

**Fleas (Insecta, Siphonaptera) of small mammals of Karelia
and Murmanskaya Oblast of Russia from the collection
of the Institute of Biology KarRC RAS Museum, Petrozavodsk, Russia**

**Блохи (Insecta, Siphonaptera) мелких млекопитающих Карелии
и Мурманской области из коллекции постоянных препаратов
музея Института биологии КарНЦ РАН в Петрозаводске**

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Abstract. The fauna of fleas (Siphonaptera) parasitizing small mammals was analyzed using collections from a field study undertaken during 1950–1962. Samples were collected from 19 sites in the Republic of Karelia and 2 sites in Murmanskaya Oblast. In total, 4093 individual fleas were examined; 22 species belonging to four families were identified, namely Hystrichopsyllidae (9), Ceratophylloidae (9), Leptopsyllidae (3) and Ischnopsyllidae (1). Feeders (hosts) are represented by 18 species of four orders: 5 on insectivores (Eulipotyphla), 11 on rodents (Rodentia), 1 on a bat (Chiroptera) and 1 on a carnivore (Carnivora). The data obtained from the collection have extended our knowledge of the species diversity of fleas on small mammals of the Republic of Karelia and Murmanskaya Oblast.

Резюме. Проведён анализ фауны блох (Siphonaptera) мелких млекопитающих по коллекционному материалу, собранному в результате полевых исследований в 1950–1962 годах. География сборов включает территории Республики Карелия (19) и Мурманской области (2 точки сбора). Просмотрено 4093 экз. блох. Идентифицировано 22 вида блох, относящихся к четырём семействам: Hystrichopsyllidae — 9, Ceratophylloidae — 9, Leptopsyllidae — 3 и Ischnopsyllidae — 1 вид. Прокормители (хозяева) представлены 18 видами из четырёх отрядов: Насекомоядные (Eulipotyphla) — 5, Грызуны (Rodentia) — 11, Рукокрылые (Chiroptera) — 1 и Хищные (Carnivora) — 1 вид. Уникальная коллекция позволила дополнить данные о видовом разнообразии фауны блох мелких млекопитающих Республики Карелия и Мурманской области.

Introduction

The flea order (Siphonaptera) comprises insects with a complete metamorphosis, whose secondarily wingless adults are blood-sucking ectoparasites of small mammals and, less often, birds [Balashov, 1982; Vashchenok, 1988]. Fleas have a pan-global distribution and transmit various viruses, bacteria, protozoa, helminthes, many of which are pathogenic for certain vertebrate species, including humans [Vashchenok, 1988; Bitam et al., 2008]. Among members of this order the greatest danger for humans is posed by those carrying plague, which occur in over 44 focal areas in the Caucasus, Transcaucasia, Volga region, Kazakhstan, South Siberia, and Far East. There are currently reports of 257 plague-infected flea species, i.e. around 12 % of all known flea species [Medvedev et al., 2019].

In Karelia, studies of the fauna of fleas parasitizing small mammals started at the beginning of this century. Key focus has been on parasites of the most common small mammal species [Bespyatova et al., 2003a, b; 2005]. The data were obtained both through long-term monitoring [Bespyatova et al., 2008, Medvedev, Stanyukovich, 2022] and through occasional sampling efforts, including surveys in protected areas [Bugmyrin et al., 2003; 2008; Bespyatova, Medvedev, 2004].

Museum collections of various, both plant and animal, species are an important source of scientific information. They provide data for assessing the geo-

graphic distribution of taxa, features of their morphology or genetics, long-term changes in the species diversity [Medvedev, 2001; Medvedev et al., 2004; Eckerlin, 2016; Medvedev, Khalikov, 2016; Baryshev et al., 2017; Hastriter, 2021]. The lead role in creating the collection of parasites of different systematic and ecological groups found in Karelia belonged to the founder and first head of the Laboratory for Parasitology of the Karelian-Finnish Branch of the USSR Academy of Sciences Professor, Doctor of Biology Aino Lutta (1902–1982). As a result of large-scale fieldwork, unique collections of scientific value have been assembled and mounted.

The aim of this study was to investigate the fauna of fleas collected from small mammals in Karelia and Murmanskaya Oblast in the 1950s–1960s.

Material and Methods

The material used for this study is the collection of flea parasites of small mammals, which is stored at the Museum of the Institute of Biology KarRC RAS and comprises over two thousand permanent mounts (glass slides) with 4093 flea specimens in Canadian balsam [Kocherova et al., 2022]. Most of them are supplied with labels and remain in satisfactory condition. Information on the host species, place and time of sampling is provided on the slides. Sampling was done during integrated parasitological surveys in Karelia and Murmanskaya Oblast in 1950–1962.

Most of the points surveyed (19) were situated in the Republic of Karelia: in Kondopozhskii (Kivach, Unitsa), Olonetskii (Klimenty, Mikhailovskoye), Medvezhyegorskii (Kuznavolok, Padany, Selga, Tikhvin Bor), Pitkyarantskii (Kavaino, Lunkulansaari Island, Lyaskelya, Harlu), Sortavalskii (Alalampi, Vahvajarvi), Lahdenpohskii, Suojarvskii, Muezerskii (Kivijarvi, Kimovara), Kemska (Krivoy Porog), Prionezhskii (Rostan), and Pudozhskii (Nigizhma) districts. The material for Murmanskaya Oblast comes from two points: Kovda village (Kandalakshskii District) and Imandra village (Olenegorskii Urban District).

We described the geographic distribution of fleas using the classification for the natural agro-climatic zonation of Karelia [Romanov, 1961]. The republic was divided by the sum of active temperatures and natural characteristics (topography, geological features, vegetation distribution and characteristics, etc.) into four zones: northern, middle, southern, and southwestern. Indications of the agro-climatic zone are provided for all flea-sampling locations in Karelia (Fig. 1, Tabl. 1).

The species composition of feeder hosts is made up of members of four orders: 1) insectivores (Eulipotyphla), 5 species: European mole *Talpa europaea* Linnaeus, 1758, common shrew *Sorex araneus* Linnaeus, 1758, Laxmann's shrew *S. caecutiens* Laxmann, 1788, Eurasian pigmy shrew *S. minutus* Linnaeus, 1766, water shrew *Neomys fodiens* (Pennant, 1771); 2) rodents (Rodentia), 10 species: bank vole *Myodes glareolus* (Schreber, 1780), grey red-backed vole *Myodes rufocanus* (Sundevall, 1846), common vole *Microtus arvalis*

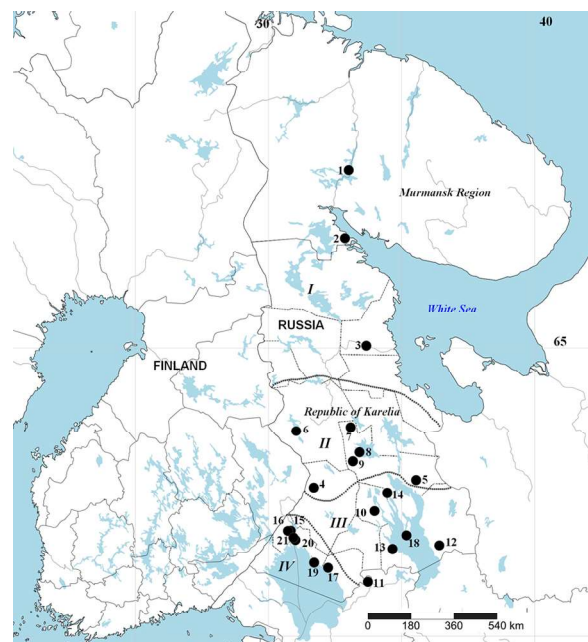


Fig. 1. Locality map of parasitological surveys carried out in the Republic of Karelia and Murmanskaya Oblast in 1950–1962. The map was made in SimpleMapp [Shorthouse, 2010].

Рис. 1. Районы проведения паразитологических исследований на территории Республики Карелия и Мурманской области в 1950–1962 гг. Карта создана в приложении SimpleMapp [Shorthouse, 2010].

(Pallas, 1778), field vole *Microtus agrestis*, (Linnaeus, 1761), striped field mouse *Apodemus agrarius* (Pallas, 1771), Northern birch mouse *Sicista betulina* (Pallas, 1779), Eurasian harvest mouse *Micromys minutus* (Pallas, 1771), brown rat *Rattus norvegicus* (Berkenhout, 1769), water vole *Arvicola amphibius* (Linnaeus, 1758), and red squirrel *Sciurus vulgaris* Linnaeus, 1758; 3) bats (Chiroptera), a single mount from a bat, and 4) carnivores (Carnivora), least weasel *Mustela nivalis* Linnaeus, 1766. The number of examined specimens of each host species cannot be precisely estimated since not all mounts have the host indicated and some slides have fleas collected from several animals of the same species mounted on them.

Fleas were identified to species using taxonomic keys [Skalon, 1970; Medvedev, 1996; Brinck-Lindroth, Smit, 2007]. The abundance of individual flea species in different agro-climatic zones and on different host species was estimated by calculating their share in the total sample pool (%).

The tool used for the comparative analysis of the flea species composition between small mammal species was species accumulation curves (rarefaction curves), which characterize the relationship between the number of flea species and the number of flea specimens examined. The plots were generated with Past software [Hammer et al., 2001].

The present work is registered in ZooBank (www.zoobank.org) under LSID urn:lsid:zoobank.org:pub:375B2093-611A-4FA0-B0F0-0EC088FDE014.

Table 1. Locations and periods of the parasitological surveys
Таблица 1. Районы и даты проведения паразитологических исследований

Sampling locality No.*	Coordinates, N, E	Sampling location	Period	District
Murmanskaya Oblast				
1	67.6786; 33.0119	Imandra	Sept., Oct. 1959; Sept. 1960	Olenegorskii
2	66.686; 32.8704	Kovda	Sept., Oct. 1960	Kandalakshskii
Republic of Karelia				
Northern agro-climatic zone				
3	65.0354; 33.6724	Krivoy Porog	Aug., Sept. 1956; Sept. 1961	Kemskii
Middle agro-climatic zone				
4	62.6798; 31.6998	Kivijarvi	Aug., Sept. 1950	Suojarvskii
5	62.8101; 35.5432	Tikhvin Bor	Sept. 1952	Medvezhyegorskii
6	63.6394; 31.0395	Kimovara	Sept. 1955; Oct. 1958	Muezerskii
7	63.7056; 33.0854	Kuznavolok	Sept. 1956; Oct. 1958	Medvezhyegorskii
8	63.2817; 33.4159	Padany	Jul., Aug. 1952	Medvezhyegorskii
9	63.1294; 33.1705	Selga	Aug., Sept. 1953; Jun., Aug.-Oct. 1955	Medvezhyegorskii
Southern agro-climatic zone				
10	62.2767; 33.9823	Kivach	Jul.-Oct. 1961	Kondopozhskii
11	61.0145; 33.7326	Mikhailovskoye	Aug. 1952	Olonetskii
12	61.6642; 36.4152	Nigizhma	Jun. 1962	Pudozhskii
13	61.6006; 34.6578	Rostan	Jun.-Aug. 1954	Prionezhskii
14	62.5919; 34.4617	Unitsa	Jul., Aug. 1952	Kondopozhskii
South-western agro-climatic zone				
15	61.9281; 30.8330	Alalampi	Sept. 1950; Aug. 1951; Jul., Aug. 1952; Sept. 1953	Sortavalskii
16	61.9235; 30.7291	Vahvajarvi	Aug. 1951	Sortavalskii
17	61.2674; 32.2374	Kavaino	Jun.-Sept. 1950; Jul., Aug. 1952; Jul. 1956	Pitkyarantskii
18	61.8435; 35.1837	Klimenty	Jun.-Aug., Oct. 1961; Jul.-Sept. 1962	Olonetskii
19	61.3598; 31.7132	Lunkulansaari	Jun. 1950; Jun.-Sept. 1953; Aug. 1958; Jul., Aug. 1959	Pitkyarantskii
20	61.7616; 31.0102	Lyaskelya	Jul. 1950; Jul.-Sept. 1951; Jul. 1953	Pitkyarantskii
21	61.8043; 30.9361	Harlu	Jun., Aug.-Oct. 1950	Pitkyarantskii

* of the sampling point corresponds to its number on the map (Fig. 1)

* точки сбора соответствует номеру на карте (рис. 1)

Results

The study resulted in identification of 22 flea species of four families: Hystrichopsyllidae — 9 species; Ceratophyllidae — 9 species; Leptopsyllidae — 3 species; Ischnopsyllidae — 1 species. Where the exact sampling location was not indicated on the slides, reference to the administrative district is provided.

An annotated checklist of flea species of small mammals of Karelia and Murmanskaya Oblast of Russia from the collection of the Institute of Biology KarRC

RAS museum, Petrozavodsk, Russia is given in the **Appendix: (p. 19–21).**

Discussion

HOST-PARASITE INTERACTIONS

The collection contains material on 17 host species, of which 15 belong to the small mammal group (rodents and insectivores). The greatest numbers of flea species (12 each) were retrieved from the rodents which

prevailed in terms of the number of specimens examined are bank vole *Myodes glareolus* and field vole *Microtus agrestis* (Fig.2). The most abundant species in the flea fauna of *M. glareolus* were *A. penicilliger* (30 % of the total sample) and *P. silvatica* (24 %); on *Microtus agrestis* — *P. silvatica* (37 %) and *M. walkeri* (22 %) (Tabl. 2). High species richness of fleas was found for the water vole (10), common shrew (10), and water shrew (11 species). The European mole *Talpa europaea*, brown

rat *Rattus norvegicus*, and red squirrel *Sciurus vulgaris* hosted narrow specialists (Tabl. 2).

Species accumulation curves can indicate how much the parasite fauna of a certain host species is covered by the given sampling effort [Dove, Cribb, 2006]. The large number of *M. glareolus* and *M. agrestis* specimens examined brings the results very close to the maximum diversity of their flea fauna possible in this region (Fig. 2). Considering the high ecological valence of the

Table 2. Relative abundances (%) of fleas on different host species.
Таблица 2. Относительное обилие блох (%) у разных видов хозяев.

Flea species	Small mammal species														
	Sar	Smi	Sca	Nfo	Teu	Svul	Mgl	Mru	Aam	Mag	Mar	Mmi	Aag	Rno	Sbe
<i>C. agyrtes</i> (Heller, 1896)				3	11				53	1		4	58	9	17
<i>C. uncinatus</i> (Wagner, 1898)	4	4		4			10	(1)	6	10			7		2
<i>C. bisoetodontatus</i> Kolenati, 1863					13										
<i>P. kohauti</i> Dampf, 1911					85										
<i>P. soricis</i> (Dale, 1878)	45	40	(2)	47	<1		4		2	2		6	18		11
<i>C. birulai</i> (Ioff, 1928)	1	8		19											
<i>D. dasyncnema</i> (Rothschild, 1897)	18	32		8	<1		4		2	<1		9	1		2
<i>R. integella</i> Jordan et Rothschild, 1921							3	(1)	2	1					
<i>H. talpae</i> (Curtis, 1826)	4	4		4			1		2	12		4			
<i>A. penicilliger</i> (Rothschild, 1911)	4			<1	<1		30	(2)	2	3		1	1		
<i>C. garei</i> (Rothschild, 1902)							<1								
<i>C. sciurorum</i> (Schrank, 1803)						33									
<i>M. rectangularis</i> (Wahlgren, 1903)	<1						10		6	3					
<i>M. turbidus</i> (Rothschild, 1909)										<1			4		4
<i>M. walkeri</i> (Rothschild, 1902)	2			5	<1		4		17	22	(3)		1		4
<i>N. fasciatus</i> (Bosc, 1800)														91	
<i>T. octodecimdentata</i> (Kolenati, 1863)						67									
<i>A. sibirica</i> (Wagner, 1898)				<1			<1	(1)							
<i>P. bidentata</i> (Kolenati, 1863)	<1			<1			9			7		7			
<i>P. silvatica</i> (Meinert, 1896)	21	12		8	<1		24	(4)	6	37	(5)	69	8		60
Total host specimens	63	8	2	34	52	9	351	1	13	97	2	42	37	8	34
No of flea species	10	5	1	11	8	2	12	5	10	12	2	7	8	2	7
Total flea specimens	141	25	2	158	532	59	546	9	48	433	8	79	74	34	47

Sar — *Sorex araneus* Linnaeus, 1758, Smi — *S. minutus* Linnaeus, 1766, Sca — *S. caecutiens* Laxmann, 1788, Nfo — *Neomys fodiens* (Pennant, 1771), Teu — *Talpa europaea* Linnaeus, 1758, Svul — *Sciurus vulgaris* Linnaeus, 1758, Mgl — *Myodes glareolus* (Schreber, 1780), Mru — *Myodes rufocanus* (Sundevall, 1846), Aam — *Arvicola amphibious* (Linnaeus, 1758), Mag — *Microtus agrestis* (Linnaeus, 1761), Mar — *Microtus arvalis* (Pallas, 1778), Mmi — *Micromys minutus* (Pallas, 1771), Aag — *Apodemus agrarius* (Pallas, 1771), Rno — *Rattus norvegicus* (Berkenhout, 1769), Sbe — *Sicista betulina* (Pallas, 1779).

The data for each flea species is the relative abundance (%), a percentage share in the total number of fleas collected from each host species; the numbers in parentheses are absolute abundances (number of flea specimens collected).

Для каждого вида блох приведены значения его относительного обилия (в %) — доля в общих сборах блох у данного вида хозяина, в скобках приведены абсолютные значения (число собранных блох).

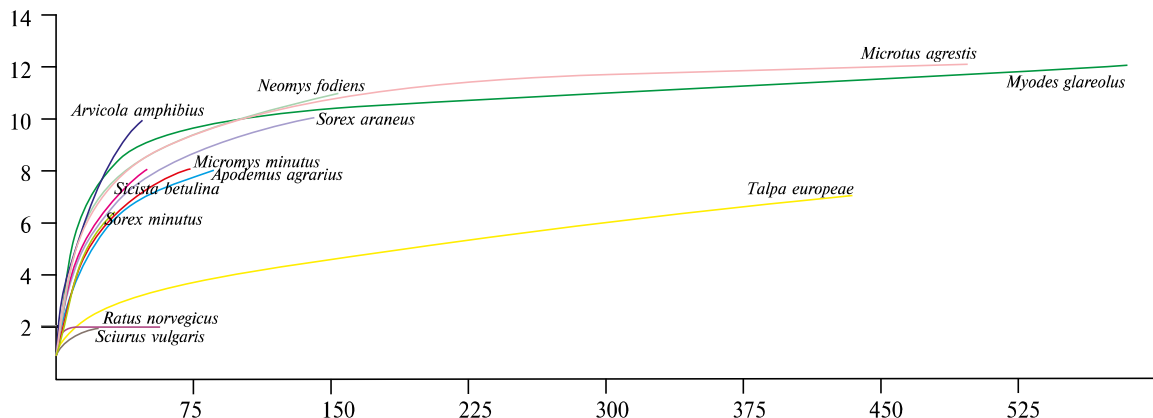


Fig. 2. Species accumulation curves for fleas on small mammals in Karelia and Murmanskaya Oblast (sampled in the 1950s–1960s).
Рис. 2. Кривые накопления видового богатства блох у мелких млекопитающих Карелии и Мурманской обл. (сборы 1950–1960 гг.)

bank vole, however, more flea species, not specific to this host, may be found in the future. The number of *R. norvegicus* and *S. vulgaris* specimens examined in Karelia is not high (8 and 9, respectively), but since their flea fauna consists only of the species' narrow specialists, the curves reached a plateau even with the sampling effort as small as this.

Some material in the collection is related to hosts represented by just several slides. To wit, the least weasel hosted *C. uncinatus* (2 ind.) and *M. walkeri* (10 ind.); a bat (species not indicated on the slide) hosted *Myodopsylla trisellis*.

GEOGRAPHIC DISTRIBUTION

We reduced the description of the geographic distribution of fleas in Karelia and Murmanskaya Oblast to parasites with a wide range of small mammal hosts, excluding specialists *C. sciurorum*, *M. trisellis*, *P. kohauti*, *N. fasciatus*, since their occurrence in a given area depended on the presence of the host in the sample.

Only seven of 15 flea species occurred in all agro-climatic zones of Karelia and in Murmanskaya Oblast, namely: *C. (E.) uncinatus*, *P. soricis*, *P. bidentata*, *D. dasyncnema*, *M. (G.) rectangulatus*, *P. sylvatica* and *R. (A.) integella* (Tabl. 3).

In Murmanskaya Oblast, the prevalent flea species collected from small mammals was *A. sibirica* (20 %); meanwhile, this species was absent in samples from southerner districts of Karelia. Another species retrieved only from Murmanskaya Oblast, from red-backed voles (*Myodes* sp.), was *M. (M.) calcarifer*.

The prevalent species in the northern agro-climatic zone of Karelia was *A. penicilliger* (45 %), in the middle zone — *P. sylvatica* (47 %), in the southern zone — *P. soricis* (33 %). The species *M. turbidus* was reported only from one point in the southern agro-climatic zone. The south-western agro-climatic zone yielded 12 flea species, of which the most abundant were *P. soricis* (19 %), *M. (M.) walkeri* (18 %), and *P. sylvatica* (17 %). This was the only zone of Karelia where *C. (C.) agyrtes* has been found (Tabl. 3).

The duration of field sampling surveys, their replication in different seasons, and the number of locations varied among agro-climatic zones of Karelia. Thus, sampling in northern Karelia was done at a single point in August and September, while southwestern Karelia had seven locations sampled from June through October (Tabl.1). It is therefore difficult to draw accurate comparisons between districts, considering that the structure of the parasite fauna of small mammals can depend on both geographic zonality and seasonality. Yet, the geographic distribution of fleas collected from small mammals in the 1950s–1960s generally agrees with the results of the long-term studies carried out in Karelia in the 2000s [Bespyatova et al., 2003a, b; 2005; 2008]. The main spatial patterns are shaped by the species confined to northern *M. (M.) calcarifer* and *A. sibirica*, or southern *M. (G.) turbidus* and *C. (C.) agyrtes* districts, whose occurrence may be related to their principal hosts *M. rufocanus* or *Apodemus* sp., respectively.

The analysis of the museum collection has thus expanded our knowledge of the species diversity of fleas parasitizing small mammals in the Republic of Karelia and Murmanskaya Oblast, primarily due to the addition of specialist parasites (*C. (C.) bisocidentatus*, *P. kohauti*, *C. (M.) sciurorum*, *N. (N.) fasciatus*, *T. octodecimentata*) of poorly studied host species *Talpa europaea*, *Sciurus vulgaris*, and *Rattus norvegicus*.

Acknowledgements

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Table 3. Relative abundances (%) of flea species collected from small mammals in different agro-climatic zones
Таблица 3. Относительное обилие (%) отдельных видов блох мелких млекопитающих в сборах из разных агроклиматических зон

Flea species	Karelia				Murmanskaya Oblast
	South-western	Southern	Middle	Northern	
<i>C. agyrtes</i> (Heller, 1896)	11				
<i>C. uncinatus</i> (Wagner, 1898)	11	3	3	10	5
<i>P. soricis</i> (Dale, 1878)	19	33	11	8	2
<i>C. birulai</i> (Ioff, 1928)	<1	3	4		
<i>D. dasyncema</i> (Rothschild, 1897)	12	9	4	4	2
<i>R. integella</i> Jordan et Rothschild, 1921	<1	2	3	1	6
<i>H. talpae</i> (Curtis, 1826)	9	2	2		<1
<i>A. penicilliger</i> (Rothschild, 1911)	2	12	12	44	16
<i>M. rectangulatus</i> (Wahlgren, 1903)	<1	3	5	27	11
<i>M. turbidus</i> (Rothschild, 1909)		2			
<i>M. calcarifer</i> (Wagner, 1913)					2
<i>M. walkeri</i> (Rothschild, 1902)	18	3		1	<1
<i>A. sibirica</i> (Wagner, 1898)					20
<i>P. bidentata</i> (Kolenati, 1863)	<1	9	9	3	18
<i>P. silvatica</i> (Meinert, 1896)	17	19	47	2	17
Total species	12	12	10	9	12
Total specimens	1306	298	674	123	971

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Appendix to the article: N.A. Kocherova, L.A. Bespyatova, S.G. Medvedev, S.V. Bugmyrin. Fleas (Insecta, Siphonaptera) of small mammals of Karelia and Murmanskaya Oblast of Russia from the collection of the Institute of Biology KarRC RAS Museum, Petrozavodsk, Russia (Euroasian Entomological Journal. 2023. Vol.22. No.5. P.277–283)

Приложение к статье: Н.А. Кочерова, Л.А. Беспятова, С.Г. Медведев, С.В. Бугмырин. Блохи (Insecta, Siphonaptera) мелких млекопитающих Карелии и Мурманской области из коллекции постоянных препаратов музея Института биологии КарНЦ РАН в Петрозаводске (Евразийский энтомологический журнал. 2023. Т.22. Вып.5. С.277–283)

A checklist of flea species of small mammals of Karelia and Murmanskaya Oblast of Russia from the collection of the Institute of Biology KarRC RAS Museum

Hystrichopsyllidae Tiraboschi, 1904

Ctenophthalmus (Ctenophthalmus) agyrtes (Heller, 1896)

Material. Republic of Karelia: Alalampi (Aug. 1951, Aug. 1952) — 9♂♂, 5♀♀; Vahvayarvi (Jun., Aug., Sept. 1950, Aug. 1951) — 22♂♂, 28♀♀; Kiviyarvi (Sept. 1950) — 1♂, 1♀; Lunkulansaari Island (Aug. 1953) — 3♂♂; Lyaskelya (Jul. 1950, Jul., Aug. 1951, Jul. 1953) — 18♂♂, 18♀♀; Harlu (Jun., Sept., Oct. 1950) — 17♂♂, 19♀♀; Lahdenpohskii Distr. (Jul. 1958) — 2♂♂, 2♀♀; Sortavalskii Distr. (Sept., Oct. 1950; Jul., Aug., Oct. 1951) — 21♂♂, 28♀♀; place and period of collection unknown — 7♂♂, 10♀♀.

Notes. The species has a Western Palearctic, European-Mediterranean type of range. The species is widespread in the European forest zone, where it parasitizes Cricetidae and Muridae. The nominotypical subspecies inhabits northern parts of Central and Eastern Europe. There are two subspecies in the collection, *C. (C.) agyrtes agyrtes* (Heller, 1896) and *C. (C.) agyrtes kleinschmidianus* Peus, 1950.

Ctenophthalmus (Ctenophthalmus) bisoctodentatus bisoctodentatus Kolenati, 1863

Material. Republic of Karelia: Vahvayarvi (Aug. 1951) — 1♀; Kiviyarvi (Sept. 1950) — 1♀; Harlu (Aug., Oct. 1950) — 3♂♂, 8♀♀. The place and time of collection are not specified — 1♀.

Notes. *C. (C.) bisoctodentatus* has a Western Palearctic, European-Mediterranean type of range. The species is widespread in the European forest zone, where it parasitizes *Talpa europea*, and on other small mammals as like as Cricetidae and *Sorex* shrews.

Ctenophthalmus (Euctenophthalmus) uncinatus uncinatus (Wagner, 1898)

Material. Republic of Karelia: Alalampi (Aug. 1952, Sept. 1953) — 1♂, 6♀♀; Vahvayarvi (Aug. 1951) — 2♀♀; Kavaina (Aug. 1950) — 1♂, 1♀; Kimovary (Oct. 1958) — 6♂♂, 5♀♀; Klimency (Jul., Aug. 1961, Jul.-Sept. 1962) — 15♂♂, 19♀♀; Krivoi Porog (Aug., Sept. 1956) — 6♂♂, 6♀♀; Kuznavolok (Oct. 1958) — 4♂♂, 4♀♀; Lunkulansaari Island (Jun.-Sept. 1953, Aug. 1958) — 33♂♂, 50♀♀; Lyaskelya (Aug. 1951) — 2♀♀; Mihailovskoe (Aug. 1952) — 3♀♀; Rostan (Aug. 1954) — 2♀♀; Selga (Aug., Sept. 1955) — 2♀♀; Ulica (Jul., Aug. 1952) — 4♀♀; Lahdenpohskii Distr. (Jul. 1958) — 1♂, 1♀; Sortavalskii Distr. (Aug. 1951, Jul. Sept. 1953) — 4♂♂, 7♀♀; Suoyarvskii Distr. (Oct. 1958) — 1♀.

Material. Murmanskaya Oblast: Imandra (Sept. 1960) — 19♂♂, 28♀♀. The place and time of collection are not specified — 1♂.

Notes. *C. (E.) uncinatus* and its nominotypical subspecies have a West-Central Palearctic type of range. Widespread from Central and Northern Europe to Western Siberia; parasitizes Cricetidae, Muridae, and Soricidae.

Palaeopsylla kohauti Dampf, 1911

Material. Republic of Karelia: Alalampi (Sept. 1953) — 1♂; Kiviyarvi (Aug., Sept. 1950) — 6♂♂, 6♀♀; Lyaskelya — 3♂♂, 1♀; Mihailovskoe (Aug. 1952) — 1♂; Harlu (Aug.-Oct. 1950) — 186♂♂, 156♀♀; Sortavalskii Distr. (Sept. 1950, Jul., Aug. 1951) — 7♂♂, 12♀♀.

Notes. The species has a Western Palearctic type of range. Widespread from Western Europe to the Urals; parasitizes insectivores of the families Erinaceidae and Talpidae.

Palaeopsylla soricis (Dale, 1878)

Material. Republic of Karelia: Vahvayarvi (Jun., Aug. 1950, Aug. 1951) — 13♂♂, 20♀♀; Kavaina (Jun.-Sept. 1950, Jul., Aug. 1952, Jul. 1956) — 9♂♂, 14♀♀; Kivach (Jun., Sept. 1961) — 2♂♂, 4♀♀; Kimovary (Sept. 1955, Oct. 1958) — 9♂♂, 5♀♀; Klimency (Jun.-Aug. 1961, Jul.-Sept. 1962) — 30♂♂, 33♀♀; Krivoi Porog (Sept. 1956) — 4♂♂, 6♀♀; Kuznavolok (Oct. 1958) — 2♂♂, 5♀♀; Lunkulansaari Island (Jun. 1950, Jul., Aug. 1953, Jul. 1959) — 20♂♂, 21♀♀; Lyaskelya (Jul. 1950, Aug. 1951) — 17♂♂, 18♀♀; Padany (Aug. 1952) — 4♂♂, 5♀♀; Mihailovskoe (Aug. 1952) — 1♂; Rostan (Jun.-Aug. 1954) — 34♂♂, 35♀♀; Tikhvin Bor (Sept. 1952) — 1♂; Segezhskskii Distr. (Oct. 1958) — 1♂; Sortavalskii Distr. (Oct. 1950, Jul., Aug., Oct. 1951, Jul.-Aug. 1953) — 24♂♂, 26♀♀; Selga (Aug.-Oct. 1955) — 18♂♂, 24♀♀; Ulica (Jul., Aug. 1952) — 9♂♂, 9♀♀; Pitkyarantskii Distr. (Jul., Aug. 1953) — 4♂♂, 6♀♀; Suoyarvskii Distr. (Oct. 1958) — 2♂♂. **Murmanskaya Oblast:** Imandra — 9♂♂, 14♀♀. The place and time of collection are not specified — 3♂♂, 1♀.

Notes. *P. soricis* has a Western-Central Palearctic type of range. Widespread from Western Europe to Siberia; parasitizes Soricidae and Erinaceidae, but has also been reported from Cricetidae and Muridae. There are two subspecies in the collection — nominotypical subspecies *P. soricis soricis* (Dale, 1878) and *P. soricis starki* Wagner, 1930.

Corrodopsylla birulai (Ioff, 1928)

Material. Republic of Karelia: Kavaina (Jul. 1950) — 1♂, 1♀; Klimency (Jul. 1962) — 1♀; Nigizhma (Jun. 1962) — 1♂; Selga (Aug., Sept. 1955) — 11♂♂, 14♀♀; Rostan (Aug. 1954) — 5♂♂, 4♀♀.

Notes. Has a wide trans-Palearctic type of range. Spotted in Eastern Europe, Siberia, Central Asia (Tian Shan), and Far East; parasitizes Erinaceidae.

Doratopsylla dasyncema dasyncema
(Rothschild, 1897)

Material. Republic of Karelia: Vahvayarvi (Aug. 1951) — 5♂♂, 2♀♀; Kavaina (Jun., Jul., Sept. 1950, Jul. 1952) — 13♂♂, 4♀♀; Kivach (Jul.-Oct. 1961) — 8♂♂, 5♀♀; Kimovary (Sept. 1955, Oct. 1958) — 4♂♂, 2♀♀; Klimency (Jul., Aug. 1961; Jul.-Sept. 1962) — 64♂♂, 48♀♀; Krivoi Porog (Aug., Sept. 1956) — 3♂♂, 2♀♀; Kuznavolok (Oct. 1958) — 2♂♂; Lunkulansaari Island (Jun. 1950, Jul. 1953) — 2♂♂; Lyaskelya (Jul. 1950, Aug., Sept. 1951) — 8♂♂, 3♀♀; Mihailovskoe (Aug. 1952) — 1♀♀; Padany (Aug. 1952) — 2♀♀; Rostan (Jul., Aug. 1958) — 2♀♀; Selga (Sept. 1955) — 7♂♂, 7♀♀; Unica (Jul., Aug. 1952) — 6♂♂, 4♀♀; Segezhsksii Distr. (Oct. 1958) — 1♂; Sortavalsksii Distr. (Aug. 1951, Jul. 1953) — 4♂♂, 3♀♀; Suoyarvskii Distr. (Oct. 1958) — 1♂. The place and time of collection are not specified — 2♂♂, 2♀♀.

Notes. *D. dasyncema* and its nominotypical subspecies have a West-Central Palearctic type of range: widespread from Western Europe to Western Siberia, parasitizing Soricidae and Erinaceidae.

Rhadinopsylla (Actenophthalmus) integella
Jordan et Rothschild, 1921

Material. Republic of Karelia: Kavaina (Sept. 1950) — 1♀; Kimovary (Oct. 1958) — 2♂♂, 4♀♀; Krivoi Porog (Sept. 1956) — 1♂; Kuznavolok (Oct. 1958) — 5♂♂, 4♀♀; Selga (Sept. 1955) — 1♀; Medvezhegorskii Distr. (Sept. 1958) — 3♂♂, 2♀♀; Sortavalsksii Distr. (Jul. 1951) — 1♀; Suoyarvskii Distr. (Oct. 1958) — 2♂♂, 4♀♀. **Murmanskaya Oblast:** Imandra (Sept., Oct. 1959, Sept. 1960) — 19♂♂, 33♀♀; Kovda (Sept., Oct. 1960) — 1♂, 4♀♀.

Notes. Has a wide trans-Palearctic type of range: widespread in the forest zone from Western Europe to the Far East, including the Korean Peninsula; parasitizes Cricetidae and Muridae, reported also for Erinaceidae.

Hystrichopsylla talpae talpae (Curtis, 1826)

Material. Republic of Karelia: Kavaina (Aug., Sept. 1950, Aug. 1952) — 6♂♂, 1♀; Klimency (Aug. 1962) — 1♀; Kuznavolok (Oct. 1958) — 2♂♂, 3♀♀; Lunkulansaari Island (Jun.-Oct. 1953, Aug. 1959) — 40♂♂, 52♀♀; Rostan (Aug. 1954) — 2♂♂, 1♀; Selga (Aug., Sept. 1955) — 2♂♂, 3♀♀; Unica (Aug. 1952) — 3♀♀; Medvezhegorskii Distr. (Sept. 1958) — 1♂, 3♀♀; Pitkyarantskii Distr. (Jul. 1953) — 2♂♂, 1♀; Sortavalsksii Distr. (Jul.-Sept. 1953) — 5♂♂, 6♀♀.

Notes. West-Central Palearctic type of range: widespread from Western Europe to Western Siberia; parasitizes Soricidae and Talpidae as well as Cricetidae and Erinaceidae.

Ceratophyllidae Damph, 1908

Amalaraeus penicilliger pedias (Rothschild, 1911)

Material. Republic of Karelia: Alalampi (May 1952) — 1♂; Vahvayarvi (Aug. 1951) — 4♀♀; Kimovary (Oct. 1958) — 21♂♂, 27♀♀; Klimency (Jul.-Sept. 1962) — 5♂♂, 8♀♀; Krivoi Porog (Aug., Sept. 1956) — 22♂♂, 33♀♀; Kuznavolok (Oct. 1958) — 6♂♂, 22♀♀; Lunkulansaari Island (Jul., Aug. 1953) — 1♂, 8♀♀; Selga (Aug. 1955) — 2♂♂, 1♀; Unica (Jul. 1952) — 3♂♂; Harlu (Oct. 1950) — 2♀♀; Medvezhegorskii Distr. (Sept. 1961) — 3♀♀; Sortavalsksii Distr. (Aug. 1951, Jul. 1952, 1953) — 2♂♂, 2♀♀; Suoyarvskii Distr. (Oct. 1958) — 14♂♂, 19♀♀. **Murmanskaya Oblast:** Imandra (Sept., Oct. 1959, Sept. 1960) — 56♂♂, 89♀♀; Kovda (Oct. 1960) — 2♂♂, 2♀♀.

Notes. Has a wide Holarctic, Euro-Siberian-Central Asian-Canadian type of range: widespread in Western Europe, Fennoscandia, as well as in the North-Western and Central European part of Russia; parasitizes Cricetidae and Muridae.

Ceratophyllus (Emmareus) garei
(Rothschild, 1902)

Material. Republic of Karelia: Lunkulansaari Island (August 1953) — 1♂.

Notes. *Ceratophyllus (E.) garei* has a wide Holarctic, European-Siberian-Central Asian-Canadian type of range, parasitizing many bird species.

Ceratophyllus (Monopsyllus) sciurorum sciurorum
(Schränk, 1803)

Material. Republic of Karelia: Alalampi (Sept. 1950) — 2♀♀; Vahvayarvi (Aug. 1951) — 1♂, 5♀♀; Lyaskelya (Aug. 1951) — 5♂♂, 2♀♀. The place and time of collection are not specified — 1♂, 2♀♀.

Notes. Has a wide trans-Palearctic, European-Siberian-Turanian-Iranian type of range: widespread from Europe to Western Siberia, Middle and Central Asia.

Megabothris (Gebiella) rectangulatus
(Wahlgren, 1903)

Material. Republic of Karelia: Kimovary (Oct. 1958) — 8♂♂, 12♀♀; Klimency (Aug. 1962) — 1♀; Krivoi Porog (Aug., Sept. 1956, Sept. 1961) — 19♂♂, 14♀♀; Kuznavolok (Oct. 1958) — 9♂♂, 4♀♀; Padany (Aug. 1952) — 1♀; Selga (Sept. 1955) — 1♂; Unica (Aug. 1952) — 1♂, 3♀♀; Medvezhegorskii Distr. (Sept. 1958) — 1♀; Pitkyarantskii Distr. (Aug. 1953) — 1♀; Suoyarvskii Distr. (Oct. 1958) — 3♂♂, 1♀. **Murmanskaya Oblast:** Imandra (Sept. 1959, 1960) — 46♂♂, 58♀♀; Kovda (Sept., Oct. 1960) — 2♂♂, 2♀♀.

Notes. Has a trans-Palearctic, European-Siberian-Central Asian type of range: widespread in Europe, Western and Central Siberia, Central Asia (Tian Shan); parasitizes Cricetidae.

Megabothris (Gebiella) turbidus
(Rothschild, 1909)

Material. Republic of Karelia: Rostan (Jun.-Aug. 1954) — 2♂♂, 5♀♀.

Notes. Has a wide trans-Palearctic, European-Siberian type of range: widespread from Western Europe to Eastern Siberia (Western Transbaikalia); parasitizes Cricetidae and Muridae.

Megabothris (Megabothris) calcarifer
(Wagner, 1913)

Material. Murmanskaya Oblast: Imandra (Sept. 1959) — 16♂♂, 7♀♀; Kovda (Oct. 1960) — 1♂.

Notes. Has a wide trans-Palearctic, Euro-Siberian type of range: widespread in Northern Europe, Siberia, Central Asia, and Far East; predominant hosts are Cricetidae.

Megabothris (Megabothris) walkeri
(Rothschild, 1902)

Material. Republic of Karelia: Vahvayarvi (Jun., Aug. 1950) — 10♂♂, 13♀♀; Kavaina (Sept. 1950) — 2♂♂, 1♀; Klimency (Jul. 1961, Jul., Aug. 1962) — 3♀♀; Krivoi Porog (Sept. 1956) — 1♀; Lunkulansaari Island (Jun.-Sept. 1953) — 42♂♂, 129♀♀; Lyaskelya (Jul., Aug. 1950) — 6♂♂, 3♀♀; Mihailovskoe (Aug. 1952) — 1♀; Unica (Jul., Aug. 1952) — 3♂♂, 4♀♀; Lahdenpohskii Distr. (Jul. 1958) — 2♂♂; Pitkyarantskii Distr. (Jul., Aug. 1953) — 5♂♂, 3♀♀; Sortavalsksii Distr. (Jun., Aug., Oct. 1951, Jun.-Sept. 1953) — 7♂♂, 17♀♀; Suoyarvskii Distr. (Oct. 1958) — 1♂. **Murmanskaya Oblast:** Kovda (Oct. 1960) — 1♂.

Notes. Has a wide trans-Palearctic, Euro-Siberian type of range: widespread in Western and Eastern Europe, the Caucasus, and Western Siberia; predominant hosts are Cricetidae and Muridae.

Nosopsyllus (Nosopsyllus) fasciatus (Bosc, 1800)

Material. Republic of Karelia: Kuznavolok (Oct. 1958) — 14♂♂, 16♀♀; Lyaskelya (Jul. 1950) — 1♀.

Notes. Cosmopolitan type of range; mostly parasitizes rats, but has been reported also from many other rodent species.

Tarsopsylla octodecimdentata octodecimdentata
(Kolenati, 1863)

Material. Republic of Karelia: Alalampi (Sept. 1950) — 4♂♂, 3♀♀; Lyaskelya (Aug. 1951) — 1♂, 3♀♀. The place and time of collection are not specified — 11♂♂, 16♀♀.

Notes. *T. octodecimdentata* has a wide Holarctic, European-Siberian-East Asian-Canadian-West American type of range. The nominotypical subspecies has a trans-Palaearctic, European-Siberian-East Asian type of range: widespread in Eurasian boreal forests; parasitizes squirrels.

Leptopsyllidae Rothschild et Jordan, 1915
Amphipsylla sibirica sibirica (Wagner, 1898)

Material. Murmanskaya Oblast: Imandra (Sept., Oct. 1959) — 91♂♂, 102♀♀; Kovda (Oct. 1960) — 2♂♂, 1♀.

Notes. *A. sibirica* has a wide Holarctic, European-Siberian-Canadian type of range. The nominotypical subspecies is widespread from Northern Europe, including Northwestern European Russia, to Western Siberia and Central Asia (Tian Shan); parasitizes Cricetidae.

Peromyscopsylla bidentata bidentata
(Kolenati, 1863)

Material. Republic of Karelia: Kimovary (Oct. 1958) — 7♂♂, 4♀♀; Klimency (Jul. 1961) — 1♂; Krivoi Porog (Sept. 1956) — 4♂♂; Kuznavolok (Sept. 1956, Oct. 1958) — 10♂♂, 18♀♀; Lunkulansaari Island (Aug. 1953) — 2♂♂, 1♀; Selga (Sept., Oct. 1955) — 2♂♂, 9♀♀; Medvezhegorskii Distr. (Sept., Oct. 1958) — 3♂♂, 7♀♀; Pitkyarantskii Distr. (Sept. 1953) — 1♀; Sortavalskii Distr. (Oct. 1956) — 1♂, 1♀; Suoyarvskii Distr. (Oct. 1958) — 14♂♂, 13♀♀. **Murmanskaya Oblast:** Imandra (Sept., Oct. 1959, Sept. 1960) — 91♂♂, 82♀♀; Kovda (Oct. 1960) — 1♂, 1♀.

Notes. *P. bidentata* and its nominotypical subspecies have a wide trans-Palaearctic, European-Siberian type of range; predominant hosts are Cricetidae.

Peromyscopsylla silvatica (Meinert, 1896)

Material. Republic of Karelia: Vahvayarvi (Aug. 1951) — 3♂♂, 2♀♀; Kavaina (Aug., Sept. 1950, Jul., Aug. 1952) — 3♂♂, 14♀♀; Kivach (Sept. 1961) — 1♀; Kimovary (Oct. 1958) — 7♂♂, 8♀♀; Klimency (Jun.-Sept. 1962) — 36♂♂, 45♀♀; Krivoi Porog (Aug. 1956) — 2♂♂; Kuznavolok (Sept. 1956, Oct. 1958) — 1♂, 3♀♀; Lunkulansaari Island (Jul.-Sept. 1953, Aug. 1959) — 45♂♂, 41♀♀; Padany (Jul., Aug. 1952) — 11♂♂, 11♀♀; Mihailovskoe (Aug. 1952) — 5♂♂, 1♀; Rostan (Jul.-Aug. 1954) — 3♂♂, 2♀♀; Selga (Aug., Sept. 1953, Jun.-Oct. 1955) — 95♂♂, 155♀♀; Unica (Jul., Aug. 1952) — 14♂♂, 24♀♀; Harlu (Sept. 1950, Sept. 1955) — 2♂♂, 1♀; Medvezhegorskii Distr. (Sept. 1958) — 13♂♂, 14♀♀; Pitkyarantskii Distr. (Jul.-Sept. 1953) — 4♂♂, 6♀♀; Sortavalskii Distr. (Sept. 1950, Jul.-Aug. 1951, Jul.-Sept. 1953) — 11♂♂, 9♀♀; Suoyarvskii Distr. (Oct. 1958) — 2♂♂, 5♀♀. **Murmanskaya Oblast:** Imandra (Sept. 1959, Sept. 1960) — 71♂♂, 88♀♀; Kovda (Sept., Oct. 1960) — 2♂♂, 1♀.

Notes. *P. silvatica* has a wide trans-Palaearctic, European-Siberian type of range: widespread in Western and Eastern Europe, Western Siberia. The nominotypical subspecies is widespread in Eastern Europe, Western Siberia, and Kazakhstan.

Ischnopsyllidae Wahlgren, 1907
Myodopsylla trisellii Jordan, 1929

Material. Republic of Karelia: Sortavalskii Distr. (Sept. 1950) — 1♀.

Notes. Has a wide Holarctic, European-Siberian-Central Asian-East Asian type of range. Widespread from Eastern Europe (Northwestern and Central regions of European Russia) to the Far East; parasitizes mouse-eared bats.