□ Parasitology □ Research note

Parasitic Helminths Obtained from the Hazel Grouse, *Bonasa bonasia vicinitas* Riley, 1915, in Hokkaido and Russia

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エゾライチョウ *Bonasa bonasia vicinitas* Riley, 1915 から得られた寄生蠕虫類

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ABSTRACT. A helminthological survey performed on 18 individuals of the Hazel Grouse, *Bonasa bonasia vicinitas* collected between 1995 and 2009 in Hokkaido, Japan and Vestretosovo, Primorskii krai, Russia, and the present survey is first for *B. b. vicinitas*. Three nematode [*Heterakis gallinarum*, *Aonchotheca* (*Avesaonchotheca*) *caudinflata*, Subuluridae gen. sp.] and one trematode (*Leucochloridium* sp.) species were obtained and identified from 9 individuals examined. Among the above, Subuluridae gen. sp. is the first host record of *B. bonasia*. Hence, the present result suggested that the grouses were infected by feeding the intermediate hosts (e.g., earthworms, snails) including larvae of the present nematode and trematode species, respectively.

Key words : First host record, Hazel Grouse, Parasitic helminths

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The Hazel Grouse, *Bonasa bonasia* (Linnaeus, 1758), is a small forest grouse widely distributed in temperate and boreal forests from Scandinavia to the Far East, Sakhalin and Hokkaido, Japan [1], but especially in Hokkaido, a decline in this species has been observed because of artificial development, predation by red fox and/or hunting during the last decade [2-4]. Although, several biological and ecological studies on the grouses have been conducted, including the studies of their feeding behavior, age determination, genetic diversity and reproduction [1, 2, 5-9], there is little information regarding the disease-causing agents, particularly parasitic helminths of these grouses have so far been recorded [10, 11]. In this paper, some helmimth species including the nematode genus *Heterakis* Dujardin, 1845 (Heterakoidea: Heterakidae) obtained from the Hazel Grouse at the first time from Japan.

Between November 1995 and September 2009, total individuals of 18 Hazel Grouses were collected in Hokkaido (Bihoro, Shimizu, Hidaka, Urahoro, Shintoku, Shiranuka, Nakasatsunai, Obira, Obihiro and Unknown locality in Hokkaido) and Vostretsovo, Primorskii krai, Russia (Table 1).The carcasses stored at −20℃ or visceral organs (gastrointestinal tract, liver, heart and pancreas) fixed in 70% ethanol were examined under a binocular microscope. These samples were taken to the Wild Animal Medical Center (WAMC) of Rakuno Gakuen University, Japan, for parasitological examination. Helminths obtained from the hosts were preserved in 70% ethanol, and nematodes were

Table 1 Materials of Hazel Grouses in the present examination

Locality	Date	Sample
Bihoro	07/06/1996	gastrointestinal tract
Shimizu	24/08/1996	gastrointestinal tract
Shimizu	24/08/1996	gastrointestinal tract
Shintoku	19/10/1996	gastrointestinal tract, liver
Hidaka	12/10/1996	gastrointestinal tract, pancreas
Urahoro	29/09/1996	gastrointestinal tract, heart, liver
Shiranuka	14/04/1996	gastrointestinal tract, pancreas
Unknown	u/11/1995	gastrointestinal tract
Vostretsovo	24/09/2000	gastrointestinal tract, liver
Vostretsovo	24/09/2000	gastrointestinal tract, liver
Vostretsovo	24/09/2000	gastrointestinal tract, liver
Vostretsovo	24/09/2000	gastrointestinal tract, heart, liver
Vostretsovo	24/09/2000	gastrointestinal tract, liver
Vostretsovo	24/09/2000	gastrointestinal tract
Nakasatsunai	u/07/2001	whole body
Obira	10/09/2008	whole body
Obihiro	25/11/2009	whole body
Unknown	u/u/2006	visceral organs

cleared in lacto-phenol solution and trematodes were stained with Heidenhain iron hematoxylin solution for microscopic observation. Morphological and biometric data recorded using a camera lucida (OLYMPUS Model BH-2DA). The helminths specimens have been deposited in the WAMC or the Meguro Parasitological Museum, Tokyo, Japan.

Three nematode species, i.e., *Aonchotheca* (*Avesaonchotheca*) *caudinflata* (Molin, 1858) Barus and Sergejeva, 1990 (small intestine; Capillaridae), *Heterakis gallinarum* (Shrank, 1788) Madsen, 1949 (small intestine and cecum; Heterakidae) and Subuluridae gen sp (proventriculus), and one trematode species, i.e., *Leucochloridium* sp. (cecum; Leucochloridiidae), were obtained from both Russian and Japanese samples. Herein, this is the first helminthological report from the Japanese population of *B. bonasia*. Although several helminths reported from the Hazel Grouse in the Europe and USSR including six nematode, two trematode and five cestode species [12-20], therefore, the present survey provides the first host record of Subuluridae gen. sp. from *B. bonasia*, too.

Of the 18 hosts, 50% were infected with at least one helminths species, and no nematode species found from the samples collected at Vostretsovo. The most common species was *H. gallinarum*, which occurred in 16.7% of grouses. Also we found one trematode specimen from one of the samples collected in Vostretsovo and some cestode segments from one of the samples collected in unknown place of Hokkaido, but we could not give them definitive name because they were heavily degenerated. No evidence of pathogenicity or mortality directory attributable to the helminth infection was found in the present survey. According to taxonomical reviews and/or keys to the species of the genus *Heterakis* [21-25], the present heterakid nematode was identified as *H. gallinarum*, because of the measurement, especially spicule length (left spicule=2.21mm, right one=0.73mm) and arrangement of the caudal papillae of the present male individual [22, 25] (Fig. 1B). Several species belonging to the genus *Heterakis*, including *H. gallinarum*, previously reported from the wild and captive birds in Japan [24-27]. Because *H. gallinarum* inhabits the poultry's cecum and is important as the transport host for *Histomonas meleagridis* that causes an often-fatal disease for many birds,blackhead disease [28, 29]. Hence, the infection of nematode genus *Heterakis* should be taken into epidemiological consideration.

The capillariid nematodes identified as *A. (A.) caudinflata*, based on the morphological characters of male bursa and caudal wing, and size of female vulvar appendage (0.063-0.150mm long) [30, 31] (Fig. 2A, B). Also, *A. (A.) caudinflata* was previously reported from several wild and domestic birds in Japan [25, 32], but it was the first geographical record from Hokkaido. And Subuluridae gen. sp. is mainly parasites in rectum and cecum of birds and mammals of the worldwide

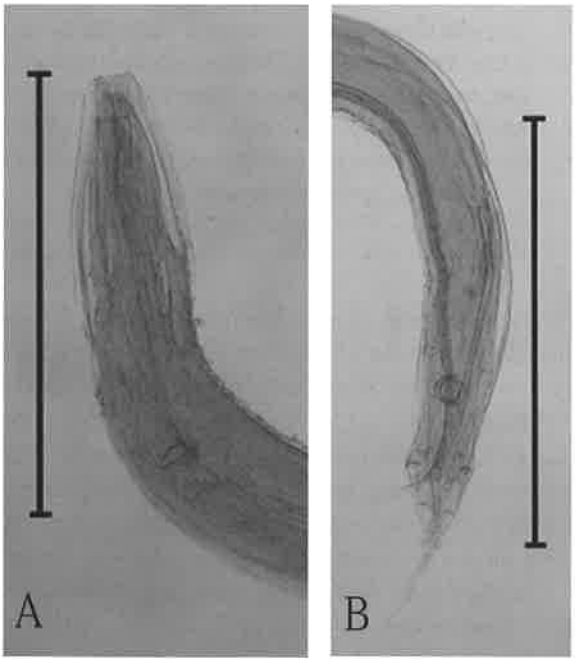

Fig. 1 *Heterakis gallinarum* obtained from the Hazel Grouse (scale=1mm). A : anterior extremities of males, B : posterior extremities of males.

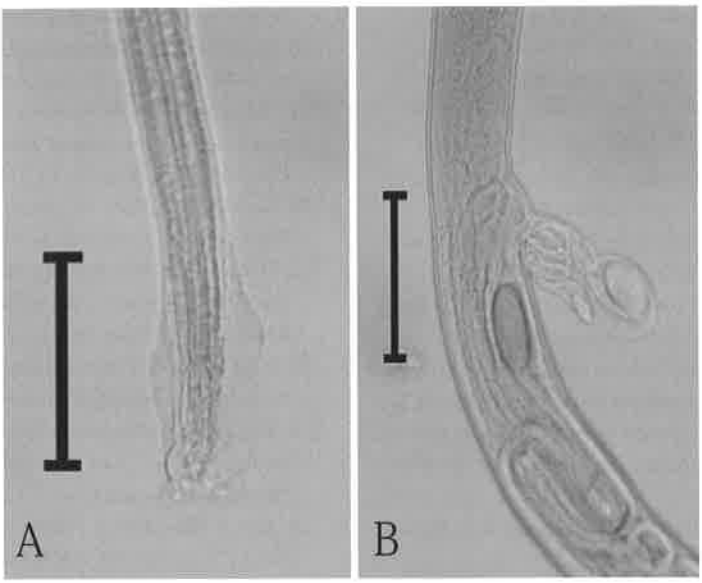

Fig. 2 *Aonchotheca (Avesaonchotheca) caudinflata* obtained from the Hazel Grouse (scale=0.1mm). A : posterior extremities of males, B : vulvar appendage of female.

[33]. But in this survey, the present specimen was only four immature ones and found from proventriculus of the host, and we could not give it definitive name. In Japan, only one species has been reported from wild birds, namely *Subulura coturnicis* Yamaguti, 1935 from the Japanese Quail, *Coturnix japonicus* Temminck and Schlegel, 1849, respectively [25, 33].

The digenetic trematode, *Leucochloridium* sp., is mainly parasites in cloaca of the galliformes and passeriformes birds of the world [34]. In this survey, three gravid specimens were obtained from cloaca of the host. In Japan, four species belonging to the genus *Leucochloridium* Carus, 1835 sensu lato were previously reported, namely *L. japonicum* Ishii, 1932 (host: *S. soemmerringi*) and *L. sime* Yamaguti, 1935 [host: *Coccothraustes coccothraustes* (Linnaeus, 1758)] in Honshu [29], and *L. variae* McIntosh, 1932 reported from *B. bonasia* and *Bonasa umbellus* (Linnaeus, 1766) in Karelia region, Russia [14]. Although we could not give the present specimen definitive name because the obtained specimens were degenerated, genital organs of the present specimens were accorded with generic key characters of previous works [14, 29, 34]. Although there were few reports of sporocyst of the *Leucochloridium* sp. in the Amber Snail, *Succinea lauta* Gould, 1859, from Hokkaido, it was the first record of gravid specimen of this genus from Hokkaido [36-38].

The present nematode and/or trematode species in this survey are requiring intermediate hosts, mainly earthworms or terrestrial snails as intermediate hosts [25, 36, 39]. Thus, it suggested that the hazel grouse ingested such earthworms and/or snails, although there were several researches of the gastric contents of the hazel grouse, no report of the earthworms eaten by the grouse in Japan [1, 8].

Although there were no evidence of pathogenicity or mortality directory attributable to helminth infection was found in the present survey, 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 [11].

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要　　約

1995年から2009年の間に北海道内およびロシアで採集されたエゾライチョウ18個体の寄生蠕虫類保有状況を調査した。なお，北海道個体群では初めての調査となる。調べた9個体から線虫3種（*Heterakis gallinarum*, *Aonchotheca* (*Avesaonchotheca*) *caudinflata*, Subuluridae gen. sp.）および吸虫1種（*Leucochliridium* sp.）が検出された。スブルラ科線虫の寄生がこの鳥種で認められたのは今回初めてであった。また，検出された線虫類はミミズ類，吸虫類はモノアラガイ類がそれ

ぞれ中間宿主であるため，これらを摂食することで感染したと考えられた。

キーワード：エゾライチョウ，寄生蠕虫類，新宿主記録

REFERENCES

1. Fujimaki Y. 2002a. The biology of Hazel Grouse, *Bonasa bonasia*. *Jpn J Ornithol* 51: 74-86 (in Japanese with English summary).
2. Fujimaki Y. 2000. Recent Hazel Grouse *Bonasa bonasia* population decline in Hokkaido, Japan. *Jpn J Ornithol* 48: 281-284.
3. Wildlife Division of the Ministry of the Environment. 2002. *Red Data Book: Birds*. Japan Wildlife Research Center, Tokyo (in Japanese).
4. Natural Environmental Division of the Hokkaido Government. 2001. *Red Data Book of Hokkaido*. Hokkaido Government, Sapporo (in Japanese).
5. Baba Y, Fujimaki Y, Koike H. 1999. Genetic diversity and gene flow of the Hazel Grouse *Bonasa bonasia* in Japan. *Jpn J Ornithol* 48, 47-60 (in Japanese with English summary).
6. Chae HY, Fujimaki Y. 1996. Age determination of the Hazel Grouse based on skull pneumatization. *Jpn J Ornithol* 45: 17-22.
7. Fujimaki Y. 1995. Problems in captive breeding and release of hazel grouse. *J Jpn Wildl Res Soc* 21: 37-43 (in Japanese with English summary).
8. Fujimaki Y. 2002b. Food habit of Hazel Grouse in Hokkaido, Japan. *J Yamashina Inst Ornithol* 34: 73-79.
9. Mitani A, Fujimaki Y. 1992. Age determination of the hazel grouse and carrion crow based on the layered structure of the mandible. *Jpn J Ornithol* 40: 109 – 111.
10. Leighton FA. 2002. Health risk assessment of the translocation of wild animals. *Rev Sci Tech (OIE)* 21: 187-195.
11. Asakawa, M., Nakamura, S. and Brazil, M. A. (2002) An overview of infectious and parasitic diseases in relation to the conservation biology of the Japanese avifauna. Journal of the Yamashina Institute for Ornithology 34, 200-221.
12. Andreev KI. 1983. Prevalence of endoparasites in *Tetrastes bonasia* in USSR. In *Vliyanie antropogennykh faktorov na strukturu i funktsionirovanie biotsenozov*. pp. 126-133. Moscow, USSR (in Russian).
13. Belopolskaya MM. 1963. Parasite fauna of birds in the Sudzukhinsk reserve (Primorsk region). IV. Cestoidea. *Trudy gel'mint Lab* 13: 144-163 (in Russian).
14. Gromova NN. 1972a. Trematodes of tetraonid birds in Karelia (USSR). In *Biologicheskie osnovy borby s transmissivnymi i parazitarnymi zabolevaniyami na Severe*. (Lutta AS. ed.), pp. 79-86. Izdatel'stvo Kareliya, Petrozavodsk, USSR (in Russian).
15. Gromova NN. 1972b. The cestode *Ophryocotyle proteus*, found for the first time in tetraonid birds in the USSR. In *Biologicheskie osnovy borby s transmissivnymi i parazitarnymi zabolevaniyami na Severe*. (Lutta AS., ed.), pp. 87-88. Izdatel'stvo Kareliya, Petrozavodsk, USSR (in Russian).
16. Isomursu M, Ratti O, Helle P, Hollmen T. 2006. Sex and age influence intestinal parasite burden in three boreal grouse species. *J Avian Biol* 37: 516-522.
17. Isomursu M, Ratti O, Helle P, Hollmen T. 2008. Parasitized grouse are more vulnerable to predation as revealed by a dog-assisted hunting study. *Ann Zool Fennici* 45: 496-502.
18. Khuan SI. 1962. New and rare helminths of game birds in the lower reaches of the Amur. *Trudy gel'mint Lab* 12: 301-316 (in Russian).
19. Merkusheva IV, Kraevskaya LI. 1963. Helminth fauna of *Tetrao urogallus, Lyrurus tetrix* and *Tetrastes bonasia* in the Byelorussian SSR. Doklady Acad Sci BSSR 7: 212-215 (in Russian).
20. Skrjabin KI, Sobolev VV. 1963. *Spirurata of animals* and *man. Part 1. Spiruroidea*. Nauka, Moscow (in Russian).
21. Chabaud AG. 1978. *Keys to genera of the superfamilies Cosmocercoidea, Seuratoidea, Heterakoidea and Subuluroidea. CIH Keys to the Nematode Parasites of Vertebrates, No.6*. CAB, Farnham Royal, UK.
22. Inglis WG. 1967. The evolution, host relationships and classification of the nematode superfamily Heterakoidea. *Bull Br Mus Nat Hist* 15: 3-28.
23. Skrjabin KI, Shikhobalova NP, Lagodovskaya EA. 1961. *Oxyurata of animals and man. Part 2. Heterakoidea*. Israel Program for Scientific Translations, Jerusalem.
24. Sato A, Nakamura S, Takeda M, Murata K, Mitsuhashi Y, Kawai N, Tanaka N, Asakawa M. 2005. Parasitic helminths from exhibited avian species kept in Kinki District in Japan. *Jpn J Zoo Wildl Med* 10: 35-38.
25. Uchida A, Uchida K, Itagaki H, Kamegai S. 1991. Check list of helminth parasites of Japanese birds. *Jpn J Parasitol* 40: 7-85.
26. Ushigome N, Yoshino T, Suzuki Y, Kawajiri M, Masaki K, Endoh D, Asakawa M. 2010. Three species of the genus *Heterakis* Dujardin, 1845 (Nematoda: Heterakidae) from a captive Satyla Tragopan (*Tragopan satyra*) (Aves) in a zoological garden. *Nematol Res* 40: 21-23.
27. Yoshino T, Onuma M, Nagamine T, Inaba M, Kawashima T, Murata K, Kawakami K, Kuwana T, Asakawa M. 2008. First record of the genus *Heterakis* (Nematoda: Heterakidae) obtained from two scarce avian species, Japanese Rock Ptarmigan (*Lagopus mutus japonicus*) and Okinawa Rails (*Gallirallus okinawae*), in Japan. *Jpn J Nematol* 38: 89-92.
28. Chalvet-Monfray K, Sabatier P, Chauve C, Zenner L. 2004. A mathematical model of the population dynamics of *Heterakis gallinarum* in turkeys (*Meleagridis gallopavo*). *Poultry Sci* 83: 1629-1635.
29. McDougald LR. 2005. Blackhead disease (histomoniasis) in poultry: a critical review. *Avian Dis* 49: 462-476.
30. Barus V, Sergejeva TP. 1990. Capillariids parasitic in birds in the Palearctic region (4). Genera *Pterothominx* and *Aonchotheca*. *Acta Sci Nat Acad Sci Bohem Brno* 24: 1-48.
31. Moravec F. 1982. Proposal of a new systematic arrangement of nematodes of the family Capillariidae. *Folia Parasitol* 29: 119-132.
32. Yoshino T, Shingaki T, Onuma M, Kinjo T, Yanai T, Fukushi H, Kuwana T, Asakawa M. 2009. Parasitic helminths and arthropods of the Crested Serpent Eagle *Spilornis cheela perplexus* Swann, 1922 from the Yaeyama. *J Yamashina Inst Ornithol* 41: 55-61.
33. Pojmanska T. 2002. Family Leucochloridiidae Poche, 1907. In *Keys to the Trematoda, Vol. 1* (Gibson, D. I., Jones, A. and Bray, R. A. eds.), pp. 47-51. CAB Int & Nat Hist Mus, London.
34. Iwaki T, Okamoto M, Nakamori J. 2009. *Urogonimus macrostomus* (Digenea: Leucochloridiidae) from the rustic bunting, *Emberiza rustica*, in Japan. *Parasitol Int* 58: 303-305.
35. Kagan IG. 1952. Revision of the subfamily Leucochloridiinae Poche,

1907 (Trematoda: Brachylaemidae). *Am Midland Nat* 48: 257 – 300.

36. Asakawa M, Konno T. 2000. Report of a refined amber snail infected by the trematode genus *Leucochloridium*. *J Hok Vet Med Assoc* 44: 312 (in Japanese).
37. Minato H, Takeda Y. 1993. Notes on *Leucochloridium* sp. (Digenea, Trematoda) parasitic on *Succinea lauta* Gould in Japan. *Mitamaki (J Sagami Shell Club)* 27: 10-12 (in Japanese).
38. Yamada S, Fukumoto S. 2011. Isolation of sporocyst broodsacs of the genus *Leucochloridium* (Leucochloridiidae: Trematoda) from the intermediate host, *Succinea lauta*, in Japan. *Jpn J Vet Res* 59: 101-104.