Article

Fauna and ecological features of ants (Hymenoptera, Formicidae) in the southeast of the Crimean Peninsula

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Abstract. The faunistic data is presented for the ants (Hymenoptera, Formicidae) sampled in 2019–2020 in the southeast of Crimea. In total, 28 species belonging to 16 genera and 4 subfamilies have been collected and identified. Fourteen species are new records for the Karadag Nature Reserve, and *Lasius bicornis* (Foerster, 1850) is recorded for the first time for the fauna of the Crimean Peninsula.

Keywords: Ponerinae, Dolichoderinae, Formicinae, Myrmicinae, Karadag Nature Reserve, State Nature Reserve “Mountain Range Tepe-Oba”, Malaise traps, Merike traps.

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Introduction

Southeastern Crimea locates along the Black Sea coastline between the towns Sudak and Feodosia. In 1947, it has been included into the list of the protected areas (PA); in 1979, a Karadag Nature Reserve (old name), or State Nature Reserve “Karadagsky” (recent name), has been established. Since 2018, this area belongs to PA of federal significance (Russia). It is a rocky massif of the Jurassic period, about 150–160 million years old. Two landscape zones cover the most of its territory, steppes and shrub woodlands and forests. The main forest-forming species are Bene (*Pistacia atlantica* subsp. *mutica*), downy oak (*Quercus pubescens*), and Crimean pine (*Pinus nigra* subsp. *pallasiana*). The maximum absolute height

is 577 m above sea level. The total area of Karadag Nature Reserve is 2874.2 hectares, the overland part of the reserve is 2065.1 hectares (Didukh and Shelyag-Sosonko, 1982).

State Nature Reserve “Mountain Range Tepe-Oba” (maximum height 302 m above sea level) is another PA of regional significance of the Republic of Crimea; it covers 1200.0 hectares, locating approximately 15 km eastwards off the Karadag Nature Reserve, in vicinity of Feodosia town. There are both steppe and forest pine areas on the territory of this mountainous PA (Ena et al., 2004).

The family Formicidae includes more than 13800 species worldwide, belonging to 338 genera and 17 extant subfamilies (Bolton, 2021). The ant

fauna of Russia includes 44 genera comprising about 264 species (Dubovikoff and Yusupov, 2017). About almost half of them live in Crimea, 18 species of ants are known from Karadag region and Crimea Mountains (Ivanov and Stukalyuk, 2007; Stukalyuk and Radchenko, 2011).

The study aims to identify the species composition and distribution of ants at Karadag and at adjacent territories.

Materials and methods

During the study of entomological collections for May and September 2019–2020, 465 specimens of ants were analyzed and identified to 28 species from 16 genera. The insects were collected with ten Merike and three Malaise traps (Fig. 1), which were set at six sites: N 44°56'23.79" E 35°14'11.11", N 44°54'47.57" E 35°12'02.38", and N 44°54'46.70", E 35°11'59.42" (Karadag Nature Reserve); N 45°01'18.72" E 35°24'11.49" and N 45°00'29.02" E 35°22'56.63" (Mountain Range Tepe-Oba); N 44°54'57.00" E 35°11'09.96" (the coast of the drying mountain Otuzka River in the Otuz Valley, near the Karadag Nature Reserve) (Figs. 1, 2).

The material was identified by Z.M. Yusupov, the collection of material and its preliminary taxonomic sorting was carried out by K.I. Shorenko. The ants were determined down to the species level by taxonomic keys (Radchenko, 2016). The occurrence of species was calculated according to the equation:

$$D = (k / K) \times 100\%,$$

where k is the number of individuals of particular species, and K is the total number of individuals of all collected species. The dominant species (occurrence of 15% or more in collections) are considered *widespread species*, *common species* comprised 5% to 15%, *relatively rare species* contributed less than 5%.

Results and discussion

Annotated list of species of ants in the southeastern Crimea

An annotated list of examined species is provided.

Legend: ♀ – female, ♂ – male, w – worker specimen, Ms – Malaise traps, Mk – Merike traps. Dates are given as dd.mm.yyyy.

Subfamily Ponerinae Lepeletier de Saint-Fargeau, 1835

Ponera coarctata (Latreille, 1802)

Karadag Nature Reserve, 1 ♀, 7.06.–14.06.2019 (Ms), 1 ♂, 21.08.–28.08.2019 (Ms), 1 ♂, 26.09.–2.10.2019 (Ms).

Subfamily Dolichoderinae Forel, 1878

Bothriomyrmex communista Santschi, 1919

Karadag Nature Reserve, 1 ♀, 14.08.–20.08.2019 (Ms).

Bothriomyrmex corsicus Santschi, 1923

Karadag Nature Reserve, 1 ♀, 1 ♂, 8.07.–9.07.2020 (Mk).

Tapinoma erraticum (Latreille, 1798)

Karadag Nature Reserve, 2 ♂, 10.05.–20.05.2019 (Ms), 1 w, 2 ♂, 20.05.–31.05.2019 (Ms), 1 w, 31.05.–7.06.2019 (Ms), 1 w, 1 ♀, 7.06.–14.06.2019 (Ms), 9 w, 14.06.–21.06.2019 (Ms), 28 w, 1 ergatoginna, 14.06.–21.06.2019 (Ms), 2 w, 7.06.–9.06.2020 (Mk), 2 w, 7.06.–9.06.2020 (Mk), 1 w, 7.06.–14.06.2020 (Ms), 1 w, 21.06.–23.06.2020 (Mk), 1 w, 5.07.–6.07.2020 (Mk). Mountain Range Tepe-Oba, 1 w, 17.06.–18.06.2020 (Mk), 1 w, 23.06.–24.06.2020 (Mk), 14 w, 14.07.–16.07.2020 (Mk). Otuz Valley, 1 w, 21.06.–23.06.2020 (Mk).

Subfamily Formicinae Latreille, 1809

Camponotus aethiops (Latreille, 1798)

Karadag Nature Reserve, 3 w, 24.04.–1.05.2019 (Ms), 4 w, 10.05.–20.05.2019 (Ms), 2 w, 20.05.–31.05.2019 (Ms), 6 w, 31.05.–7.06.2019 (Ms), 9 w, 7.06.–14.06.2019 (Ms), 1 ♀, 21.06.–25.06.2019 (Ms), 1 ♂, 25.06.–28.06.2019 (Ms), 2 w, 5.08.–14.08.2019 (Ms), 12 w, 14.05.–21.05.2020 (Ms), 1 w, 14.05.–21.05.2020 (Ms), 3 w, 7.06.–14.06.2020 (Ms), 2 w, 8.07.–9.07.2020 (Mk). Mountain Range Tepe-Oba, 3 w, 25.06.–27.06.2020 (Mk).

Camponotus fallax (Nylander, 1856)

Karadag Nature Reserve, 1 w, 28.05.–4.06.2020 (Ms), 1 w, 4.06.–12.06.2020 (Ms).

Camponotus lateralis (Olivier 1792)

Otuz Valley, 1 w, 13.07.–16.07.2020 (Mk).

Camponotus piceus (Leach, 1825)

Karadag Nature Reserve, 1 w, 2 ♂, 10.05.–20.05.2019 (Ms), 3 w, 20.05.–31.05.2019 (Ms), 2 w, 31.05.–7.06.2019 (Ms), 1 w, 7.06.–14.06.2019 (Ms), 1 w, 14.08.–20.08.2019 (Ms), 6 w, 7.06.–9.06.2020 (Mk), 1 w, 7.06.–14.06.2020 (Ms). Mountain Range Tepe-Oba, 1 w, 25.06.–27.06.2020 (Mk), 2 w, 13.07.–16.07.2020 (Mk). Otuz Valley, 3 w, 19.06.–20.06.2020 (Mk), 3 w, 4.07.–7.07.2020 (Mk), 7 w, 13.07.–16.07.2020 (Mk).

Cataglyphis aenescens (Nylander, 1849)

Karadag Nature Reserve, 4 w, 20.05.–31.05.2019 (Ms).

Colobopsis truncata (Spinola, 1808)

Karadag Nature Reserve, 1 ♂, 28.06.–2.07.2019 (Ms).

Formica cinerea Mayr, 1853

Otuz Valley, 1 w, 4.07.–7.07.2020 (Mk).

Formica cunicularia Latreille, 1798

Karadag Nature Reserve, 1 w, 1.05.–10.05.2019 (Ms), 2 w, 31.05.–7.06.2019 (Ms), 5 w, 14.05.–21.05.2020 (Ms), 2 w, 21.06.–23.06.2020 (Mk), 1 w, 8.07.–9.07.2020 (Mk), 3 w 13.07.–16.07.2020 (Mk). Otuz valley, 1 w, 19.06.–20.06.2020 (Mk), 2 w, 4.07.–7.07.2020 (Merike trap), 3 w 13.07.–16.07.2020 (Mk).

Fig. 1. Sampling sites of collecting the ants (Formicidae). **A, B** – Mountain Range Tepe-Oba (Feodosia), **C** – Karadag Nature Reserve, **D** – Malaise trap installed in the Karadag Nature Reserve, **E** – Merke trap installed in the biological station.

***Formica gagates* Latreille, 1798**

Karadag Nature Reserve, 32 w, 24.04.–1.05.2019 (Ms), 2 w, 1.05.–10.05.2019 (Ms), 29 w, 10.05.–20.05.2019 (Ms), 11 w, 31.05.–7.06.2019 (Ms), 9 w, 7.06.–14.06.2019 (Ms), 1 w, 25.06.–28.06.2019 (Ms), 12 w, 14.05.–21.05.2020 (Ms), 1 w, 14.05.–21.05.2020 (Ms), 3 w, 28.05.–4.06.2020 (Ms), 3 w, 4.06.–12.06.2020 (Ms).

***Lasius bicornis* (Foerster, 1850)**

Karadag Nature Reserve, 1 ♀, 14.05.–21.05.2020 (Ms).

Distribution. Europe, Caucasus, Transcaucasia [Radchenko, 2016; Vankerkhoven et al., 2018].

***Lasius neglectus* Van Loon, Boomsma et Andrasfalvy, 1990**

Karadag Nature Reserve, 6 w, 10.05.–20.05.2019 (Ms), 4 w, 31.05.–7.06.2019 (Ms), 2 w, 7.06.–14.06.2019 (Ms), 1 w, 14.06.–21.06.2019 (Ms). Otuz Valley, 1 w, 21.06.–23.06.2020 (Mk).

***Lasius paralienus* Seifert, 1992**

Karadag Nature Reserve, 2 w, 8.07.–9.07.2020 (Mk), 3 w, 13.07.–16.07.2020 (Mk). Mountain Range Tepe-Oba, 13 w, 25.06.–27.06.2020 (Mk). Otuz Valley, 3 w, 13.07.–16.07.2020 (Mk).

Subfamily Myrmicinae Lepeletier de Saint-Fargeau, 1835***Anergates atratulus* (Schenck, 1852)**

Karadag Nature Reserve, 1 ♀, 15.07.–22.07.2019 (Ms).

***Aphaenogaster subterranea* (Latreille, 1798)**

Karadag Nature Reserve, 1 w, 4.06.–12.06.2020 (Ms).

***Crematogaster schmidtii* (Mayr, 1853)**

Karadag Nature Reserve, 1 w, 28.05.–4.06.2020 (Ms), 1 w, 4.06.–12.06.2020 (Ms).

***Messor structor* (Latreille, 1798)**

Karadag Nature Reserve, 1 ♀, 24.04.–1.05.2019 (Ms).

***Myrmica bergi* Ruzsky, 1902**

Karadag Nature Reserve, 2 ♀, 11.09.–18.09.2019 (Ms). Mountain Range Tepe-Oba, 1 w, 21.06.–22.06.2020 (Mk).

***Myrmica speciosides* Bondroit, 1918**

Karadag Nature Reserve, 2 w, 31.05.–7.06.2019 (Ms), 1 w, 7.06.–14.06.2019 (Ms), 25 w, 8.07.–9.07.2020 (Mk). Mountain Range Tepe-Oba, 1 w, 17.06.–18.06.2020 (Mk), 1 w, 19.06.–20.06.2020 (Mk), 13 w, 13.07.–16.07.2020 (Mk). Otuz Valley, 1 w, 19.06.–20.06.2020 (Mk), 28 w, 13.07.–16.07.2020 (Mk), 4 w, 15.07.–18.07.2020 (Mk).

***Solenopsis fugax* (Latreille, 1798)**

Karadag Nature Reserve, 3 ♀, 4.09.–11.09.2019 (Ms).

***Temnothorax tauricus* (Ruzsky, 1902)**

Karadag Nature Reserve, 2 w, 17–19.06.2020 (Mk).

***Temnothorax tuberum* (Fabricius, 1775)**

Karadag Nature Reserve, 2 w, 10.05.–20.05.2019 (Ms), 4 w, 8.07.–9.07.2020 (Mk).

***Temnothorax unifasciatus* (Latreille, 1798)**

Karadag Nature Reserve, 1 w, 7.06.–14.06.2019 (Ms).

***Tetramorium caespitum* (Linnaeus, 1758)**

Karadag Nature Reserve, 1 w, 21–23.06.2020 (Mk).

***Tetramorium chefketi* Forel, 1911**

Otuz Valley, 1 w, 4.07.–7.07.2020 (Mk). Mountain Range Tepe-Oba, 1 w, 17.06.–18.06.2020 (Mk).

Occurrence and distribution of species

In our opinion, stationary traps allow to assess reliably the occurrence of some Formicidae species in the study area. Here, we use conditional classification of ant species (three categories):

1. widespread species (*Formica gagates*, *Tapinoma erraticum*, and *Myrmica speciosides*);

2. common species (*Camponotus aethiops*, *Camponotus piceus*, *Formica cunicularia*, and *Lasius paralienus*);

3. relatively rare species (*Anergates atratulus*, *Aphaenogaster subterranea*, *Bothriomyrmex communista*, *Bothriomyrmex corsicus*, *Camponotus fallax*, *Camponotus lateralis*, *Colobopsis truncata*, *Cataglyphis aenescens*, *Crematogaster schmidtii*, *Formica cinerea*, *Lasius bicornis*, *Lasius neglectus*, *Messor structor*, *Myrmica bergi*, *Ponera coarctata*, *Solenopsis fugax*, *Temnothorax tauricus*, *Temnothorax tuberum*, *Temnothorax unifasciatus*, *Tetramorium caespitum*, and *Tetramorium chefketi*).

The data on the distribution of other species of ants from Karadag Nature Reserve (*Lasius brunneus* (Latreille, 1798), *Lasius flavus* (Fabricius, 1782), *Plagiolepis tauricus* Santschi, 1920 (= *Plagiolepis pallescens* Forel, 1889), *Temnothorax parvulus* (Schenck, 1852) (this record most likely belongs to another species – *Temnothorax crasecundus* Seifert et Csösz, 2015), *Tetramorium hungaricum* Rösler, 1935) are known in accordance to Ivanov and Stukalyuk (2007), Wagner et al. (2017). Therefore, the ant fauna of the Karadag Nature Reserve currently includes 33 species belonging to 17 genera and 4 subfamilies.

Species found within the present study in steppe and shrubs woodlands (altitude up to 250–300 m above sea level) are *Anergates atratulus*, *Bothriomyrmex communista*, *Bothriomyrmex corsicus*, *Colobopsis truncata*, *Cataglyphis aenescens*, *Camponotus aethiops*, *Camponotus lateralis*, *Camponotus piceus*, *Formica cinerea*, *Formica cunicularia*, *Formica gagates*, *Lasius bicornis*, *Lasius neglectus*, *Lasius paralienus*, *Myrmica speciosides*, *Messor structor*, *Myrmica bergi*, *Ponera coarctata*, *Solenopsis fugax*,

Fig. 2. Sampling sites (Malaise and Merike traps) in the Karadag Nature Reserve in 2019–2020 (Google Earth, open access). 1, 2, 3, 6 – Karadag Nature Reserve; 4, 5 – Mountain Range Tepe-Oba (Feodosia).

Tapinoma erraticum, *Temnothorax tauricus*, *Temnothorax tuberum*, *Temnothorax unifasciatus*, *Tetramorium caespitum*, and *Tetramorium chefketi*.

The species found in the woodlands (altitude 300–500 m above sea level) are *Aphaenogaster subterranea*, *Camponotus aethiops*, *Camponotus fallax*, *Crematogaster schmidtii*, and *Formica gagates*.

Conclusions

In total, 28 species from 16 genera of ants were found at the territory of Karadag, Otuz Valley, and the Mountain Range Tepe-Oba in May and September 2019–2020. The species *Anergates atratulus*, *Aphaenogaster subterranea*, *Bothriomyrmex communista*, *Bothriomyrmex corsicus*, *Camponotus fallax*,

Formica cinerea, *Lasius bicornis*, *Lasius neglectus*, *Myrmica bergi*, *Myrmica speciosoides*, *Ponera coarctata*, *Solenopsis fugax*, *Temnothorax unifasciatus*, and *Tetramorium chefketi* were first recorded for the fauna of the Karadag Nature Reserve. The species *Lasius bicornis* (Foerster, 1850) is new both to the fauna of Crimea and of the Karadag Nature Reserve. Information about myrmecofauna of the Mountain Range Tepe-Oba is presented for the first time.

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