

# Gastro-intestinal Parasites of Assamese Macaque (*Macaca assamensis* Hodgson, 1840) in Shivapuri Nagarjun National Park, Kathmandu, Nepal

Geeta Pokhrel<sup>1</sup> and Mahendra Maharjan<sup>2</sup>

Central Department of Zoology, Tribhuvan University, Kirtipur, Kathmandu, Nepal

E-mail: <sup>1</sup>z.pokharelgeeta@gmail.com & <sup>2</sup> Maharjan.m@gmail.com

## ABSTRACT

The macaque is a member of the sub family Cercopithecinae and family Cercopithecidae of primate order of mammalian class. Among five species of monkeys reported from Nepal, Assamese Macaque is one of the less common primate species. A total of 85 fresh faecal samples of Assamese Macaque (*Macaca assamensis*) were collected from Shivapuri Nagarjun National Park (SNNP), Kathmandu, Nepal. All the samples were macroscopically as well as microscopically examined to identify the distribution of gastrointestinal parasites using faecal floatation and Sedimentation techniques. The result revealed the distribution of three species of protozoan and seven species of helminthes parasite among Assamese Macaque of SNNP with the prevalence rate of 72.94% (62/85). Among protozoan parasites, *Balantidium coli* showed the highest prevalence (28.24%) followed by *Entamoeba* sp. (20%), and *Isospora* sp. (3.53%). *Ascaris* sp. was found to be distributed maximum (10.58%) among helminth parasites followed by *Trichuris* sp. (9.41%), *Strongyloides* sp. (8.24%), *Moniezia* sp. (8.24%), *Oesophagostomum* sp. (4.7%), Hookworm (4.7%) and *Physeloptera* sp. (1.17%). The present study highlights the necessity of considering parasitic diseases as one of the threat in conservation of Assamese Macaque.

**Keywords:** Assamese macaque (*Macaca assamensis*), *Balantidium coli*, conservation, intestinal parasites.

## INTRODUCTION

Primates are the highest order of mammals which includes lemurs, monkeys, apes, human and other similar forms, typically having dexterous hands and feet, binocular vision as well as developed brain (Mary *et al.* 2007). The macaque is a member of the sub family Cercopithecinae and family Cercopithecidae of primate order of mammalian class. A total of five species of monkeys have been reported from Nepal: Assamese Macaque (*Macaca assamensis* Hodgson, 1840), Rhesus Macaque (*Macaca mulatta* Zimmermann, 1780), Terai Grey Langur (*Semnopithecus hector* Pocock, 1928), Nepal Grey Langur (*Semnopithecus schistaceus* Hodgson, 1840), and Himalayan Grey Langur (*Semnopithecus ajax* Pocock, 1928) (Jnawali *et al.* 2012). Among them Assamese Macaque is one of the less common primate species and is explored patchily in Nepal (Chalise 2010). *Macaca assamensis* are only sporadically distributed in limited areas of the Nepal, India, Bhutan, Southeast Asia, and China (Wada 2005). In Nepal it has been recorded from 380 m in Mulghat Tamor to 2350 m a.s.l. in Langtang (Chalise 2005).

Parasites play a major role in ecosystems (Esch & Fernandez 1993), host population growth and regulation

(Hochachka & Dhondt 2000, Hudson *et al.* 1998), and community biodiversity (Hudson *et al.* 2002). Both helminth and protozoan parasites are common in non-human primates (Munene *et al.* 1998, Muriuki *et al.* 1998). Some of the parasites are considered to be nonpathogenic. However, a large number can result in physiologic disturbances, nutritional loss, or may produce lesions that result in serious debilitation, and can create opportunistic for secondary infections that may be fatal (Toft & Eberhard 1998). In monkeys, disease emergence can occur directly through human introduced diseases or indirectly through human induced changes in the disease ecology of wildlife. This study aims to determine the distribution of intestinal parasites of Assamese Macaque (*Macaca assamensis*). A few studies of Assamese Macaque have been done on the ecological basis (Wada 2005, Regmi & Kandel 2008, Pandey 2012) but, the information regarding the gastro-intestinal parasites of Assamese Macaque is still lacking. Hence, the present study has provided information regarding distribution of various protozoan and helminth parasites of Assamese Macaque of SNNP.

**MATERIALS AND METHODS**

A total of 85 faecal samples of monkeys were collected in two seasons: summer (40) and winter (45) of 2012 respectively. During the sample collection, a troop of macaques were systematically followed from dawn to dusk. About 5 gram of fresh samples was carefully collected in sterile sample collection vials with paper marking. All faecal samples were stored in vials containing 2.5% potassium dichromate solution. Before and after collection, all the faeces were examined macroscopically for consistency, presence of blood or mucus, tapeworm proglottids and adult or larval nematode. In the laboratory, the samples were microscopically examined using concentration techniques viz., faecal floatation and sedimentation.

The samples resulting from the application of these techniques were divided among three different slides, each for a different method using temporary staining (Lugol’s iodine) and examined under light microscopy at 10X×10X and 40X×40X magnification.

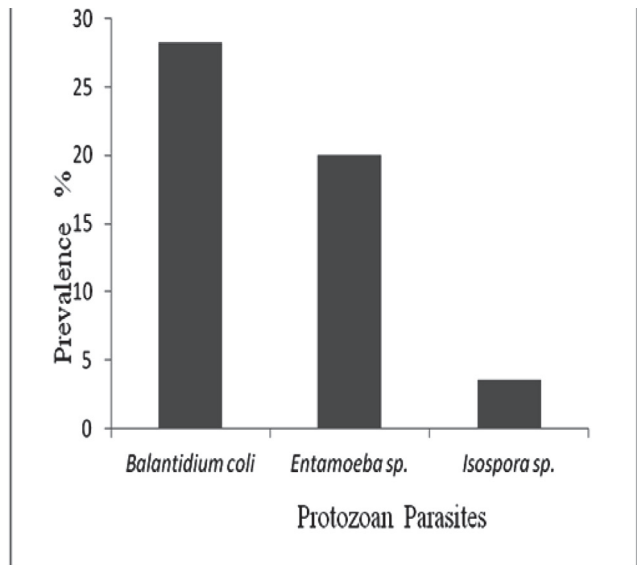
**RESULTS**

**General prevalence of intestinal parasites**

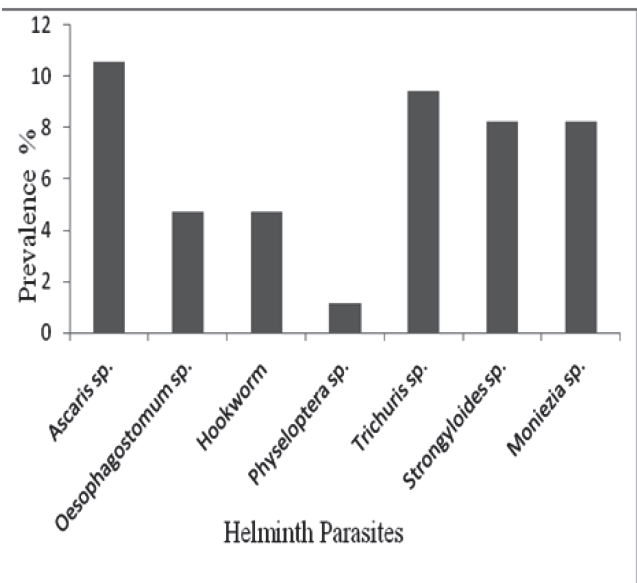
Out of 85 faecal samples examined, 62 samples were found to be positive for either protozoans or helminthes or both parasites showing prevalence rate of 72.94%. The result revealed that a total of 10 different species of gastrointestinal parasites were found to be distributed among Assamese Macaque of SNNP. Distribution of helminth parasites (7 species) was found to be higher compared to the protozoan parasites (3 species).

**Distribution of specific intestinal parasites**

Among the three species of protozoan parasites, *B. coli* showed high distribution in Assamese Macaque of SNNP with prevalence rate of 28.24% followed by *Entamoeba* sp. (20%) and *Isospora* sp. (3.53%). Among the seven species of helminthes parasites reported, six species belonged to nematoda and only one species belongs to cestoda. Trematode parasite was not observed in Assamese Macaque of SNNP. *Ascaris* sp. (10.58%) was found to be distributed maximum among nematode parasites in these monkeys followed by distribution of *Trichuris* sp. (9.41%), *Strongyloides* sp. (8.24%), *Moniezia* sp. (8.24%), *Oesophagostomum* sp. (4.7%), Hookworm (4.7%) and *Physeloptera* sp. (1.17%). While concerning only protozoan parasites, *B. coli* was the highest infective parasite whereas *Ascaris* sp. was the highest infective helminth parasite (Figs. 1 & 2).



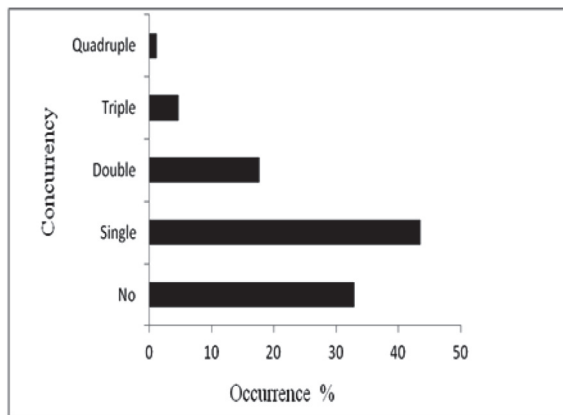
**Fig. 1. Prevalence of Protozoan Parasites**



**Fig. 2. Prevalence of Helminth Parasites**

**Concurrency of intestinal parasites**

The result indicated that maximum number of Assamese Macaque suffered from single parasite infection, either protozoan or helminth parasites showing prevalence rate of 43.53%. 15 (17.65%) samples were found to be positive for two parasites. The triple infection by intestinal parasites was 4.7% and quadruple infection of intestinal parasites in same sample was the least (1.17%). Only one sample was found infected by four different parasites. Maximum samples with multiple infections were due to combination of both protozoan and helminth parasites (Fig. 3).



**Fig. 3. Concurrency and occurrence of intestinal parasites**

## DISCUSSIONS

Assamese Macaque is a less common primate species and is explored patchily in Nepal (Chalise 2010). It is also given the status of Endemic in distribution due to localization in Nepal only (Chalise 2005). The species is confirmed from Kimni Acham, Dadeldhura, Ramdi Palpa, Langtang NP and Helambu area, Makalu-Barun NP and Bhumlingtar, Hariharpur and Nagarjun forests of Kathmandu. They are not recorded from Tarai plain and high snowy mountains and in human settlements (Chalise 2005) although five species of monkeys have been reported from Nepal (Jnawali *et al.* 2012). Intestinal parasites in Assamese Macaque found in present study resemble that of the previous studies of prevalence of parasites in *Macaca assamensis* (Wongsawad 2009). The prevalence rate (of 93 %) reported from feral Bonnet Macaque in India (Varadharajan and Pythal 1999) was the highest prevalence of gastrointestinal parasites reported till now. Previous studies among Rhesus Monkey from different area of Nepal has shown the positivity ranging from 60-85% (Dhoubhadel 2007, Malla 2007, Nepal 2010) though prevalence rates were seen to vary according to locality. Three protozoan parasites viz: *B. coli*, *Entamoeba* sp., and *Isospora* sp. were observed occupying prevalence percentage of 28.24%, 20%, and 3.53% in present study. Similar protozoan parasites were also reported in *Macaca assamensis* (Wongsawad 2009), in free living Feral Bonnet Macaque (*Macaca radiata*) elsewhere in the world. *B. coli* was the predominant intestinal protozoan parasites, whose presence in present study was supported by previous studies 27.5 % and 62 % of balantidial infection in *Macaca assamensis* and *Papio anubis* (Wongsawad 2009, Ryan *et al.* 2012) whereas less prevalence of *Balantidium coli* was reported in the Bonnet Macaque (Varadharajan & Pythal 1999) contributing only 6%. *Entamoeba* sp. was found to be highly prevalent in *Macaca assamensis* showing

prevalence rate of 87.5% (Wongsawad 2009). This result is higher than the present study. *Isospora* sp. has been reported in *Macaca radiata* and *Macaca assamensis* (Varadharajan and Pythal 1999, Wongsawad 2009).

The helminth parasites observed in this study were also reported in several previous studies concerning intestinal parasitic infection in *Macaca radiata* and *Macaca mulatta* (Varadharajan and Pythal 1999, Eberhard *et al.* 2001). The prevalence rate of *Ascaris* sp. was reported indicating 34% from *Macaca radiata* (Varadharajan & Pythal 1999), followed by 10.48% from *Macaca mulatta* (Malla 2007) and by 7.45% from the similar species (Nepal 2010). But in the present study it was found to be 10.58% from *Macaca assamensis*. *Oesophagostomum* sp. was found to be highly prevalent in a *Papio anubis* (Bezjian *et al.* 2008) with prevalence rate of 85% followed by 20% from Assamese Macaque's (Wongsawad 2009). Some researchers of Nepal suggested low prevalence of *Oesophagostomum* sp. from *Macaca mulatta* of different areas ranging from 4-10% infection rate (Nepal 2010, Dhoubhadel 2007, Malla 2007) while in this study prevalence rate was found to be 4.7% from *Macaca assamensis*. Only 4.7% hookworm was observed in the study. The difference in parasite species might be due to the environmental as well as genetic and behavioural factors. Mutani *et al.* (2003) documented prevalence rate of *Physeloptera* sp. to be 58.5% from *Cercopithecus aethiops sabaesus*. However, this study showed very low prevalence rate from *Macaca assamensis* that was 1.17%. In the case of *Trichuris* sp., previous studies among Rhesus Monkey from different area of Nepal has shown the low positivity ranging from 7-12% (Dhoubhadel 2007, Malla 2007, Nepal 2010). This result shown is almost similar to the present study. Likewise, only 5% prevalence of *Trichuris* sp. was shown from *Macaca assamensis* (Wongsawad 2009). Wongsawad (2009) found 60% prevalence rate of *Strongyloides* sp. from *Macaca assamensis*. But, in the similar type species (*Macaca mulatta* and *Macaca radiata*) the prevalence rate was found 40% (Dhoubhadel 2007, Varadharajan & Pythal 1999). It was found to be 13.72% from Assamese Macaque in this study. The study shows the variation of parasitic distribution as well as their prevalence according to the host as well as locality.

*Oesophagostomum* sp. and *Strongyloides fulleborni* were prevalent only in adult female guenon (Gillespie *et al.* 2004). This may reflect energy and nutrient stress associated with producing and raising infants. However, *Strongyloides fulleborni* was higher in adult male compared to adult female Red Colobus. Perhaps this reflects energy and nutrient stress associated with maintaining social dominance (Gillespie *et al.* 2005)

which may result in an increased susceptibility to infection (Milton 1996). Dunn (1963) reported *Moniezia* sp. from Wild Howlers (*Alouatta* sp.). Although *Moniezia* sp. is the parasite of herbivores, its presence in the monkeys is not uncommon as the monkeys of SNNP are more closely in contact with herbivore animals of that area. It can be concluded from this study that the competitors also affect on the types and prevalence of intestinal parasites on these monkeys.

## CONCLUSIONS

In conclusion the Assamese Macaque of Shivapuri Nagarjun National Park are infected with various protozoan and helminth parasites. Among them *Balantidium coli* was found to be highly prevalent species compared to other parasites. Test revealed that there was no significant difference in the prevalence of parasites between two seasons. The study highlights the importance of further in depth studies regarding disease aspects of monkeys and their association with their survivability in order to conserve them.

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