

Local fauna of bumblebees (Hymenoptera: Apidae: *Bombus* Latr.) in the outskirts of the town of Kandalaksha, southwest Kola Peninsula

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Abstract

This article presents the results of research focussed on the local bumblebee fauna in the southwest of the Kola Peninsula (near the town of Kandalaksha). In general, if we include the published data, the local fauna have 16 species of bumblebees. Among the species of the present study, the recent record for this region is *Bombus wurflenii* Radoszkowski, 1860. This species was previously unknown in the European North of Russia. It is typical for mountain ecosystems in Europe (Scandinavia, the mountains of Central and Western Europe, the Balkans, Northern Turkey and the Caucasus). We assume that the record of *B. wurflenii* on the Kola Peninsula is the recent appearance of this species in the region. One of the possible reasons for the expansion of this species is climate change. Other species of bumblebees in the local fauna are typical for the region. The species present wide ranges, i.e., Transpalaeartic, Holarctic and one species of West-Central Palaearctic. In the outskirts of Kandalaksha, there are 2 species (*B. distinguendus* Morawitz, 1869 and *B. veteranus* (Fabricius, 1793)) which belong to the group of meadow species according to their habitat preference. They are not common for the taiga habitats in the European North of Russia. We can explain their presence in the local fauna by noting the presence of anthropogenic meadow habitats in the studied area.

Keywords

bumblebees, local fauna, biodiversity, Murmansk Region, European North

The study of the fauna of bumblebees in the Kola Peninsula and the adjacent territories of northern Fennoscandia has a long history. The first information about the fauna of bumblebees for this region is known from the first half of the 19th century (Zetterstedt 1838). Later, during the period from the late 19th century to the first half of the 20th century, a large amount of material was collected in the Murmansk Region, mainly covering the territories along the coast of the Barents Sea from the northeast of the Kola Peninsula to the Norwegian border and the Khibiny Mountains. These materials are presented in the papers of

Løken (1973, 1984), Pekkarinen et al. (1981), and Söderman and Leinonen (2003). Paukkunen and Kozlov (2015) present the latest checklist for the bumblebees from the Murmansk Region.

However, despite the long history of research of the bumblebee fauna in this region, a number of the territories remain poorly studied, primarily the southwestern part of the Kola Peninsula. In this regard, we conducted the field research on the outskirts of the town of Kandalaksha in order to obtain additional data on the bumblebee fauna.

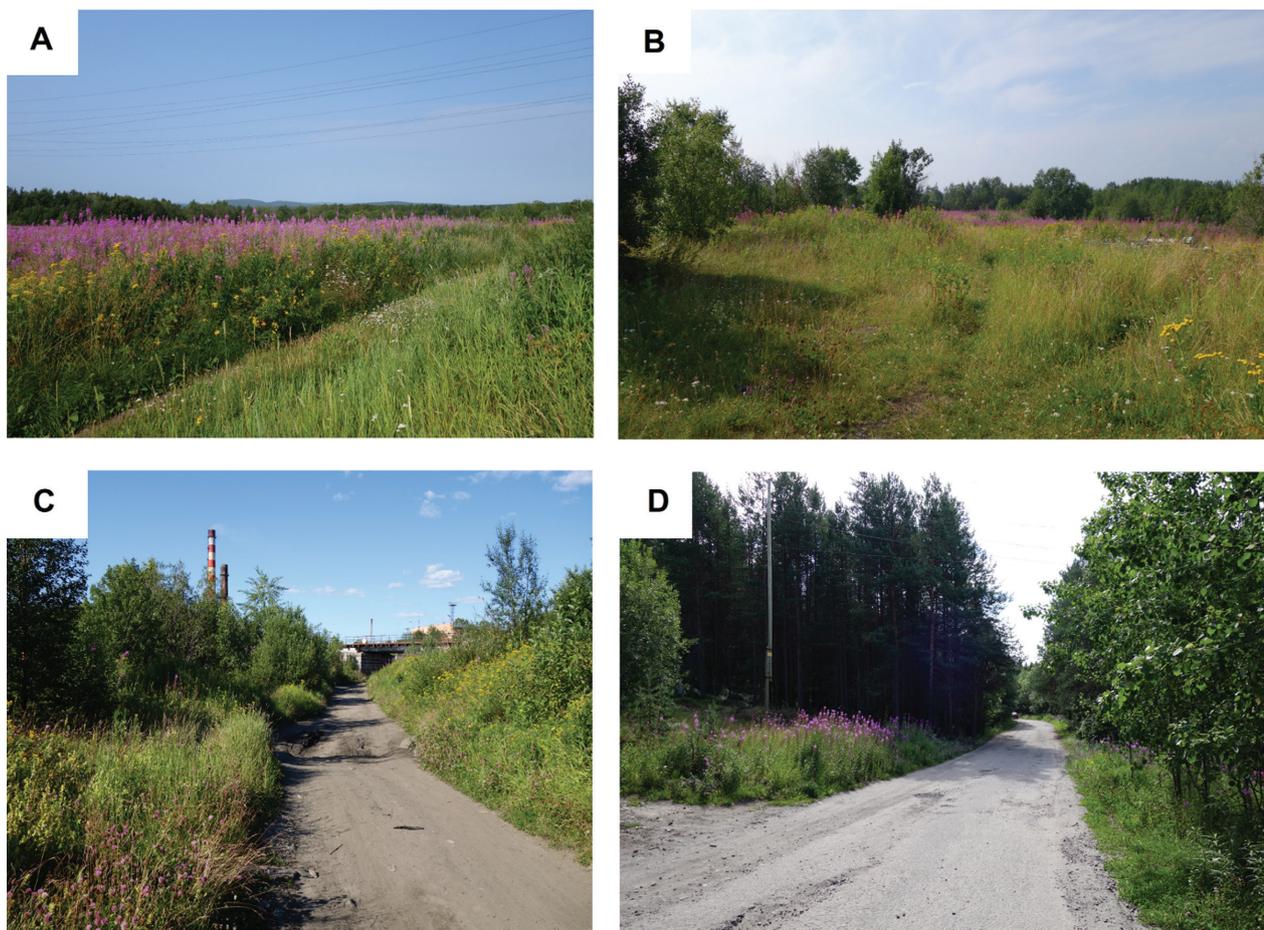


Fig. 1. The typical foraging habitats for bumblebees in the outskirts of Kandalaksha. (A) Ruderal communities with *Epilobium angustifolium* L. (B) Meadow-like habitats. (C) Roadsides in the town. (D) Roadsides alongside the forest. Photos: GS Potapov

These data are important in connection with the forecasts of changes in the species range of bumblebee species under conditions of global warming (Rasmont et al. 2015). The territories of Northern Europe are especially interesting, because here we can observe the northwards expansion of a number of species.

The purpose of this paper is to analyse the local fauna of bumblebees in the southwestern part of the Kola Peninsula and to consider the studied species according to ecological group.

Materials and methods

Bumblebees were collected on the outskirts of the town of Kandalaksha (67°08'N; 32°25'E) on 29th of July 2012 and during the period 22–28th of July 2016. They were caught with an entomological net on transects (Pesenko 1972). We studied various types of habitat. The typical sites of concentration of bumblebee individuals are ruderal communities with *Epilobium angustifolium* L., meadow-like habitats, roadsides in the town and alongside the forest (Fig. 1). A total of 255 individuals were collected.

The specimens of bumblebees are deposited in the Russian Museum of the Biodiversity Hotspots (RMBH), Federal

Center for Integrated Arctic Research (FCIARctic), Russian Academy of Sciences (RAS), Arkhangelsk, Russia.

The nomenclature of species follows Williams (2018). The species of bumblebees were identified according to Løken (1973, 1984) and Panfilov (1978). Identification of species of the *Bombus lucorum* complex is according to Rasmont and Terzo (2010). We did not use DNA barcoding. The identification of these species only according to morphological characters is not always reliable (Bossert 2015), hence, for the present study we present in the species list *B. cf. cryptarum* (Fabricius, 1761) (Table 1). This species dominates the bumblebee communities in the north of Eastern Fennoscandia (Pamilo et al. 1997). To our knowledge, the probability of records of *B. lucorum* (Linnaeus, 1761) and *B. magnus* Vogt, 1911 on the Kola Peninsula, as a whole, is not very high.

Types of distribution of bumblebees are given according to the classification of Gorodkov (1984). We used the materials of Russian and European entomologists (Pekkarinen and Teräs 1993, Dolgin and Filippov 2012, Levchenko and Tomkovich 2014, Rasmont and Iserbyt 2018, and Williams 2018). Ecological groups of bumblebees are considered by using the data of Bolotov and Kolosova (2006), and Potapov (2015).

The plant species are given according to The Plant List (2013).

Results

According to the results of the present study for 2012 and 2016, 13 species were found in the study area. Paukkunen and Kozlov (2015) record only 6 species for the outskirts of Kandalaksha and the adjacent areas, i.e., *B. pascuorum* (Scopoli, 1763), *B. jonellus* (Kirby, 1802), *B. sporadicus* Nylander, 1848, *B. cingulatus* Wahlberg, 1854, *B. lapponicus* (Fabricius, 1793), and *B. balteatus* Dahlbom, 1832. The last 3 species were not found during our research, hence, the total number of species in the local fauna is 16 (Table 1).

Most of the species in the local fauna are Transpalaeartic (11 species), three species are Holarctic, one of each are West-Central Palaeartic and European, respectively. Concerning the zonal distribution, 6 species are temperate, 4 species are arcto-temperate, and 2 species of each are arcto-temperate, boreal and boreal-montane, respectively.

Discussion

The basis of the local fauna of bumblebees in the outskirts of Kandalaksha is species, which are widely distributed in Eurasia. This indicates a low specificity of the studied local fauna. This is not surprising, if we consider the origin of the bumblebee fauna in the northern part of Fennoscandia. Bumblebees in this territory are young immigrants and they invaded into this region after the last glaciation in Northern Europe (Løken 1973).

Among the species of the present study, the recent record for this region is *B. wurflenii* (Potapov et al. 2018).

Table 1. Local fauna of bumblebees in the outskirts of Kandalaksha

№	Species	Type of distribution	
		Hol	Te
1	<i>Bombus</i> (<i>Subterraneobombus</i>) <i>distinguendus</i> Morawitz, 1869	Hol	Te
2	<i>B. (Megabombus) hortorum</i> (Linnaeus, 1761)	Tp	Te
3	<i>B. (Thoracobombus) veteranus</i> (Fabricius, 1793)	Tp	Te
4	<i>B. (Th.) pascuorum</i> (Scopoli, 1763)	Tp	Te
5	<i>B. (Psithyrus) bohemicus</i> Seidl, 1837	Tp	At
6	<i>B. (Ps.) flavidus</i> Eversmann, 1852	Tp	Bm
7	<i>B. (Ps.) norvegicus</i> (Sparre-Schneider, 1918)	Tp	Te
8	<i>B. (Pyrobombus) lapponicus</i> (Fabricius, 1793)	Tp	Ab
9	<i>B. (Pr.) hypnorum</i> (Linnaeus, 1758)	Tp	Te
10	<i>B. (Pr.) pratorum</i> (Linnaeus, 1761)	W-Cp	At
11	<i>B. (Pr.) jonellus</i> (Kirby, 1802)	Hol	At
12	<i>B. (Pr.) cingulatus</i> Wahlberg, 1854	Tp	Bo
13	<i>B. (Alpinobombus) balteatus</i> Dahlbom, 1832	Tp	Ab
14	<i>B. (Bombus) sporadicus</i> Nylander, 1848	Tp	Bo
15	<i>B. (Bo.) cf. cryptarum</i> (Fabricius, 1761)	Hol	At
16	<i>B. (Alpigenobombus) wurflenii</i> Radoszkowski, 1860	Eu	Bm

Notes: Hol – Holarctic, Tp – Transpalaeartic, W-Cp – West-Central-Palaeartic, Eu – European, Ab – arcto-boreal, At – arcto-temperate, Bo – boreal, Bm – boreo-montane, Te – temperate.

This species is typical for the mountain regions of Europe, i.e., Scandinavia, Central Europe, northern Spain, the Balkans, the Caucasus and northern Turkey (Løken 1973, Reinig and Rasmont 1988, Rasmont and Iserbyt 2018). One old record is known of *B. wurflenii* from the North of Finland which, according to some authors is doubtful (Söderman and Leinonen 2003, Rasmont and Iserbyt 2018). In Russia, this species was known in the south part of the Urals and the Northern Caucasus (Reinig and Rasmont 1988, Panfilov and Berezin 2001, Popov 2006, Rasmont and Iserbyt 2018). In the European North of Russia, *B. wurflenii* was not previously registered, including in the Murmansk Region. Before 2016, the nearest confirmed locality was northern Sweden (Reinig and Rasmont 1988).

We assume that this record of *B. wurflenii* in the Murmansk Region is due to the recent appearance of this species in the region (Potapov et al. 2018). One of the possible reasons for expanding the range of this species, which adapted to the mountain regions, is climate change (Potapov et al. 2018). For example, in northern Norway, *B. wurflenii* is currently recorded “200 km north of its 1973 limits” (Martinet et al. 2015). For this reason, the expansion of *B. wurflenii* through northern Finland to the Murmansk Region is also quite possible along mountain ecosystems (Potapov et al. 2018). Moreover, according to models of changes in the range of bumblebees up to the middle of the 21st century, the Kola Peninsula and its adjacent areas are considered to be the future area for *B. wurflenii* (Rasmont et al. 2015).

Attention should be paid to the presence in the local fauna of *B. distinguendus* and *B. veteranus*. These species belong to the group of meadow species, concerning their habitat preference (Bolotov and Kolosova 2006). According to Paukkunen and Kozlov (2015), *B. distinguendus* and *B. veteranus* have already been recorded in the southern part of the Murmansk Region and *B. veteranus* has probably only recently appeared in the Kola Peninsula.

These species are not common for native taiga, in general. Their presence in the local fauna is due to the presence of anthropogenic meadow habitats in the study area. Similar patterns, expressed by the increase in a number of meadow species of bumblebee in the taiga landscapes of the European North of Russia, were previously summarized for the region (Potapov 2015).

Among the tundra species, only *B. lapponicus* and *B. balteatus* are recorded near Kandalaksha. Two species in the local fauna belong to the group of forest species (*B. pratorum* and *B. cingulatus*), and the others species are ubiquitous.

Conclusion

The local fauna of bumblebees in the outskirts of Kandalaksha is typical for the southern part of the Kola Peninsula and adjacent areas. The species are widely presented and are typical for the northern taiga. A regional trait

is expressed by the presence in the local fauna of tundra species and *B. wurflenii*, which is common to the mountain ecosystems of Europe.

Further studies of bumblebees in the southwest of the Kola Peninsula and adjacent areas should be focussed on the distribution of *B. wurflenii*.

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