Biogeography 14.
143–148. Sep. 20, 2012

First record of *Porrocaecum depressum* (Nematoda: Ascaridoidea), *Craspedorrhynchus* sp. and *Degeeriella* sp. (Insecta: Psocodea) obtained from a Hodgson's Hawk Eagle, *Spizaetus nipalensis*, in Gifu Prefecture, Japan

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Abstract. A male young Hodgson's Hawk-eagle, *Spizaetus nipalensis* collected in October 2003 at Gifu Prefecture, Japan. In the post-mortem examination, two individuals of nematode were found from proventriculus and four specimens of chewing lice were obtained from face. The present specimens were identified as *Porrocaecum depressum*, *Craspedorrhynchus* sp. and *Degeeriella* sp. by their measurements and morphological characters. This is the first host record for the present parasites from *S. nipalensis*, and the first geographical record of *P. depressum* and *Degeeriella* sp. from Japan. Considering the life cycle, *P. depressum* requires the earthworms as intermediate hosts and use insectivores (mainly soricids) as paratenic hosts. Thus, it suggested that the hawk-eagle was infected with the nematode by ingestion of small animals such as earthworms and soricids.

Key words: chewing lice, Hodgson's Hawk-eagle, *Porrocaecum depressum*

Introduction

The Hodgson's Hawk Eagle, *Spizaetus nipalensis* (Hodgson, 1836), is distributed in broadleaved forests in East Asia including Japan, and under the risk of extinction (Morimoto & Iida, 1992), so that the eagle is classified as IB (EN: Endangered) in the red list of Japan, and their current estimates suggest a population size of about 1000 individuals, but the number of Hodgson's Hawk Eagles has been decreasing year by year (Kanai, 2002). Several biological studies on the Hodgson's Hawk Eagle have been conducted, including the studies of their ecology, including feeding behavior and reproduction (Asai *et al.*, 2006; Iida, 1999; Iida *et al.*, 2007; Morimoto & Iida, 1992, 1994; Nishigaito *et al.*, 1971; Yanbe & Yui, 2011). Also there are several reports of problems of their conservation such as lead poisoning, electrocution and so on, however there is little information regarding the disease-causing agents in

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this species, particularly helminths and arthropods (Nakamura *et al.*, 2001; Okano *et al.*, 2010; Saito and Watanabe, 2006; Watanabe *et al.*, 2008). Recent contractions of the available habitat for *S. nipalensis* in Japan have greatly increased the risk of infectious disease outbreaks, such as fatal helminthiasis (Asakawa *et al.*, 2002; Friend and Franson, 1999). We therefore investigated the parasites of *S. nipalensis*.

Materials and Methods

A male adult Hodgson's Hawk Eagle was found at Gifu Prefecture, Japan, in October 2003. In postmortem examination performed at Gifu University, two individuals of ascaridid nematode and four female chewing lice were obtained. These parasite specimens were fixed in 70% ethanol and taken to the Wild Animal Medical Center of Rakuno Gakuen University (WAMC) for taxonomical examination. The nematode specimen was cleared in lacto-phenol solution and the lice were mounted by Hoyer's medium for microscopic observation. Morphological and biometric data were recorded using a camera lucida (OLYMPUS DP20). All parasite specimens are preserved in the WAMC (WAMC-AS-5751).

Results

The present nematodes obtained from the proventriculus of the *S. nipalensis* were identified as *Porrocaecum depressum* (Zeder, 1800) by the morphological characters according to the criteria of Chaboud (1974), Mozgovoi (1953) and Barus *et al.* (1978). They have following characters; mouth with three lips hexagonal and very narrow at base, row of denticles present on inner side of lips and reaching to base on sides behind papillae, interlabia short and approximately half the length of lip, labial pulp bilobed anteriorly and each lobe with two finger like processes on anterior margin, cervical alae absent, intestinal cecum five to seven times as long as ventriculus, ventriculus cylindrical, gubernaculum absent, spicules equal. Their morphological characters and measurements were given (Fig. 1, Tab. 1.). Measurements of the present specimens were match to the previously reported *P. depressum* (Mozgovoi, 1953, Barus *et al.*, 1978).

The present chewing lice obtained from the face of the *S. nipalensis* were identified as belonging to the family Philopteridae because of following characters; antenna filiform and exposed, each tarsus with two claws (Price *et al.*, 2003). They include two types, one has thick body and the other has slender ones. The former was identified as the genus *Craspedorrhynchus* Keler, 1938 from head narrowed anteriorly, imparting triangular shape, length of preantennal head region shorter than postantennal region (Mey, 2001; Price *et al.*, 2003). The latter was identified as the genus *Degeeriella* Neumann, 1906 from head broad anteriorly, with suboval shape, with complete and not lobate marginal carina, abdomen slender and its sides subparallel, head much longer than wide, female subgenital plate margin straight, with row of short fine setae (Clay, 1958; Price *et al.*, 2003).

Discussion

For the *S. nipalensis*, two nematode (*Synhimantus nipponensis* Yamaguti, 1941, unidentified spirurid species) and one trematode (*Pseudostrigea buteonis* Yamaguti, 1933) species have previously recorded in Japan (Nakamura *et al.*, 2001; Uchida *et al.*, 1991). Also, nematodes belonging to the genus *Porrocaecum* Raillict & Henry, 1915 was so far been known from several avian hosts, mainly Falconiformes, Strigiformes, Ciconiiformes, Charadriiformes and Passeriformes living in the worldwide, and about 40 species have ever been recorded in this genus, and *P. depressum* previously reported from mainly Falconiformes and Strigiformes birds living in Europe, Asia, America and Australia regions (Atkinson *et al.*, 2008; Barus *et al.*, 1978; Mozgovoi, 1953). There were several species belonging to the genus *Porrocaecum* recorded from wild and captive birds in Japan: *P. angusticolle* (Molin, 1860), *P. crassum* (Deslongchamps, 1824), *P. ensicaudatum* (Zeder, 1800), *P. phalacrocaracis* Yamaguti, 1941, *P. retic-*

Table.1. Measurements of the male *Porrocaecum depressum* (mm)

	present worms (n=2)	Barus *et al.*, 1978
Body length	85.88, 90.52	27.0 - 100.0*
Body width	1.27, 1.38	0.46 - 1.5
Length of esophagus	4.31, 5.14	1.85 - 4.48
Length of ventriculus	0.58, 0.59	0.27 - 0.58
Length of intestinal cecum	3.64, 3.84	1.56 - 3.78
Spicules	1.42, 1.44	0.723 - 1.504
Cloaca from tail end	0.34, 0.45	0.15 - 0.41

* range

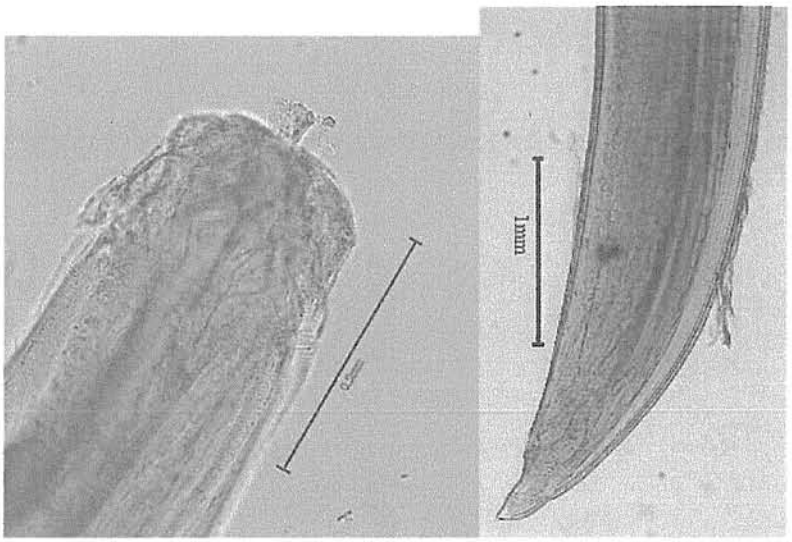

Fig. 1. *Porrocaecum depressum* obtained from the Hodgson's Hawk Eagle
head of (fe)male (A), posterior extremity and spicules of male (B)

ulatum (Linstow, 1899), *P. semiteres* (Zeder, 1800), *P. spirale* (Rudolphi, 1795), *P. wui* Hsu, 1933 and *Porrocaecum* sp. (Uchida *et al.*, 1991; Onuma *et al.*, 2011). So, the present case is the first host record for *P. depressum* from *S. nipalensis* on worldwide basis and the first geographical record from Japan.

The present chewing lice, *Craspedorrhynchus* sp. and *Degeeriella* sp., have already been recorded from several Falconiformes species in worldwide (Clay, 1958; Mey, 2001; Price *et al.*, 2003). There were some chewing lice species recorded from *S. nipalensis*, namely *Colpocephalum* impressum Rudow, 1866, *Colpocephalum turbinatum* Denny, 1842, *Falcolipeurus suturalis* (Rudow, 1869) and *Laemobothrion* (*Laemobothrion*) *vulturis* (Fabricius, 1775) (Price *et al.*, 2003), and several species of chewing lice including *Craspedorrhynchus* sp. have already been reported from wild and captive birds in Japan (Uchida 1926, 1948, 1949; Yoshino *et al.*, 2009). The present *Craspedorrhynchus* sp. seems to be close to *C. nipalensis* Eichler, 1944 described by the specimen obtained from *Aquila nipalensis* (Hodgson, 1836) in Berlin Zoo (Eichler, 1944; Mey, 2001; Price *et al.*, 2003). Also, the present *Degeeriella* sp. seems to be close to *D. fulva* (Giebel, 1874) described by the specimens of *A. chrysaetus* (Linnaeus, 1758) and has already been reported from several falconiform birds in Europe and Asia (Clay, 1958; Price *et al.* 2003). However, we could not give the present specimens definitive name because of no

Table.2. Measurements of the female *Craspedorrhynchus* sp. and *Degeeriella* sp. (mm)

	Craspedorrhynchus sp.(n=2)	*Degeeriella* sp.(n=2)
Head length	0.82, 0.91	0.59, 0.59
Head width	0.81, 0.93	0.48, 0.49
Prothorax width	0.47, 0.51	0.28, 0.28
Pterothorax width	0.71, 0.75	0.46, 0.48
Abdomen length	1.03, 1.15	1.35, 1.40
Abdomen width	1.01, 1.07	0.62, 0.64
Total	2.12, 2.34	2.26, 2.34

Fig. 2. chewing lice obtained from the Hodgson's Hawk Eagle
Female *Craspedorrhynchus* sp. (A) and *Degeeriella* sp. (B)

male specimen obtained (Clay, 1958; Eichler, 1944; Mey, 2001). Both the present chewing lice are the first host records from *S. nipalensis* and the first geographical record of *Degeeriella* sp. from Japan.

It is known that the genus *Porrocaecum* uses earthworms as intermediate host, and some of the *Porrocaecum* species including *P. depressum* are known that using small mammals (e. g. shrews) as paratenic host (Anderson, 2000; Erkinaro & Heikura, 1977; Osche, 1959). *S. nipalensis* is well known as top level predator of Japanese forest ecosystems and feeds several mammals and birds (Iida, 1999; Iida *et al.*, 2007; Morimoto & Iida, 1992). Thus, the present case might be the result of the ingestion of small animals such as earthworms and shrews having the infective larvae of the nematode.

The genus *Porrocaecum* is known as a pathogenic agent for wild and captive birds, sometimes can be a contributory cause of death. If hosts are infected a large amount of the nematodes, they produce a severe inflammatory response. especially, when juvenile worms embed and migrate within the walls of the digestive tracts, and ruffled feathers and an inability to maintain body balance (Friend & Franson, 1999; Atkinson *et al.*, 2008). It is well known that chewing lice often cause severe dermatitis and/or feather damage on their hosts if in infections of high intensity (Arnall & Keymer, 1975; Atkinson *et al.*, 2008; Keymer *et al.*, 1981).

Although no evidence of pathogenicity or mortality directly attributable to the present parasites infection was found in the present case, effect of infection of these parasites appears that birds subjected to stress (e. g. capture, deterioration of habitat) are

more susceptible to parasitic infection than those from wild populations (Asakawa *et al.*, 2002; Atkinson *et al.*, 2008; Friend & Franson, 1999). Thus, the attention needs to be parasite infection in considering the conservation of *S. nipalensis*.

The present survey was supported in part by the Grant-in-Aid (Nos. 18510205, 20380163) of the Ministry of the Education, Culture, Sports, Science and Technology, Japan.

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(Received April 28, 2011; Accepted June 23, 2011)