First data on parasites from bats (Chiroptera) in Karelia are presented. Bats were captured at hibernacula in Lahdenpohsky and Sortavalsky Districts of Karelia in March 2010 and February 2011. Partial helminthological dissection was applied to 12 bat individuals of three species: northern bat *Eptesicus nilssonii* Keyserling & Blasius, 1839 (8 specimens), brown long-eared bat *Plecotus auritus* (Linnaeus, 1758) (1 spm.), and Brandt’s bat *Myotis brandtii* (Eversmann, 1845) (3spm.). Ectoparasites were collected from the bats captured in March 2010: *E. nilssonii* – 6 individuals (3 from each of Sortavalsky and Lahdenpohsky Districts), *P. auritus* – 1 ind. (Lahdenpohsky District), *M. brandtii* – 1 ind. (Sortavalsky District). The surveys revealed 14 species of parasites from different taxonomic groups. All the parasites were found in Karelia for the first time. Helminthes were represented only by trematodes of 3 families: Plagiorchiidae (*Plagiorchis vespertilionis*, *P. koreanus*, *P. muelleri*), Lecithodendriidae (*Lecithodendrium linstowi, Paralecithodendrium chlorostomum, P. skrabini*), and Pleurogenidae (*Parabascus magnitestis*). Ectoparasites in the samples include gamasid mites of the families Spinturnicidae (*Spinturnix kolenati, S. plecotinus*) and Macronyssidae (*Macronyssus crosbyi, M. cyclaspis*), chigger mites of the family Trombiculidae (*Leptotrombidium sp.*), and fleas of the family Ischnopsyllidae (*Ischnopsyllus hexactenus, Ischnopsyllus sp.*). All the parasites are bat specialists, known to occur in various parts of Russia and Europe.

**Key words:** bats; Chiroptera; Karelia; parasites; Trematoda; mites; Trombiculidae; fleas.

**FIRST RECORDS OF BAT PARASITES IN KARELIA**

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Introduction

Bats (Chiroptera, Vespertilionidae) are members of the mammalian class whose habitats in Eastern Fennoscandia are at the northern limit of their distribution range [Siivonen, Sulkava, 1999; Siivonen, Wermundsen, 2003, 2008]. Five bat species (northern bat, Brandt’s bat, whiskered bat, Daubenton’s bat, and brown long-eared bat) spend the winter in Karelia, and the northern bat dominates among them. In the summer time, the common noctule Nyctalus noctula (Schreber, 1774), parti-coloured bat Vespertilio murinus Linnaeus, 1758, Natterer’s bat Myotis nattereri (Kuhl, 1817) and pond bat Myotis dasycneme (Boie, 1825) additionally occur there [Belkin et al., 2018, 2019].

Chiropterans of Karelia have been addressed by few papers, focused on the distribution boundaries, species composition and abundances [Belkin et al., 2015, 2018, 2019]. Some publications deal with the study of various aspects of the physiological state of hibernating bats in Karelia [Ilyukha et al., 2015; Kizhina et al., 2018; Uzenbaeva et al., 2019]. There are no data on bat parasites in the territory of Karelia.

Material and methods

Bats were captured at hibernacula in Lahdenpohsky (61°32ʹN, 30°12ʹE) and Sortavalsky (61°57ʹN, 30°35ʹE) Districts of Karelia in March 2010 and February 2011. The hibernacula were not natural habitats, but man-made caves and lined underground spaces. The conditions in the Ruskeala adit (Sortavalsky District), in comparison with the concrete tunnel in the Lahdenpohsky District, were characterized by lower temperature and high relative humidity due to year-round water pooling [Belkin et al., 2015].

Partial helminthological dissection was applied to 12 bat individuals of three species: northern bat Eptesicus nilssonii Keyserling & Blasius, 1839 (8 specimens), brown long-eared bat Plecotus auritus (Linnaeus, 1758) (1 specimen), and Brandt’s bat Myotis brandtii (Eversmann, 1845) (3 specimens) [Ivashkin et al., 1971]. Since the bats were sampled primarily for physiological study, only the digestive tract was examined for helminth infections.

Ectoparasites were collected from the bats captured in 2010 (March 15): E. nilssonii – 6 individuals (3 from each of Sortavalsky and Lahdenpohsky Districts), P. auritus – 1 ind. (Lahdenpohsky District), M. brandtii – 1 ind. (Sortavalsky District).

Parasite identification relied on keys: Medvedev, 1996; Stanyukovich, 1997; Kudryashova, 1998; Tkach et al., 2000; Kirillov et al., 2012; Orlova et al., 2015.

The following parameters were used to quantify the bats’ infection rate: (Ab) Average infection intensity (number of parasites per 1 host specimen) or Abundance: Ab = Σn/N, where N is the number of examined bats and Σn is the total number of parasites found in all examined bats; Minimum and maximum number of parasites registered in the host.

Results and discussion

The surveys revealed 14 species of parasites from different taxonomic groups. Helminthes
were represented only by trematodes belonging to 3 families: Plagiorchiidae, Lecithodendriidae, and Pleurogenidae. Ectoparasites in the samples included gamasid mites of the families Spinturnicidae and Macronyssidae, chigger mites (Trombiculidae), and fleas of the family Ischnopsyllidae.

Trematoda
Family Plagiorchiidae Lühe, 1901
Genus *Plagiorchis* Lühe, 1899

*Plagiorchis vespertilionis* (Müller, 1780)
Found in all the 3 host species. The infection rate was the highest in the northern bat: 7 of the 8 host individuals were infected (Ab 1 1; 7–24); two of the three *M. brandtii* were infected (Ab 14; 7–21); the only examined *P. auritus* specimen contained two trematodes. It is a widespread parasite of bats [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

*Plagiorchis koreanus* (Ogata, 1938)
Singular specimens were retrieved from all the three host species: one of the 8 captured *E. nilssonii* hosted one worm, *M. brandtii* and *P. auritus* each hosted 2 worms. It is a widespread parasite of bats [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

*Plagiorchis muelleri* Tkach et Sharpilo, 1990
Trematodes were retrieved only from *P. auritus* (one worm) and *M. brandtii* (two worms). It is a widespread parasite of bats [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

Family Lecithodendriidae (Lühe, 1901)
Genus *Lecithodendrium* Lühe, 1896

*Lecithodendrium linstowi* Dollfus, 1931
In Karelia this species was found only in the northern bat. Five of the eight host individuals were infected, and the intensity of infection ranged from 2 to 260 worms (Ab 35). The life cycle of this parasite most probably involves semi-aquatic flying insects on which bats feed actively late in summer and in autumn. Flukes mature soon after infesting the host and overwinter this way. Almost all the retrieved individuals were mature, with the uterus packed with eggs. A similar situation was observed for *Prosthemodendrium longiforme* (Bhalerao, 1926) in *Myotis daubentoni* and *M. brandtii* from the Samara Region [Kirillova, Kirillov, 2012]. It is a widespread parasite of bats [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

*Paralecithodendrium Odhner, 1911

*Paralecithodendrium chilostomum* (Mehlis, 1831)
The species was found only in the northern bat. Five of the eight host individuals were infected (Ab 81; 3–347). This species demonstrated the same pattern as *Lecithodendrium linstowi*, i. e. only mature individuals were present, with the uterus packed with eggs. It is a widespread parasite of bats [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

*Paralecithodendrium skrjabini* Schadybin in Skarbilovich, 1948
Only two worms were found in one northern bat individual. The species is a bat specialist. Previously known in Russia only from the Chita, Nizhny Novgorod and Samara Regions [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

Family Pleurogenidae Looss, 1899
Genus *Parabascus* Looss, 1907

*Parabascus magnitestis* Khotenovski, 1985
Three specimens of the parasite were retrieved from one Brandt’s bat. The species is a bat specialist. Previously known in Russia only from the Voronezh and Samara Regions [Kirillov et al., 2012]. The species was encountered in Karelia for the first time.

Acari: Parasitiformes
Family Spinturnicidae Oudemans, 1901
Genus *Spinturnix* von Heyden, 1826

*Spinturnix kolenatii* Oudemans, 1910
Eight males and 7 females were collected from three *Eptesicus nilssonii* from the Lahdenpohsky District. This holarctic species is found mainly on bats of the genus *Eptesicus* [Stanjukovich, 1990; Virta, 2014; Orlova et al., 2015].

*Spinturnix plecotinus* (Koch, 1839)
Two females and two males were collected from *P. auritus* in the Lahdenpohsky District of Karelia. It is a palaeartic species; specialist in bats of the genus *Plecotus* [Orlova et al., 2015]. It was also found in the Leningrad Region [Stanjukovich, 1990] and Finland [Virta, 2014] adjacent to Karelia.

Family Macronyssidae Oudemans, 1936
Genus *Macronyssus* Kolenatii, 1858

*Macronyssus crosbyi* Ewing et Stover, 1915
Four northern bats (*E. nilssonii*) from Sortavalsky (2) and Lahdenpohsky Districts (2 spm.) yiel-
while helminths of the species occurred in the greatest number of host species, *Paralecithodendrium chilostomum* were the most abundant. Ectoparasites in the same study were represented by two flea species: *Spinuntix koledatii* and *Macronyssus crosbyi* and *M. cyclaspis*, and other mite species as well. The diversity of the parasite fauna in the northern bat is probably explained by the highest number of host individuals examined.

The one brown long-eared bat (*P. auritus*) in the sample contained only ectoparasites: gamasid mites *Spinuntix plecotinus*, *M. crosbyi* (protonymphs), and a flea *Ischnopsyllus hexacenus*.

The Brandt’s bat (*M. brandtii*) hosted 5 trematoda species and 1 flea species (*Ischnopsyllus simplex / I. mysticus*). *Plagiorchis vespertilionis* and *Lecithodendrium linstowi* were the most prevalent and abundant. Trematodes *Parabascus magnitestis* were singular, found only in the whiskered bat.

Being insectivorous, bats are infested by all trematode species while feeding on infected flying insects. All the trematode species detected in our study are bat specialists, known to occur in various parts of Russia and Europe [Kirillow et al., 2012].

Thus, our surveys have yielded only the first records of bat parasites in Karelia. More sampling is needed to expand our knowledge of the parasite species composition of this host group.

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