

The Ants Database of the Khibiny Polar Mountains [†]

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Abstract: Based on the results of entomological studies in thirteen natural and anthropogenic disturbed ecosystems of the Khibiny polar mountains in 2014–2018, a Database on ants was created. The Database contains information on 18 collected ant species and three non-captured species known in Khibiny from reports of the first Scientific Mountain Base in the 1930s. A total of 21 species make up 82% of known myrmecofauna of the Kola Subarctic. The collected ants belong to 4 genera and 2 subfamilies of the family Formicidae, including 13 species of the subfamily Formicinae and 5 species of the subfamily Myrmicinae. Seven *Formica* species we are reporting in Khibiny for the first time (*F. aquilonia*, *F. forsslundi*, *F. polychtena*, *F. rufibarbis*, *F. sanguinea*, *F. suecica* and *F. truncorum*). Among them, the boreo-alpine ant *F. suecica* is rare in Fennoscandia and is a red-listed species in Finland. Three wood ants (*F. aquilonia*, *F. lugubris* and *F. polychtena*) are included in European Red List (1992) in the vulnerable category and in IUCN Red List of Threatened Species (1996) as near-threatened species.

Keywords: Khibiny polar mountains; ants; Myrmicinae; Formicinae; checklist; database

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1. Introduction

The Khibiny mountains, with the maximal altitude about 1200 m asl, located in 150 km northern the Arctic Circle (67°34'–50' N, 33°14'–34°11' E; Figure 1a) and are highest peaks in the Kola Subarctic. The specificity of the mountain climate, rocks, soils and the altitudinal zonation of these abiotic factors [15, 18, 19, 24] determine the uniqueness of the mountain flora and fauna. To preserve the unique mountain nature a most of the territory of Khibiny has received a protected status of the National Park in 2018. Within the project on assessment of a polar mountains biodiversity, we have been studying the invertebrate fauna of Khibiny since 2008 and have identified about 450 species of arachnids, insects, earthworms, gastropods, and centipedes [25]. For the most diversity taxa we create the databases. In this article, we report a Database on the local myrmecofauna of Khibiny mountains, registered in 2021.

2. Materials and Methods

2.1. Fieldworks

The ants were collected in 2014–2018 in different parts of Khibiny mountains: western (Yumechorr Mt), eastern (Suolaiv Mt), and central part (Yuksporr and Kuelporr Mts), in ten natural and three disturbed ecosystems (Figure 1b). Natural biotopes were selected on slopes of different exposures, in four main vegetative belts in the height range from 235 to 730 m above sea level: mountain taiga (rare-stand spruce and pine forests), forest-tundra (birch crooked forests), lower tundra and high-mountain tundra with fragmentary vegetation. Disturbed ecosystems were represented by 6-year-old pine forests

felling and 5-year-old burnt forest and burnt felling, in the intermountain valley of the Kuniyok River, 220 m asl, in the north of Khibiny. The altitude and coordinates of each biotope were measured using the Garmin navigator eTrex–30.

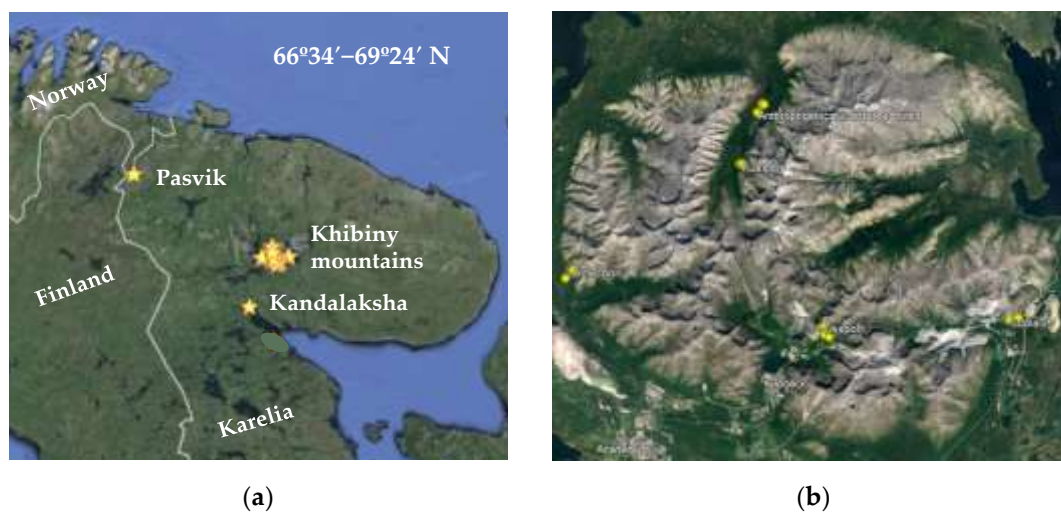


Figure 1. Location of Khibiny mountains and other areas of the Kola Subarctic with studied myrmecofauna (a) and mountains investigated in Khibiny (b). “Pasvik” and “Kandalaksha” Nature Reserves (a) – the literature data, Khibiny mountains (b) – own data.

The ants were collected from June to August–September (during 60–95 days) using 500 ml plastic traps with 4% formaldehyde. The replication of traps in each biotope was 30-fold: three lines of 10 traps with a distance of 10 meters between the traps and the lines.

The temperature (°C) and humidity (%) of atmospheric air and soil depth of 5 cm were measured daily in each biotope during the period of ant capture, using automatic sensors (recorders) with a measurement range from –25 to +40 °C and from 1 to 100% [21].

2.2. Species identification

All collected ants were identified by the second author using the stereomicroscope STEMI 2000 and different keys [4, 5, 20, 22]. The systematic and nomenclature was given according to the world catalog of ants [1]. All material is stored in Myrmecological Collection of Tembotov Institute of Ecology of Mountain Territories RAS, Nalchik.

2.3. A Database creating

Based on the results of species identification, a checklist of ants of the Khibiny mountains was compiled. The distribution of ants in Khibiny was mapped in the ArcGIS software package (ver 10.4) of the Russian company Esri CIS. The checklist was compared with well-studied ant fauna of two Nature Reserves located in different parts of the Kola Subarctic: in north-west, on the border with Norway and Finland (the trilateral “Pasvik” Reserve, 240 km from the Khibiny mountains), and on the southern White Sea coast (“Kandalaksha” Reserve, 90 km from the Khibiny) (Figure 1a).

We studied the lists of ants published in the Reports of the first Mountain Scientific Base in the 1930s [8], and later, during the entomological survey of Khibiny mountains before the creation of the National Park [26]. We also took into account a recent critical review of the order Hymenoptera of North-Western Russia [16].

3. Results

3.1. Taxonomic part of a Database

The created Database is called "Local Fauna of ants (Hymenoptera, Formicidae) of the Khibiny mountains" and contains information on 18 ant species collected by the authors in 2014-2018, and three non-collected species known in Khibiny from Reports of the first Scientific Mountain Base in the 1930s [8]. A total of 21 species from 4 genera and 2 subfamilies, including 16 species of the subfamily Formicinae and 5 species of the subfamily Myrmicinae (Table).

Table. Checklist of ants inhabiting Khibiny polar mountains and other areas of Kola Subarctic.

Taxonomy			Finds		
Subfamily	Genera	Species	Khibiny mountains	Pasvik Reserve ²	Kandalaksha Reserve ³
Formicinae Latreille 1809					
	<i>Camponotus</i> Mayr, 1861				
		<i>C. herculeanus</i> (Linnaeus 1758)	+ (5)	+	+
	<i>Formica</i> Linnaeus, 1758				
		<i>F. aquilonia</i> Yarrow 1955**	+ (5)	+	+
		<i>F. exsecta</i> Nylander 1846	+ (3)	+	+
		<i>F. forsslundi</i> Lohmander 1949**	+ (1)	+	no data
		<i>F. fusca</i> Linnaeus 1758	+ (2)	+	+
		<i>F. gagatoides</i> Ruzsky 1904	+ (8)	+	+
		<i>F. lemni</i> Bondroit 1917	+ (9)	+	+
		<i>F. lugubris</i> Zetterstedt 1838	+ (2)	+	+
		<i>F. picea</i> Nylander 1846 ¹	not found	+	no data
		<i>F. polyctena</i> Foerster 1850**	+ (1)	no data	+
		<i>F. pratensis</i> Retzius 1783 ¹	not found	no data	+
		<i>F. rufa</i> Linnaeus 1761 ¹	not found	no data	no data
		<i>F. rufibarbis</i> Fabricius 1793* ^{***}	+ (1)	no data	no data
		<i>F. sanguinea</i> Latreille 1798**	+ (2)	+	+
		<i>F. suecica</i> Adlerz 1902**	+ (2)	no data	no data
		<i>F. truncorum</i> Fabricius 1804**	+ (3)	+	+
Myrmicinae Lapeletier de Saint-Fargeau, 1835					
	<i>Leptothorax</i> Mayr, 1855				
		<i>L. acervorum</i> (Fabricius 1793)	+ (10)	+	+
	<i>Myrmica</i> Latreille, 1804				
		<i>M. lobicornis</i> Nylander 1846	+ (12)	+	+
		<i>M. rubra</i> (Linnaeus, 1758)	+ (2)	no data	+
		<i>M. ruginodis</i> Nylander 1846	+ (10)	+	+
		<i>M. sulcinodis</i> Nylander 1846	+ (9)	+	+
2 subfamily	4 genera	21 species	18 species	15 species	16 species

Note. Species collected in a single copy (*); for the first time in Khibiny mountains (**) or in the Kola Subarctic (***). In parentheses the number of biotopes with captured species is shown. The literature data: ¹[8], ²[11, 12-14], ³[2, 23].

Based on collected materials, the habitation of 12 previously known ant species is confirmed [8, 26] and seven *Formica* species (*F. aquilonia*, *F. forsslundi*, *F. polyctena*, *F. rufibarbis*, *F. sanguinea*, *F. suecica* and *F. truncorum*) have been recorded in Khibiny for the first time (Table), including two species (*F. forsslundi* and *F. fusca*) whose distribution in such northern latitudes has been questioned [16].

Three wood *Formica* ants (*F. aquilonia*, *F. lugubris* and *F. polyctena*) are included in the European Red List (1992) in the vulnerable category [7] and in the IUCN Red List of Threatened Species (1996) as near-threatened species [10], so are subject to protection everywhere. Our researches in Khibiny also confirm the existence of *Formica suecica* in the Kola Subarctic, which previously had been mentioned only for the White Sea coast in

1913 [9]. This boreo-alpine ant is rare in Fennoscandia and a red-listed species in Finland [17].

The find of the European-West Siberian thermophilous and light-loving species *Formica rufibarbis*, locally distributed in Fennoscandia up to the latitude 62° N [3], is the first to the polar myrmecofauna.

3.2. Attributive part of a Database

The attribute table contains the following data for each ant find: the geographical coordinates, the slopes exposure, the mountain belt, the altitude above sea level, the type of habitat, the timing and methods of capture. The temperature and humidity of the atmospheric air and the litter, measured during the ants' collection, are indicated. Quantitative characteristics include the number of captured females, males, worker ants, and juvenile stages.

These data showed the greatest diversity of ants in ecosystems of the birch forests belt at 300–500 m altitude (14 ant species in total) as ecotone between the taiga and tundra mountain belts (12 species in each).

3.3. Biological table of a Database

This extensive table is compiled on the basis of numerous literary and Internet sources. It contains arealogical, zoogeographic, biotopic, biomorphological and trophic characteristics of each ant species, its hydro-, thermo-, and photo- preferences, the limits of cold resistance, the specifics of nest construction, and other environmental information.

Most ant species in Khibiny mountains have extensive Trans-Paleartic ranges and belong to the boreal faunogenetic group and the biomorphological group of herpetobionts. Despite the greater species richness of Formicinae subfamily, the more cold-resistant Myrmicinae species are widespread in the Khibiny ecosystems. At the same time, the presence of a significant number of stenotopic *Formica* species with different ecological preferences indicate the heterogeneity of habitat conditions within this polar mountains.

4. Discussion

According to the previous myrmecological studies in Khibiny in the 1930s and 1990s, the checklist of ant includes 14 species: nine Formicinae species (*C. herculeanus*, *F. exsecta*, *F. fusca*, *F. gagatoides*, *F. lemami*, *F. lugubris*, *F. picea*, *F. pratensis*, and *F. rufa*) and five Myrmicinae species (*L. acervoorum*, *M. lobicornis*, *M. rubra* (= *M. laevinodis*), *M. ruginodis*, and *M. sulcinodis*) [8, 26]. Later, Paukkunen and Kozlov [16] doubted the existence of four *Formica* species (*F. forsslundi*, *F. fusca*, *F. pratensis*, and *F. rufa*) in such northern latitudes referring to the Swedish catalog of ants [6].

We did not find three *Formica* species (*F. picea*, *F. pratensis*, and *F. rufa*) from Fridolin's list [8], although the former lives in the "Pasvik" Nature Reserve in 240 km north-west of Khibiny [12–14], and the second species in the "Kandalaksha" Nature Reserve, 90 km south of Khibiny [2]. But we confirmed the presence of controversial ants *F. forsslundi* and *F. fusca*, and added seven species to the checklist of Khibiny (Table). Among them, four red-listed wood ants (*F. aquilonia*, *F. lugubris*, *F. polycytena* and *F. sueci-ca*), the protection of which and their polar habitats seems possible in the borders of the Khibiny National Park founded in 2018.

So, the present local ant fauna of Khibiny counts 18 species and is comparable with myrmecofaunas of the two most studied territories of Kola Subarctic, such as the "Pasvik" and "Kandalaksha" Nature Reserves (Figure 1), for which 17 and 18 ant species are known, correspondingly [2, 11–14, 23]. However, only 13 ant species are shared to Khibiny and both reserves. Additionally, two species (*M. rubra* and *F. polycytena*) are common for Khibiny and "Kandalaksha" Reserve and *F. forsslundi* is common for Khibiny and "Pasvik" Reserve.

5. Conclusions

Based on the results of field studies in 2014–2018, a Database on ants of the Khibiny polar mountains was created. It's including 18 confirmed species. The findings of three more species, known only from the literature, require further research. These species, is possible, will be identified in the materials collected in a dozen other mountain biotopes in recent years (the data is still being processed). Thus, the Database will be constantly updated. Taking into account, the current local fauna of the Khibiny mountains includes more than 80% species of the regional myrmecofauna, we don't expect a significant addition to the submitted checklist. However, increasing the number of studied mountain ecosystems and their inclusion in the Database will allow identifying more statistically reliable trends in the ant distribution within the Khibiny mountains and in their altitude belts.

6. Patents

The Database was registered in the "Rospatent" Federal Service for Intellectual Property of Russia (<https://rospatent.gov.ru/>). Patenting is confirmed by a Certificate № 2021620847 from April 26, 2021 (in Russian) (Figure 2).



Figure 2. The Database Certificate.

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