

## Research paper

# New data regarding the bumblebee fauna (Hymenoptera: Apidae) of the northern part of Murmansk Region

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The focus of this study is to present new data regarding the bumblebee fauna of the northern part of Murmansk Region (Northern European Russia). A total 15 species of bumblebees were found here that cover almost all species that may be found in the studied area. *Bombus sporadicus* and *B. bohemicus* are the first records in the northern part of Murmansk Region, but these species are well known from Northern Fennoscandia. No new haplotypes were found for *B. alpinus* and *B. monticola* in the Kola Peninsula. They belong to the lineages which are common in Scandinavia and Finland.

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## INTRODUCTION

Several regional publications concerning the bumblebee species of Northern Scandinavia and Finland have been published in recent decades (Løken 1973, 1984; Söderman & Leinonen 2003; Parkkinen *et al.* 2018). Among the more recent studies, we can mention a paper regarding the Varanger Region, located near the Norwegian-Russian border (Hallmen 2024a). However, for the Murmansk Region much less data are available. Most historical data about the bumblebee fauna are presented in a regional list of species of Hymenoptera: Aculeata (Paukkunen & Kozlov 2015). There are also a few papers regarding some localities of the Murmansk Region (Potapov *et al.* 2015, 2018). For the northern part of Murmansk Region, the available data are rather scarce.

The cryptic species of *Bombus lucorum*-complex, which are morphologically indistinguishable in much of their range, comprise one of the challenges for the regional studies of bumblebees (Scriven *et al.* 2015). Two species of this complex, i.e., *B. cryptarum* and *B. lucorum*, have been recorded in the north of Finland and Murmansk Region (Pamilo *et al.* 1997; Bovykina *et al.* 2025). However, their distribution in this region is not well known because they may not be reliably identified without molecular methods (Scriven *et al.* 2015). *B. alpinus* and *B. monticola* have particular interest among the bumblebee species of the northern part of Murmansk Region. For

these two species the Kola Peninsula is the eastern border of their ranges, because *B. alpinus* and *B. monticola* occur only in Europe (Rasmont *et al.* 2021). However, phylogeographic analysis has never been applied for these species from the Murmansk Region. It is unknown, whether separate haplotypes exist for *B. alpinus* and *B. monticola* in the Kola Peninsula.

In this paper, we present new data regarding the bumblebee fauna of the northern part of Murmansk Region. In addition, we applied the phylogeographic analyses for *B. alpinus* and *B. monticola* based on materials obtained from the studied region.

## MATERIALS AND METHODS

Specimens of bumblebees from the northern part of Murmansk Region were collected by Grigory S. Potapov and Anastasia A. Pervukhina in 2012, 2020, 2021 and 2022 (total  $N = 757$  specimens). The bumblebees were collected with an entomological net. This material covers the territory from the Norwegian-Russian border to Teriberka (Figure 1; Table 1). The map of the studied region was produced by Simple Mappr (<https://www.simplemappr.net/>). The specimens of bumblebees are deposited in the Russian Museum of the Biodiversity Hotspots [RMBH thereafter] of the N. Laverov Federal Center for Integrated Arctic Research of the Ural Branch of the



Figure 1. Map of the northern part of Murmansk Region. The studied localities are shown as black dots (●).

Table 1. Description of the studied localities.

Localities	Date	Coordinates	Habitats
Nikel	11.VIII.2020, 26.VII.2021	69°23'53.2"N - 30°13'01.4"E	Roadside with willow-herb
Pechenga	6.VI.2012, 23.VII.2012	69°28'50.9"N - 31°07'21.0"E	Ruderal habitat with clover
Titovka	7.VI.2012, 28.VII.2021	69°30'41.1"N - 31°53'28.9"E	Roadside with willow-herb
Zapadnaya Litsa	8.VI.2012, 23.VII.2012	69°21'14.6"N - 32°08'41.1"E	Roadside with willow-herb and European goldenrod
Murmansk	1.VIII.2020, 12.VIII.2020, 23-24.VII.2022	68°56'35.1"N - 33°05'30.4"E	Roadside with clover and willow-herb
Kildinstroy	4-5.VIII.2020, 8.VIII.2020, 25-27.VII.2021	68°46'39.9"N - 33°06'55.5"E	Roadside with willow-herb
Magnetity	24.VII.2012	68°41'05.6"N - 33°07'55.6"E	Roadside with clover and willow-herb
Teriberka	25-26.VII.2022	69°11'04.8"N - 35°07'03.0"E	Roadside with willow-herb

Russian Academy of Sciences (Arkhangelsk, Russia). The bumblebee specimens were studied using a stereomicroscope Solo 2070 (Carton Optical (Siam) Co., Ltd., Thailand). They were identified by following Løken (1973, 1984) and Rasmont *et al.* (2021). The cryptic species of *Bombus lucorum*-complex were identified using the RCR-RFLP approach as described in Bovykina *et al.* (2024, 2025).

We generated new sequences of the cytochrome c oxidase subunit I (*COI*) gene from two specimens of *B. alpinus* and two specimens of *B. monticola*, which were collected in Teriberka (Table 3). The laboratory protocols followed those described in Potapov *et al.* (2018). Resulting *COI* gene sequences were checked manually using a sequence alignment editor (BioEdit v. 7.2.5; Hall 1999). The sequencing was carried out at the Engelhardt Institute of Molecular Biology of the Russian Academy of Sciences (Moscow, Russia) using the ABI PRISM® BigDye™ Terminator v. 3.1 reagent kit. For phylogeographic analyses we used a median-joining network approach using Network v. 5.0.0.1 with default settings (Bandelt *et al.* 1999). Additional available *COI* sequences of *B. alpinus* and *B. monticola* were obtained from the BOLD (the Barcode of Life Data System) and GenBank databases ( $N = 81$ ; Table 3). Each *COI* sequence of the aligned datasets was trimmed, leaving a 611-bp fragment for *B. alpinus* and 620-bp fragment for *B. monticola*. The alignment of *COI*

sequences was performed using the ClustalW algorithm implemented in MEGA X (Kumar *et al.* 2018).

## RESULTS

A total 15 species of bumblebees were found in the northern part of Murmansk Region (Table 2). Among the species of *Bombus lucorum*-complex only one species, i.e., *B. cryptarum*, was registered by using the RCR-RFLP approach in the northern part of Murmansk Region (Bovykina *et al.* 2025). In the territory near the Norwegian-Russian border (Nikel and Pechenga), a total of 12 species were found. In the western part of the studied area (Titovka and Zapadnaya Litsa), 8 species of bumblebees were found; in the central part (Murmansk, Kildinstroy and Magnetity), 13 species were observed. In Teriberka (the eastern part), 7 species of bumblebees were registered.

We found that the sequenced specimens of *B. alpinus* from the Murmansk Region belong to a *COI* lineage that also occurs in Finland and Sweden (Figure 2; Table 3). Other haplotypes of this species are known from Norway and the Alps, where *B. alpinus* is also distributed (Rasmont *et al.* 2021). The sequenced specimens of *B. monticola* from the Murmansk Region belong to a *COI* lineage that occurs in Finland

and Norway. Several haplotypes of this species are known from Norway, Finland and Sweden. Other *COI* lineages of *B. monticola* occur in the United Kingdom and the Alps (Rasmont *et al.* 2021).

Table 2. List of the bumblebee species that are recorded in the northern part of Murmansk Region. Data for Pechenga and Magnetity were published in Potapov *et al.* (2015). Symbols: (●) recorded, according to the examined material, (–) absent.

Species/locality	Nikel	Pechenga	Titovka	Zapadnaya Litsa	Murmansk	Kildinstroy	Magnetity	Teriberka
<i>Bombus (Megabombus) hortorum</i> (Linnaeus, 1761)	●	-	-	-	●	-	-	-
<i>B. (Thoracobombus) pascuorum</i> (Scopoli, 1763)	-	●	●	-	●	●	●	-
<i>B. (Psithyrus) bohemicus</i> Seidl, 1837	-	●	-	-	-	●	-	-
<i>B. (Ps.) flavidus</i> Eversmann, 1852	●	●	-	-	●	●	-	●
<i>B. (Ps.) norvegicus</i> (Sparre-Schneider, 1918)	-	-	-	-	-	●	-	-
<i>B. (Pyrobombus) lapponicus</i> (Fabricius, 1793)	●	●	●	●	-	●	●	●
<i>B. (Pr.) monticola</i> Smith, 1849	-	-	-	-	-	-	-	●
<i>B. (Pr.) hypnorum</i> (Linnaeus, 1758)	●	●	-	●	●	●	●	-
<i>B. (Pr.) pratorum</i> (Linnaeus, 1761)	●	●	●	●	●	●	●	●
<i>B. (Pr.) jonellus</i> (Kirby, 1802)	●	●	●	●	●	●	●	●
<i>B. (Pr.) cingulatus</i> Wahlberg, 1854	-	-	-	●	●	●	●	-
<i>B. (Alpinobombus) alpinus</i> (Linnaeus, 1758)	-	●	-	-	-	-	-	●
<i>B. (Al.) balteatus</i> Dahlbom, 1832	-	●	-	●	-	●	-	-
<i>B. (Bombus) sporadicus</i> Nylander, 1848	●	●	-	-	-	●	●	-
<i>B. (Bo.) cryptarum</i> (Fabricius, 1775)	●	●	●	●	●	●	●	●
Total number of species	8	11	5	7	8	12	8	7

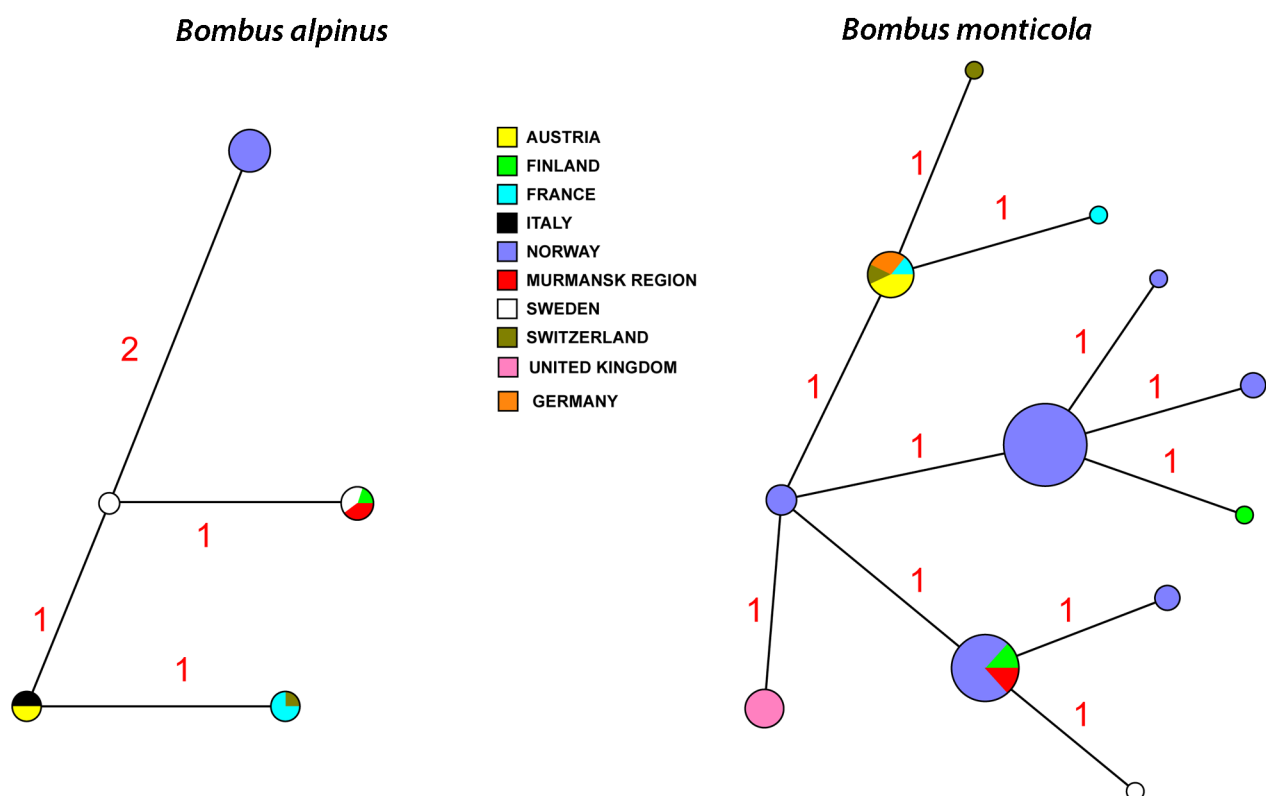


Figure 2. Median-joining haplotype networks of the available *COI* sequences of *Bombus alpinus* and *B. monticola*. The circle size is proportional to the number of available sequences belonging to a certain haplotype (the smallest circle = one sequence). Red numbers near branches indicate the number of nucleotide substitutions between haplotypes.

Table 3. List of *COI* sequences for bumblebee specimens used in phylogeographic analyses.

Species	<i>COI</i> haplo-type code	<i>COI</i> BOLD IDS / GenBank acc. no.	Specimen Voucher	Locality	References
<i>B. alpinus</i>	AL1	PV082942	RMBH Api562	Murmansk Region: Teriberka	This study
<i>B. alpinus</i>	AL1	PV082943	RMBH Api563	Murmansk Region: Teriberka	This study
<i>B. alpinus</i>	AL1	FISYM014-14 / MZ628487	GL.2955	Finland	Roslin <i>et al.</i> 2021
<i>B. alpinus</i>	AL3	BOMNI016-13	BOMBUS-048	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	BOMNI057-13	BOMBUS-139	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	BOMNI063-13	BOMBUS-145	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	BOMNI064-13	BOMBUS-146	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	BOMNI066-13	BOMBUS-148	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	BOMNI080-13	BOMBUS-212	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	NOAPI564-14	NOAPI564	Norway	BOLD [public record]
<i>B. alpinus</i>	AL3	NOAPI642-14	NOAPI642	Norway	BOLD [public record]
<i>B. alpinus</i>	AL1	LNU1856-20	AVM1535	Sweden	BOLD [public record]
<i>B. alpinus</i>	AL1	LNU1904-21	AVM1583	Sweden	BOLD [public record]
<i>B. alpinus</i>	AL2	WASPS382-14	AL# 114	Sweden	BOLD [public record]
<i>B. alpinus</i>	AL2	WASPS383-14	AL# 113	Sweden	BOLD [public record]
<i>B. alpinus</i>	AL5	CODAB887-21	BCA0887	France	BOLD [public record]
<i>B. alpinus</i>	AL5	CODAB888-21	BCA0888	France	BOLD [public record]
<i>B. alpinus</i>	AL5	CODAB892-21	BCA0892	France	BOLD [public record]
<i>B. alpinus</i>	AL5	BBBO067-10	6873F07	Switzerland	BOLD [public record]
<i>B. alpinus</i>	AL4	FBAPB990-09 / HQ948121	BC ZSM HYM 02465	Italy	Shmidt <i>et al.</i> 2015
<i>B. alpinus</i>	AL4	FBAPB991-09	BC ZSM HYM 02466	Italy	BOLD [public record]
<i>B. alpinus</i>	AL4	TDAAT1329-20	20190496	Austria	BOLD [public record]
<i>B. alpinus</i>	AL4	TDAAT1330-20	20190488	Austria	BOLD [public record]
<i>B. monticola</i>	MON1	PV082944	RMBH Api564	Murmansk Region: Teriberka	This study
<i>B. monticola</i>	MON1	PV082945	RMBH Api565	Murmansk Region: Teriberka	This study
<i>B. monticola</i>	MON1	ACUFII1860-15 / MZ608606	GP.94721	Finland	Roslin <i>et al.</i> 2021
<i>B. monticola</i>	MON1	LEFIJ8548-19	ZMUO.036396	Finland	BOLD [public record]
<i>B. monticola</i>	MON8	ACUFII1900-15 / MZ609007	GP.65740	Finland	Roslin <i>et al.</i> 2021
<i>B. monticola</i>	MON1	BOMNI002-13	BOMBUS-011	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI003-13	BOMBUS-035	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI039-13	BOMBUS-121	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI058-13	BOMBUS-140	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI062-13	BOMBUS-144	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI069-13	BOMBUS-201	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI077-13	BOMBUS-209	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	BOMNI074-13	BOMBUS-206	Norway	BOLD [public record]
<i>B. monticola</i>	MON1	GBHAP764-14 / KF434334	KF434334	Norway	Gjershaug <i>et al.</i> 2013
<i>B. monticola</i>	MON1	GBHAP768-14 / KF434338	KF434338	Norway	Gjershaug <i>et al.</i> 2013
<i>B. monticola</i>	MON1	GBHAP771-14 / KF434341	KF434341	Norway	Gjershaug <i>et al.</i> 2013
<i>B. monticola</i>	MON2	BOMNI038-13	BOMBUS-120	Norway	BOLD [public record]
<i>B. monticola</i>	MON2	BOMNI036-13	BOMBUS-118	Norway	BOLD [public record]
<i>B. monticola</i>	MON4	BOMNI008-13	BOMBUS-040	Norway	BOLD [public record]
<i>B. monticola</i>	MON4	BOMNI075-13	BOMBUS-207	Norway	BOLD [public record]
<i>B. monticola</i>	MON4	BOMNI045-13	BOMBUS-214	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI007-13	BOMBUS-039	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI034-13	BOMBUS-116	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI035-13	BOMBUS-117	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI040-13	BOMBUS-122	Norway	BOLD [public record]

Table 3. Continued.

Species	COI haplo-type code	COI BOLD IDS / GenBank acc. no.	Specimen Voucher	Locality	References
<i>B. monticola</i>	MON5	BOMNI041-13	BOMBUS-123	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI043-13	BOMBUS-213	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI060-13	BOMBUS-142	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI079-13	BOMBUS-211	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI087-13	BOMBUS-222	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI088-13	BOMBUS-223	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI089-13	BOMBUS-224	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI094-13	BOMBUS-229	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI095-13	BOMBUS-230	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	NOAPI594-14	NOAPI594	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI006-13	BOMBUS-038	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI009-13	BOMBUS-041	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	BOMNI059-13	BOMBUS-141	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	NOAPI595-14	NOAPI595	Norway	BOLD [public record]
<i>B. monticola</i>	MON5	GBHAP766-14 / KF434336	KF434336	Norway	Gjershaug et al. 2013
<i>B. monticola</i>	MON5	GBHAP769-14 / KF434339	KF434339	Norway	Gjershaug et al. 2013
<i>B. monticola</i>	MON5	GBHAP770-14 / KF434340	KF434340	Norway	Gjershaug et al. 2013
<i>B. monticola</i>	MON5	GBHAP765-14 / KF434335	KF434335	Norway	Gjershaug et al. 2013
<i>B. monticola</i>	MON5	GBHAP767-14 / KF434337	KF434337	Norway	Gjershaug et al. 2013
<i>B. monticola</i>	MON6	BOMNI010-13	BOMBUS-042	Norway	BOLD [public record]
<i>B. monticola</i>	MON7	BOMNI073-13	BOMBUS-205	Norway	BOLD [public record]
<i>B. monticola</i>	MON7	BOMNI033-13	BOMBUS-115	Norway	BOLD [public record]
<i>B. monticola</i>	MON3	LNU1927-21	AVM1606	Sweden	BOLD [public record]
<i>B. monticola</i>	MON9	BEEEE311-16	BMNH(E)#1730811	United Kingdom	BOLD [public record]
<i>B. monticola</i>	MON9	BEEEE312-16	BMNH(E)#1730812	United Kingdom	BOLD [public record]
<i>B. monticola</i>	MON9	BEEEE335-16	BMNH(E)#1730835	United Kingdom	BOLD [public record]
<i>B. monticola</i>	MON9	BOMNI068-13	BOMBUS-150	United Kingdom	BOLD [public record]
<i>B. monticola</i>	MON9	BOMNI067-13	BOMBUS-149	United Kingdom	BOLD [public record]
<i>B. monticola</i>	MON10	FBAPC708-11 / KJ838349	BC ZSM HYM 07548	France	Shmidt et al. 2015
<i>B. monticola</i>	MON11	CODAB851-21	2019.00821	France	BOLD [public record]
<i>B. monticola</i>	MON12	FBAPD626-11 / KJ837543	BC ZSM HYM 08986	Switzerland	Shmidt et al. 2015
<i>B. monticola</i>	MON10	FBAPD625-11 / KJ837131	BC ZSM HYM 08985	Switzerland	Shmidt et al. 2015
<i>B. monticola</i>	MON10	FBHAP808-09 / GU705913	BC ZSM HYM 01093	Germany	Shmidt et al. 2015
<i>B. monticola</i>	MON10	FBAPC811-11 / KJ838456	BC ZSM HYM 07936	Germany	Shmidt et al. 2015
<i>B. monticola</i>	MON10	TDAAT1331-20	20190495	Austria	BOLD [public record]
<i>B. monticola</i>	MON10	TDAAT1332-20	20190494	Austria	BOLD [public record]
<i>B. monticola</i>	MON10	TDAAT1344-20	20190481	Austria	BOLD [public record]

## DISCUSSION

According to the summary of the bumblebee fauna of the Murmansk Region, our data cover almost all species that may be found in the north of the studied area (Paukkunen & Kozlov 2015). We did not find *B. hyperboreus* Schönherr, 1809 and *B. pyrrhopygus* Friese, 1902, which are known, for example, near the Norwegian-Russian border. *Bombus hyperboreus* is remarkable because this species is rare in Fennoscandia and is confined to the high alpine and tundra regions (Paukkunen & Kozlov 2015). In addition, *B. sylvestris* (Lepeletier, 1832) that is known in the outskirts of Murmansk, was not registered in our collections. *B. soroensis* (Fabricius, 1777) probably also

occurs in this area, since it has been recently found in northernmost Finland (The Finnish Museum of Natural History: <http://id.luomus.fi/GP.114932>, GP.114925, GP.114924, GP.114920, GP.114919, GP.114918). *Bombus sporadicus* and *B. bohemicus* were not recorded earlier in the northern part of Murmansk Region, according to the regional species list of Paukkunen & Kozlov 2015. However, they are well known from Northern Fennoscandia (Söderman & Leinonen 2003). For this reason, our records of these species in the north of Murmansk Region are not surprising.

Among the studied species, *B. hortorum* and *B. bohemicus* are noteworthy, because new records have been recently made in the Varanger Region, which probably shows the northward spreading the

ranges of these species (Hallmen 2024b, c). However, *B. hortorum* was previously reported from the northern part of Murmansk Region (Dolgaya Shchel, Trifonovo and Kola) by Paukkunen & Kozlov (2015). A few records are known for the eastern part of the studied area. No available materials regarding bumblebee species were previously known for Teriberka. Seven species were found here. It is likely that *B. balteatus*, *B. hyperboreus* and *B. pyrrhopygus*, which are typical for tundra habitats, should also occur in Teriberka. Among the species of the *Bombus lucorum*-complex only *B. cryptarum* was registered in the northern part of Murmansk Region (Bovykina et al. 2025). This species is associated with cooler climate, compared to *B. lucorum* (Scriven et al. 2015). *B. lucorum* is absent or rare above the Arctic Circle (Pamilo et al. 1997). Consequently, we can assume that *B. lucorum* is unlikely to be found in the north of the Murmansk Region.

No separate haplotypes were found for *B. alpinus* and *B. monticola* in the Kola Peninsula. They belong to the lineages that are common in Scandinavia and Finland. However, it is possible that new haplotypes restricted to Kola Peninsula will be found in the future. New material will provide an opportunity to learn more about the history of expansion of *B. alpinus* and *B. monticola* in Northern Fennoscandia, because these species are southern postglacial immigrants in the Scandinavian fauna (Løken 1973).

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