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## Research Note

# First evidence of *Paraheligmonina gracilis* and *Hymenolepis sulcata* among fat dormice (*Glis glis* L.) from Croatia

D. KONJEVIĆ[1*], M. ŠPAKULOVÁ[2], R. BECK[3], M. GOLDOVÁ[4], K. SEVERIN[1], J. MARGALETIĆ[5], K. PINTUR[6], T. KEROS[7], S. PERIĆ[8]

[1]Department for Game Biology, Pathology and Breeding, University of Zagreb, Faculty of Veterinary Medicine, Heinzelova 55, 10 000 Zagreb, Croatia, E-mail: *dean.konjevic@vef.hr*; [2]Parasitological Institute SAS, Košice, Slovak Republic; [3]Department of Parasitology and Parasitic Diseases, University of Zagreb, Faculty of Veterinary Medicine, Zagreb, Croatia; [4]Department of Parasitology, Diseases of Fish, Bees & Game, University of Veterinary Medicine, Košice, Slovak Republic; [5]Department of Forest Protection and Wildlife Management, Forestry Faculty, University of Zagreb, Zagreb, Croatia; [6]Department of Gamekeeping and Environmental Protection, Polytechnic of Karlovac, Karlovac, Croatia; [7]Croatian Veterinary Institute, Zagreb, Croatia; [8]Department for Ecology and Sylviculture, Forest Research Institute, Jastrebarsko, Croatia

**Summary**

The present study reports for the first time on the helminth species occurring in the gastro-intestinal system of fat dormice (*Glis glis*) in Croatia. Out of 55 dormice, 63.7 % harboured helminths belonging to two species, the nematode *Paraheligmonina gracilis* (syn. *Longistriata elpatievskii*) (Heligmonellidae, Trichostrogyloidea) in the prevalence of 52.7 %, and the cestode *Hymenolepis sulcata* (Hymenolepididae, Cyclophyllidea) in the prevalence of 32.7 %. Concurrent infections of both parasites were found in 12 fat dormice, *P. gracilis* alone was detected in 17 hosts and *H. sulcata* alone in 6 samples. No influence of parasitic infestation on animal weight was observed. Glirid helminths do not represent zoonotic pathogens despite the fact that dormice occasionally inhabit cottages and village houses, and are used in human nutrition.

Key words: fat dormice; *Paraheligmonina gracilis*; *Hymenolepis sulcata*; Croatia

## Introduction

The fat dormouse (*Glis glis* L.) is Croatian native game species from the family of Gliridae (Rodentia) (Andrašić, 1979; Forenbacher, 2002). According to the actual regulations (Anonymus, 2005), the fat dormouse is listed as a game animal in the region south to the River Sava. In the northland districts, it is fully protected. This rodent can reach up to 35 cm in length including the tail and up to 300 g in weight (Forenbacher, 2002). It feeds mainly on different sorts of fruits, nuts and occasionally insects, small birds and eggs. Even though the fat dormice are frequently caught and consumed as a game in some rural areas of Croatia (Andrašić, 1979; Forenbacher, 2002; Konjević & Krapinec, 2004; Cvrtila *et al.,* 2004), no information is available on their health status and parasitic infestation. In this note we describe the first record of the specific helminth parasites of fat dormice in Croatia and by that a regular part of the helminthofauna of rodents in Croatia.

## Materials and Methods

*Host animals*

Fifty five fat dormice were collected during September and October 2003 in the area of Mrkopalj (Gorski Kotar) as a part of regular hunting operations. Dormice were captured by a traditional way using especially designed traps, which immediately kill the animal (Grubešić & Radović, 1996). Traps were placed on trees 3 – 4 meters above the ground, using the apple and carob (*Ceratonia siliqua* L.) as a bait. Thanks to the kindness of local hunters, all animals were immediately transported to Faculty of Veterinary Medicine University in Zagreb for examination. Prior to a necropsy, each animal had been weighted. During the standard dissection procedure, we took a complete digestive system of each animal, stored it in separate boxes and properly signed.

*Parasitological examination*

Gastric and intestinal contents were examined for the presence of parasites. Helminths were fixed in 4 % buffered formaline and transferred to 70 % ethanol after several weeks.

Table 1. Some parameters on body weight of fat dormouse grouped according to a parasite infection

| Body weight (g) | Dormice infected with *Hymenolepis sulcata* (n = 6) | Dormice infected with *Paraheligmonina gracilis* (n = 17) | Dormice infected with both parasites (n = 12) | Dormice without helminth parasites (n = 20) |
|---|---|---|---|---|
| Mean ± SD | 104.4 ± 25.0 | 121.1 ± 32.3 | 106.2 ± 34.0 | 107.3 ± 42.4 |
| Min – Max | 64 – 118 | 73 – 184 | 61 – 150 | 60 – 193 |

*Staining and identification*

Before identification, tapeworms were stained using Semichon's carmine or acid orcein, dehydrated, cleared in Clove oil, mounted in Canada balsam and measured. Nematodes were cleared in lactic acid. The species identification was made using descriptions published by Skrjabin *et al.* (1954), Murai and Tenora (1977), Faivre and Vaucher (1978) and Genov (1984).

*Statistical evaluation*

The results were analysed using SPSS for Windows 6.1. package.

## Results

Thirty-five (63.7 %) of the dormice were found to be infected with parasites. Two helminth species were identified, namely the nematode *Paraheligmonina gracilis* (Leuckart, 1842) (Heligmonellidae, Trichostrogyloidea) and the cestode *Hymenolepis sulcata* (von Linstow, 1879) (Hymenolepididae, Cyclophyllidea). Concurrent infection with both parasites was detected in 12 samples (21.8 %). Monoinfection with *P. gracilis* and *H. sulcata* were present respectively in 30.9 % and 10.9 % of the dormice examined. The body weights of infected and uninfected animals did not differ significantly (Table 1). A high variation of the standard deviation resulted from the use of non-selective traps, which captured lighter – younger as well as heavier – older animals at the same time.

Morphological features and measurements of nematodes corresponded well with the previous descriptions of the species *Longistriata elpatievskii* sensu Skrjabin *et al.* (1954) and *Paraheligmonina gracilis* sensu Genov (1984), including of the length of spicules reaching 2.2 mm.

Similarly, previous morphological descriptions of *H. sulcata* published by Murai and Tenora (1977), Faivre and Vaucher (1978) and Tenora *et al.* (1999) equated morphology of presently investigated tapeworms. The scolex (diameter up to 315 μm) contained a rostellum (137 x 59 μm) without hooklets. Four suckers (81 – 90 μm) were free of any elements and conspicuous calcareous bodies were present in the scolex part of the strobila. Strobilas were up to 70 mm long and 1.1 mm wide. The topography of male and female sex organs of the hermaphroditic proglottides was similar to this already published. Thus, three testes were located either in one row or in triangular form and were separated in two groups by an ovary.

## Discussion

The helminth species *P. gracilis* and *H. sulcata* are reported here for the first time from the fat dormouse (*G. glis*) in Croatia. Previously, both parasites were often found in this glirid species in various Palaearctic regions. For instance, the dormice nematode *P. gracilis* have been reported from Britain, Azerbaijan, Slovakia, France, Sardinia and Ukraine (Skrjabin *et al.,* 1954; Baruš & Tenora, 1956; Durette-Desset, 1969; Genov, 1984; http://www.faunaeur.org/distribution.php), while the tapeworm *H. sulcata* from Germany, Slovakia, Hungary, Switzerland and Spain, (Tenora, 1965, Murai & Tenora, 1977; Faivre & Vaucher, 1978; Feliu, 1987; Tenora *et al.,* 1999; Salamatin *et al.,* 2005).

Interestingly, the taxonomy of both parasites had been problematic for a long time. The heligmonellid roundworm *P. gracilis* was sometimes identified as *Longistriata elpatievskii* Schachnasarova, 1949 or *L. schulzi* Schachnasarova, 1949. Genov (1984) discussed this problem in detail and stated that above mentioned *Longistriata* spp. are junior synonyms of *P. gracilis*. Recently, validity of the species name *P. gracilis* was acknowledged by a list worked out under the project Fauna Europaea (http://www.faunaeur.org/full_results.php?id=229039). Remarkable taxonomical problems had been dwelling also in glirid cestodes. As rodent hymenolepidids from the point of identification still represent extremely problematic and morphologically difficult group, many erroneously identified tapeworms were reported in *G. glis,* including *Hymenolepis diminuta* (Rudolphi, 1819) (for a review see Tenora *et al.,* 1999) that can serve as an occasional human pathogen causing severe symptoms, especially in children (Cheng, 1986; Levi *et al.,* 1987; Marangi *et al.,* 2003). Fortunately, Tenora *et al.* (1999) made a thorough re-evaluation of huge museum material as well as comprehensive literature data and stated that the only hymenolepidids found to date in European dormice are *H. sulcata* with unarmed rostellum, and armed species *Armadolepis myoxi* (Rudolphi, 1819), *A. spasskii* (Tenora & Baruš, 1958) and *Rodentolepis* sp. (Tenora *et al.,* 1999). According to the relevant drawings and descriptions of *H. sulcata* (Murai & Tenora, 1977; Faivre & Vaucher, 1978; Salamatin *et al.,* 2005), we were able to identify the present material.

Both parasites occur frequently in *G. glis* and occasionally were reported from other representatives of the family Gliridae (Skrjabin *et al.,* 1954; Tenora *et al.,* 1999). However, they have never been reported from any other group of animal or from humans. Knowing that fat dormouse is a

traditional game animal in Croatia and it sometimes inhabits cottages, village houses, etc., there have been questions about its role as a possible vector of human pathogens. Considering the ecology of aforementioned helmith parasites, we can state that these species-specific parasites of glirids do not represent a threat for human health.

Another interesting aspect of the presented results concerns particularly the fat dormice diet. A relatively high number of fat dormice infested with hymenolepidid cestode *H. sulcata* suggests that grain-ingesting beetles as its intermediate hosts frequently participate in fat dormouse diet. This is in accordance with the statement of Gigirey and Rey (1998), that insects were frequently present in dormice diet, but only in small amounts. Regarding heligmonellid nematodes including *P. gracilis*, their life cycle does not include any intermediate hosts. Two movable free-living larval stages develop from eggs that pass in the faeces of infected hosts. Larvae feed on faecal and soil bacteria. The infective third stage larvae have to be ingested by a dormice host and then mature inside the host intestine. Thus, it can be hypothesized that the life cycle of the dormice nematode carries out within the host nest or near the places of its defecation.

Finally, we compared the body weight of infected and uninfected animals in order to find out whether fat dormice suffer from these parasites. No weight differences were found between the groups. However, it should be noticed that majority of dormouse individuals were infected with relatively low number of helminths. It seems that host-parasite relationship between the fat dormouse and metazoan endoparasites is well balanced during their common evolution which led to high host specificity of the aforementioned helminth species.

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