire, 1987/Gupta, 1989) among buffaloes, sheep, goat and cattle. In the present study, *Moniezia* has been reported among goats.

The overall prevalence of helminth parasites among goats raised under traditional husbandry system in South East Nigeria (Opara, Nwaobasi and Okoli, 2005) were 90.1 percent of which nematode infection was 78.4 percent, trematode and cestode infection were 13 percent and 8.7 percent respectively. The present study is found a bit similar to this study i.e. nematode infection 76.13 percent, trematode 13.96 percent and cestode 8.56 percent.

The prevalence of helminth parasites among sheep and goats in semi-arid area of Machakos district, Kenya (Waruiru, Otieno and Mutune, 2005) were *Haemonchus* (58.0%), *Fasciola* (31.5%), *Trichostrongylus* (29.0%), *Oesophagostomum* (13%) and *Moniezia* (2.5%). Comparing to the present study, the prevalence of *Haemonchus* (19.36%), *Fasciola* (5.4%), *Trichostrongylus* (17.56%) and *Oesophagostomum* (8.11%) were lower and *Moniezia* (5.4%) has been found higher. However, infection with *Moniezia* (50%) reported from South East Nigeria (Opara, Nwaobasi and Okoli, 2005) was higher than that in the present study.

The GI nematodes reported from India (Yadav *et al.*, 2005) i.e. *Haemonchus, Trichostrongylus, Bunostomum, Oesophagostomum* and *Strongyloides* were the main parasites among goats which were found similar to the present study.

The gastro-intertinal helmith parasites reported from goats in Palampur, Himanchal Pradesh (Jithendran, 1993-1997) were *Strongyloides, Trichostrongylus, Haemonchus, Oesophagostomum, Fasciola, Dicrocoelium, Moniezia,* which were found similar to the present study. Similarly *Strongyloides, Haemonchus, Trichostrongylus, Chabertia, Cooperia, Oesophagostomum* and *Ostertagia* have been reported among goats (Acharya, 1999) is found to be similar to the present study.

Nematode *Dictyocaulus* has been reported from Kathmandu among goats (ADPCD, 1982). The same genus has been also reported from goats in the present study.

Infection with *Haemonchus* (72%) and *Oesphagostomum* (13%) among goats have been reported from dry zones of Srilanka (Faizal, Rajapaksha and Rajapaksha, 1999-2000) is greatly higher than the present study i.e *Haemonchus* (19.34%) and *Oesophagostomum* (8.11%). But infection with *Haemonchus* (7%) among goats from Surkhet (kushwaha, 2000) is lower than present study.

Ascariasis (43.69%) reported from Panchthar district (Sharma, 1998-99) is found to be higher than the present study (3.15%).

The prevalence of *Trichostrongylus* (15%) reported from Srilanka (Faizal, Rajapaksha and Rajapaksha, 1999-2000) is a bit similar with the present study. But the prevalence of *Trichostrongylus* reported in the present study is lower than that of Kenya (29.0%) (Waruiru, Otieno and Mutune, 2005).

Prevalence of *Ostertagia* (2%) reported from Surkhet (Kushwaha, 2000) is lower than in the present study (9.0%).

Prevalencve of *Strongyloids*, (88%) reported from Surkhet (Kushwaha, 2000) and 62.2 percent reported from Owerri, South East Nigeria (Opara, Nwaobasi and Okoli, 2005) is greatly higher than that in the present study (9.45%).

Nematodes *Nematodirus, Chabertia, Bunostomum* and *Cooperia* were reported from goats but prevalence rate has not been reported. Like wise, mixed infection with various species of trematodes, cestodes and nematodes were reported but no prevalence rate has been reported.

7

RECOMMENDATIONS

- Strategic application of anthelmintics should be applied to eliminate the parasite from the host.
- The program for awareness of the meat borne diseases and zoonotic diseases to the public and butcher should be developed.
- Animal slaughter and meat inspection act should be implemented for better quality and disease free meat.

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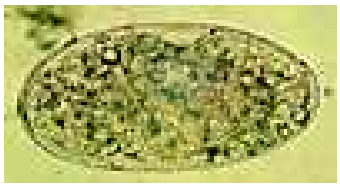
24. Collection of stool samples

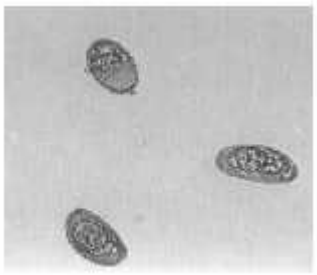
25. Processing of stool samples

PHOTOGRAPHS

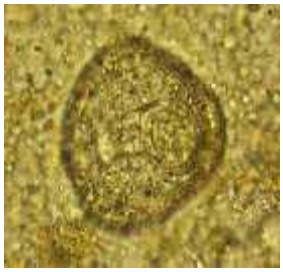
1. Egg of *Fasciola* sp (10X×4X)



2. Egg of *Paramphistomum* sp (10X×4X)



3. Egg of *Dicrocoelium* sp (10X×4X)



4. Egg of *Moniezia* sp (10X×10X)

5. Egg of *Taenia* sp (10X×10X)

6. Egg of *Haemonchus* sp (10X×10X)

7. Egg of *Ostertagia* sp (10X×10X)

8. Egg of *Strongyloides* sp (10X×10X)

9. Egg of *Trichostrongylus* sp (10X×10X)

10. Egg of *Chabertia* sp (10X×10X)

11. Egg of *Oesophagostomum* sp (10X×10X)

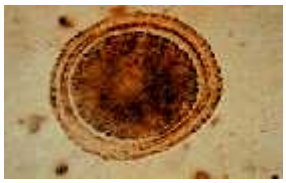
12. Egg of *Cooperia* sp (10X×10X)

13. Egg of *Trichuris* sp (10X×10X)

14. Egg of *Capillariea* sp (10X×10X)

15. Egg of *Dictyocaulus* sp (10X×10X)

16. Egg of *Ascaris* sp (10X×10X)

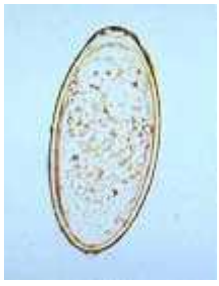


17. Egg of *Toxocara* sp (10X×10X)

18. Egg of *Nematodirus* sp (10X×10X)

19. Egg of *Bunostomum* sp (10X×10X)

20. Egg of *Dioctophyma* sp (10X×10X)



21. Egg of *Oxyuris* sp (10X×10X)

22. Goats kept for slaughter

23. Interview with goats handlers