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КРАТКИЕ СООБЩЕНИЯ

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FIRST RECORDS OF BAT PARASITES IN KARELIA

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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 chilostomum*, *P. skrjabini*), and Pleurogenidae (*Parabascus magnitestis*). Ectoparasites in the samples include gamasid mites of the families Spinturnicidae (*Spinturnix kolenatii*, *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.

K e y w o r d s: bats; Chiroptera; Karelia; parasites; Trematoda; mites; Trombiculidae; fleas.

Д. И. Лебедева, В. В. Белкин, М. К. Станюкович, Л. А. Беспятова, С. В. Бугмырин ПЕРВЫЕ СВЕДЕНИЯ О ПАРАЗИТАХ РУКОКРЫЛЫХ (CHIROPTERA) КАРЕЛИИ

Приводятся первые сведения о паразитах летучих мышей (Chiroptera) в Карелии. Летучие мыши были пойманы во время зимней спячки в Лахденпохском и Сортавальском районах Карелии в марте 2010 года и феврале 2011 года.

Методом неполного паразитологического вскрытия (на предмет зараженности паразитами изучены только желудочно-кишечные тракты) исследовано 12 особей трех видов летучих мышей: северный кожанок *Eptesicus nilssonii* Keyserling & Blasius, 1839 (8 особей), бурый ушан *Plecotus auritus* (Linnaeus, 1758) (1 экз.) и ночница Брандта *Myotis brandtii* (Eversmann, 1845) (3 экз.). Эктопаразиты были собраны только у летучих мышей, пойманных в марте 2010 года. Исследовано 6 особей северного кожанка (по 3 экз. из Сортавальского и Лахденпохского районов), 1 экз. бурого ушана (Лахденпохский район), 1 экз. ночницы Брандта (Сортавальский район). Всего в ходе исследования выявлено 14 видов паразитов разных таксономических групп. Гельминты были представлены только трематодами из трех семейств: сем. Plagiorchiidae (*Plagiorchis vespertilionis*, *P. koreanus*, *P. muelleri*), сем. Lecithodendriidae (*Lecithodendrium linstowi*, *Paralecithodendrium chilostomum*, *P. skrjabini*) и сем. Pleurogenidae (*Parabascus magnitestis*). Среди эктопаразитов отмечены представители нескольких систематических групп: гамазовые клещи из семейства Spinturnicidae (*Spinturnix kolenatii*, *S. plecotinus*) и Macronyssidae (*Macronyssus crosbyi*, *M. cyclaspis*), клещи-краснотелки семейства Trombiculidae (*Leptotrombidium* sp.) и блохи семейства Ischnopsyllidae (*Ischnopsyllus hexactenus*, *Ischnopsyllus* sp.). Все обнаруженные виды – широко распространенные паразиты рукокрылых и отмечены в Карелии впервые.

Ключевые слова: рукокрылые; Chiroptera; Карелия; паразиты; трематоды; гамазовые клещи; краснотелковые клещи; блохи.

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°32′N, 30°12′E) and Sortavalsky (61°57′N, 30°35′E) 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: $Ab = \Sigma n/N$, 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 11; 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, and the uterus of the worms was fully packed with eggs. A similar situation was observed for *Prosthodendrium longiforme* (Bhalerao, 1926) in *Myotis daubentonii* 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.

Genus *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 palaearctic 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-

ded 20 protonymphs, 5 females and 6 males. Two protonymphs were collected from *P. auritus*. It is a holarctic species; associated with various hosts [Orlova et al., 2015]. In the Leningrad Region adjacent to Karelia and Estonia [Stanjukovich, 1990], *M. crosbyi* mites were found on the northern bat, brown long-eared bat and Brandt's bat. In Latvia [Jaunbauere et al., 2009], this species was observed on mouse-eared bats (*Myotis daubentoni*, *M. dasycneme*, *M. mystacinus*), the northern bat, and Nathusius' pipistrelle (*P. nathusii*).

Macronyssus cyclaspis (Oudemans, 1906)

Two females and one protonymph were collected from two *E. nilssonii* (Sortavalsky and Lahdenpohsky Districts). In Europe, the species is mainly parasitic on *Barbastella* spp. [Stanjukovich, 1990].

Acari: Acariformes
Family Trombiculidae Ewing, 1929
Genus *Leptotrombidium* Nagayo et al., 1916

Leptotrombidium sp.

Three *Eptesicus nilssonii* from the Sortavalsky District yielded 17 larvae.

Insecta: Siphonaptera
Family Ischnopsyllidae Wahlgren, 1907
Genus *Ischnopsyllus* Westwood, 1833

Ischnopsyllus (*Hexactenopsylla*) *hexactenus* (Kolenati, 1856)

Two females were collected: one from each of *E. nilssonii* (Sortavalsky District) and *P. auritus* (Lahdenpohsky District). The species has a trans-palearctic range; the brown long-eared bat is the main host [Medvedev, 1996].

Ischnopsyllus sp.

Two females were collected from *M. brandtii* from the Sortavalsky District. One of the two individuals had only seven combs of ctenidia; the 3rd comb was absent. The collected fleas are similar to the species *Ischnopsyllus simplex* Rothschild, 1906 and *I. mysticus* Jourdan, 1942, the females of which do not differ in morphology [Medvedev, 1996]. These species are common in the Palaearctic Northwest. In Estonia and Finland, these species have also been observed in the Brandt's bat [Medvedev, Mazing, 1987; Virta, 2014].

In the northern bat (*E. nilssonii*), 10 species of parasites were found. Five of them were trematodes. The parasite *Plagiorchis vespertilionis* occurred in the greatest number of host species, while helminths of the species *Lecithodendrium linstowi* and *Paralecithodendrium chilostomum* were the most abundant. Ectoparasites in the samples were represented by mites *Spinturnix kolenatii*, *Macronyssus crosbyi* and *M. cyclaspis*, larvae of chigger mites *Leptotrombidium* sp., and the flea *Ischnopsyllus hexactenus*. 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 *Spinturnix plecotinus*, *M. crosbyi* (protonymphs), and a flea *Ischnopsyllus hexactenus*.

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 [Kirillov 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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