



Parasites of Hodgson's Giant Flying Squirrel (*Petaurista magnificus*)

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Abstract

We present the first parasitic evidence of Hodgson's Giant Flying Squirrel (*Petaurista magnificus*) collected from Shivapuri-Nagarjun National Park, Nepal. The pellets found in the large intestine were mostly rounded, grey and infested with numerous parasites. Three species of nematodes were recorded: two species of *Syphacia* in large intestine and one species of *Oxyuris* in the fecal matter. Eggs and cysts of protozoa (*Eimeria* spp.) and unidentified insects were also detected from its fecal matter. This study has widened the field of parasitic studies in the flying squirrels.

Keywords: Hodgson's Giant Flying Squirrel, parasites, *Syphacia* spp., *Eimeria* spp., *Oxyuris* spp., Nepal.

Introduction

Studies of parasites in small mammals are the hot issues in developing countries as it transfer zoonotic diseases to the people, and simultaneously parasites are threatening survival of these small mammals (Krichbaum *et al.*, 2010; Espenshade and Stewart, 2013; Jrijer *et al.*, 2015). As consequences, prevalence of parasites in small mammals has been studied in different countries (Karbowiak *et al.*, 2005; Keymer, 2008; López-Darias *et al.*, 2008; Jrijer *et al.*, 2015). However, studies on the parasitic prevalence of small mammals are very limited in Nepal (see Lama *et al.*, 2015; Shrestha and Maharjan, 2015) and no study is yet available for flying squirrels. In this paper, we have reported the first evidence of endo-parasites of Hodgson's Giant Flying Squirrel (*Petaurista magnificus*) which was collected from Shivapuri-Nagarjun National Park, Nepal. Hodgson's Giant Flying Squirrel, is one of the six species of flying Squirrel found in Nepal and is distributed from

evergreen tropical and subtropical forests of lowlands to the broad-leaf forests of temperate regions (Baral and Shah, 2008; Jnawali *et al.*, 2011; Thapa *et al.*, 2016).

Materials and Methods

We opportunistically collected a specimen of a dog killed Hodgson's Giant Flying Squirrel in March 2015 from Panimuhan of Shivapuri-Nagarjun National Park (SNNP) at an elevation of 1648m (Figure 1). The SNNP is located between 27°45' to 27°52'N and 85°15' to 85°30' E and spread over 159 sq.km. The park's altitude ranges from 1350-2732 m. The vegetation of the park has been categorized into four types viz. i) Lower mixed hardwood forests, ii) Chirpine forests, iii) Oak forests, and iv) Upper mixed hardwood forests. The major plant species found are *Schima wallichii*, *Castanopsis indica*, *Pinus roxburghii*, *Myrica esculenta*, *Pyrus pasia*,

Quercus sp., *Rhododendron arboreum*, *Juglans regia* (SNNP 2015). The SNNP is identified as the Important Bird and Biodiversity Areas of Nepal by the Bird Life International (Baral and Inskipp, 2005). It is

home for 102 species of butterfly, 318 species of bird and 21 species of mammal (excluding bats and rodents) (Ghimire, 2008; SNNP, 2015).



Figure 1: Hodgson's Giant Flying Squirrel killed by stray dog in the Shivapuri-Nagarjun National Park

The collected flying squirrel had a wound on the right chest due to dog bite (Per. comm. B. Pandey). It was taken to Natural History Museum, Tribhuvan University, Swoyambhu, Kathmandu and morphometric measurements were taken. After the specimen was skinned for preservation, its alimentary canal including stomach was taken to laboratory of the Central Department of Zoology, Tribhuvan University for studying the parasites. Fecal materials and the part of gut were examined for the parasites by using Flotation Concentration and Sedimentation Concentration methods (Dryden *et al.*, 2005) and the parasites were identified following Yamaguti (1961). The parasites could be identified only up to genus level.

Results and Discussion

Morphometric measurement of Hodgson's Giant Flying squirrel is shown in Table 1. While inspecting its gut, we found crushed plants materials. The pellets of large intestine were mostly rounded, grey

(Figure 2) and infested with numerous parasites. Eggs and cysts of protozoa i.e. *Eimeria* spp. and unidentified insects were detected from the fecal matter (Figure 3a). Although, *Eimeria* spp. has been recorded from squirrels (Lainson *et al.*, 2004; Keymer, 2008), it is more frequently recorded from poultry (Allen and Fetterer, 2002; Barbour *et al.*, 2015). Other parasites were identified as the nematodes: one species of *Oxyuris* in fecal matter and two species of *Syphacia* in large intestine (Figure 3b, 4, 5). *Oxyuris* spp. is recorded in donkeys (Kheir and Kheir, 1981; Shrikhande *et al.*, 2009) and horses (Kheir and Kheir, 1981). *Syphacia* spp. is pinworms in rodents, especially in mice and rats (Hill *et al.*, 2006, Sayed-Arnez and Mohd-Zain, 2006; Dewi and Hasegawa, 2010), it has also been reported from squirrels (Krichbaum *et al.*, 2010; d'Ovidio *et al.*, 2014). Presence of these parasites may threaten survival of the squirrels in wild. It is hoped that the record of these parasites in the flying squirrel will provide future reference for scientific studies.

Table 1: Morphometric measurement of the Hodgson's Giant Flying Squirrel

Body parts	Measurements
Sex	Female with developed nipples
Weight (Whole Body)	1650gm
Head Body length	51cm
Tail	48cm
Head	9cm
Forelimb	5.5cm
Claws	0.5cm in length, half circled and very sharp tips
Whiskers	Many black colored whiskers, 4.8cm longest one
Patagium	Breadth: 36.06cm but expandable up to 55cm Length:38.1cm
Pinna	Conical, 5cm in length
Black long hairs of hind limb and fore limb	9-12 black thick hairs like whiskers were present and the longer hair measures 4.1cm
Colour	Dorsal Side: Light tan Patagium: Light tan Ventral side: Dark tan Tip of Tail: Black Palm and sole: Black, hairless Mouth and nose: Flesh
Upper Incisors	Two orange colour incisors were largest in size than other teeth
Palm	5.5cm in length except clawed digits
Sole	5cm in length



Figure 2: Pellets of Hodgson's Giant Flying Squirrel

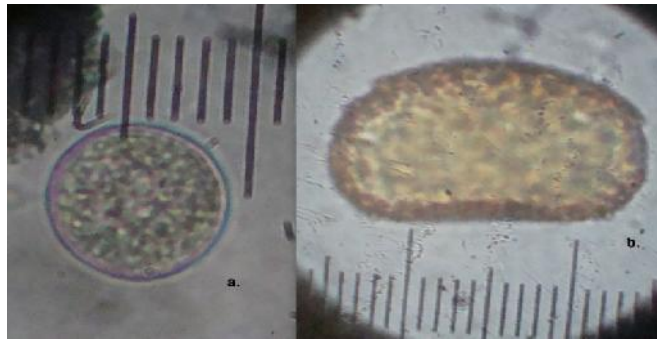


Figure 3: a-*Eimeria* spp. b-*Oxyuris* spp.



Figure 4: Photographs of *Syphacia* spp. (1): a-Posterior Region 100X, b-Anterior Region 100X, c-Whole Body 40X, d-Anterior Region 400X, e-Oesophageal Region 400X, f-Middle Region 400X, g-Posterior Region 400X



Figure 5: Photographs of *Syphacia* spp. (2): a-Whole Body 40X, b-Anal Region 400X, c-Anterior Region 400X, d-Anterior Region 100X, e-Middle Region 100X, f-Posterior Region 400X, g-Middle Region 400X

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