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Taxonomy & Inventories

An updated checklist of ants (Hymenoptera, Formicidae) of Bulgaria, after 130 years of research

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Abstract

Background

The Bulgarian myrmecofauna is one of the richest in the Balkans. This is a result of both the physicogeographical and paleoecological features of the area, as well as relatively well-studied fauna. The earliest myrmecological paper on Bulgarian fauna, listing 54 species, was published 130 years ago. The publication was later followed by numerous new faunistic records and three comprehensive reviews that significantly widened knowledge on the ant diversity from this country. The most recent checklist was released 12 years ago and considered 163 ant species from 40 genera.

New information

This work provides an updated checklist of 195 ant species from 43 genera occurring in Bulgaria. Since the last Bulgarian catalogue of ants, 44 species have been added, while 24 species have been synonymised or excluded after critical analysis of the last taxonomic

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revisions. Additionally, we discuss the status and distribution of 12 species described from Bulgaria, 23 species considered endemic and subendemic for this country, 19 species with conservation status and four non-native species.

Keywords

the Balkans, conservation, endemic species, exotic species, inventory, myrmecofauna

Introduction

Bulgaria is amongst the Balkan countries with the richest ant fauna. There are several factors that favour the existence of more than 190 ant species. The country is located in the south-eastern part of the Balkan Peninsula, considered as an important hotspot of biodiversity in Europe, with 96 types of habitats referring to three biogeographical regions – Black Sea, Continental and Alpine (European Environment Agency 2022). The Balkans act as a connecting corridor between Europe and Asia. Due to its geographic location and paleoecological events, two major zoogeographical complexes can be distinguished – northern (Holarctic-Eurosiberian) complex of cold-tolerant species and southern (Mediterranean-Central Asian) complex of thermophilic species (Hubenov 2008). The latter one includes a limited number of steppe elements (NW and NE Bulgaria), Anatolian and Iranian migrants (SE Bulgaria) and Pontian elements (eastern Bulgaria). In addition, the Bulgarian fauna includes a number of endemic and subendemic species and few exotic species. The high number of ant species (in comparison with other Balkan countries) is also due to the numerous studies on the Bulgarian myrmecofauna conducted in the last decade (see below).

The earliest paper on the myrmecofauna of Bulgaria was published 130 years ago, when Auguste Forel (1848–1931), a Swiss myrmecologist, recorded 54 ant species from various regions of the country and described three species as new to science (Forel 1892). Later, three other comprehensive reviews of the ant fauna in Bulgaria, made by Agosti and Collingwood (1987), Atanassov and Dlusskij (1992) and Lapeva-Gjonova et al. (2010), enriched knowledge on biodiversity of this country. In the list of the Balkan ants, Agosti and Collingwood (1987), based on literature and collection data, reported 112 species for Bulgaria. Exactly 100 years after the publication of the first paper on the ants of Bulgaria, Atanassov and Dlusskij (1992) presented data on the taxonomy, distribution and ecology of 111 ant species from 36 genera and four subfamilies, with identification keys to all taxa. The most recent review of 163 ant species from 40 genera (Lapeva-Gjonova et al. 2010) was prepared mainly based on published records and updated taxonomic status of taxa listed in papers preceding its publication.

Since the publication of the most recent catalogue, 44 more species have been added to the list. Some of them are new faunistic findings for the country, while others are new species mentioned for Bulgaria in taxonomic works covering also the Balkan myrmecofauna (e.g. Seifert 2012, Csősz et al. 2014, Csősz et al. 2015, Seifert and Csősz

2015, Seifert 2016, Seifert and Galkowski 2016, Wagner et al. 2017, Csősz et al. 2018, Steiner et al. 2018, Bračko et al. 2019, Seifert 2020). The high species diversity in the Balkan Peninsula is of considerable importance and has great conservation value as recognised by its hotspot status (Hewitt 2011). In recent years, the most significant progress in the study of the Balkan ant fauna has been made on Greek ants. Data on over 300 species (Salata and Borowiec 2018a), including their distribution and ecology, have been established. Additionally, a number of taxonomic revisions on specific groups of species and genera have been carried out. Important additions to the regional ant fauna of the Balkans were also made for Slovenia, Montenegro and the Republic of North Macedonia (Bračko et al. 2014a, Bračko et al. 2014b, Bračko et al. 2016).

The updated list of Bulgarian ants in the present study brings together the scattered information from numerous taxonomic and faunistic publications, justifies exclusion of some dubious and erroneous records and highlights the importance of such inventories for assessment and conservation of biological diversity.

Materials and methods

The current checklist is based on the available taxonomic and faunistic literature concerning the Bulgarian myrmecofauna. Publications since the last Bulgarian catalogue of ants (Lapeva-Gjonova et al. 2010) till recently are considered. We make critical reviews on the taxonomic data on some species.

The genera in the list are arranged by subfamilies and tribes. The species are listed alphabetically and by subgenera (if available) as their actual names are generally agreed with the Online catalogue of the ants of the world by Bolton (2022) and the most recent publications. The changes in taxon names proposed by Ward et al. (2015) for social parasitic genera *Anergates*, *Chalepoxenus*, *Myrmoxenus* and *Teleutomyrmex* were not taken into account, based on ongoing discussions and arguments to maintain stability in names (Seifert et al. 2016, Kiran et al. 2017). The excluded species from the last catalogue and subsequent articles are justified by relevant studies. The following abbreviations for the conservation status according to the IUCN Red List of Threatened Species (IUCN 2022), if any, have been used: Vulnerable (VU), Near Threatened (NT), Lower Risk (LR), Least Concern (LC) and Bulgarian Biodiversity Act (BBA). In the Notes section after the current species name, only the very first report for Bulgaria is given and if the species is endemic or subendemic.

Checklist of the ants of Bulgaria

Subfamily Amblyoponinae

Tribe Amblyoponini

***Stigmatomma denticulatum* Roger, 1859**

Notes: Forel (1892)

***Stigmatomma impressifrons* Emery, 1869**

Notes: Atanassov and Dlusskij (1992)

Subfamily Dolichoderinae

Tribe Bothriomyrmecini

***Bothriomyrmex communista* Santschi, 1919**

Notes: Atanassov (1964)

***Bothriomyrmex corsicus* Santschi, 1923**

Notes: Vassilev (1984)

Tribe Dolichoderini

***Dolichoderus quadripunctatus* (Linnaeus, 1771)**

Notes: Forel (1892)

Tribe Leptomyrmecini

***Linepithema humile* (Mayr, 1868)**

Notes: Atanassov and Dlusskij (1992)

Tribe Tapinomini

***Liometopum microcephalum* (Panzer, 1798)**

Notes: Forel (1892)

Tapinoma erraticum (Latreille, 1798)

Notes: Forel (1892)

Tapinoma subboreale Seifert, 2012

Notes: Forel (1892)

Subfamily Formicinae

Tribe Camponotini

Camponotus (*Camponotus*) *herculeanus* (Linnaeus, 1758)

Notes: Forel (1892)

Camponotus (*Camponotus*) *ligniperda* (Latreille, 1802)

Notes: Forel (1892)

Camponotus (*Camponotus*) *vagus* (Scopoli, 1763)

Notes: Forel (1892)

Camponotus (*Myrmentoma*) *aegaeus* Emery, 1915

Notes: Lapeva-Gjonova (2011); a Balkan-Anatolian subendemic.

Camponotus (*Myrmentoma*) *atricolor* (Nylander, 1849)

Notes: Forel (1892)

Camponotus (*Myrmentoma*) *dalmaticus* (Nylander, 1849)

Notes: Forel (1892)

Camponotus (*Myrmentoma*) *fallax* (Nylander, 1856)

Notes: Atanassov (1934)

Camponotus (*Myrmentoma*) *gestroi* Emery, 1878

Notes: Lapeva-Gjonova (2011)

Camponotus (*Myrmentoma*) *lateralis* (Olivier, 1792)

Notes: Forel (1892)

Camponotus (*Myrmentoma*) *piceus* (Leach, 1825)

Notes: Forel (1892)

Camponotus (*Myrmentoma*) *tergestinus* Müller, 1921

Notes: Lapeva-Gjonova and Kiran (2012)

Camponotus (*Tanaemyrmex*) *aethiops* (Latreille, 1798)

Notes: Forel (1892)

Camponotus (*Tanaemyrmex*) *ionius* Emery, 1920

Notes: Atanassov (1964); a Balkan-Anatolian subendemic.

Camponotus (*Tanaemyrmex*) *oertzeni* Forel, 1889

Notes: Lapeva-Gjonova and Santamaria (2011)

Camponotus (*Tanaemyrmex*) *samius* Forel, 1889

Notes: Atanassov (1964); a Balkan-Anatolian subendemic.

Camponotus (*Tanaemyrmex*) *universitatis* Forel, 1890

Conservation status: Vu D2

Notes: Lapeva-Gjonova and Kiran (2012)

Colobopsis truncata (Spinola, 1808)

Notes: Forel (1892)

Tribe Formicini

Cataglyphis aenescens (Nylander, 1849)

Notes: Forel (1892)

Cataglyphis nodus (Brullé, 1833)

Notes: Forel (1892)

Cataglyphis viaticoides (André, 1881)

Notes: Atanassov (1982)

Formica (*Coptoformica*) *exsecta* Nylander, 1846

Notes: Emery (1914)

Formica (*Coptoformica*) *pressilabris* Nylander, 1846

Notes: Atanassov (1934)

Formica (*Formica*) *aquilonia* Yarrow, 1955

Conservation status: LR/NT, Corine (Annex 4)

Notes: Wesselinoff (1973)

Formica (*Formica*) *lugubris* Zetterstedt, 1838

Conservation status: LR/NT, Corine (Annex 4)

Notes: Otto et al. (1962)

Formica (*Formica*) *polyctena* Förster, 1850

Conservation status: LR/NT, Corine (Annex 4)

Notes: Wesselinoff (1973)

Formica (*Formica*) *pratensis* Retzius, 1783

Conservation status: LR/NT, Corine (Annex 4)

Notes: Forel (1892)

Formica (*Formica*) *rufa* Linnaeus, 1761

Conservation status: LR/NT, Corine (Annex 4), BBA (2002) Annexes 2 and 3

Notes: Forel (1892)

Formica (*Formica*) *truncorum* Fabricius, 1804

Conservation status: Corine (Annex 4)

Notes: Wesselinoff (1973)

Formica (*Raptiformica*) *sanguinea* Latreille, 1798

Notes: Forel (1892)

Formica (*Serviformica*) *cinerea* Mayr, 1853

Notes: Forel (1892)

Formica (*Serviformica*) *clara* Forel, 1886

Notes: Barrett (1970)

Formica (*Serviformica*) *cunicularia* Latreille, 1798

Notes: Forel (1892)

Formica (*Serviformica*) *fusca* Linnaeus, 1758

Notes: Forel (1892)

Formica (*Serviformica*) *gagates* Latreille, 1798

Notes: Forel (1892)

Formica (*Serviformica*) *lemani* Bondroit, 1917

Notes: Atanassov (1936)

Formica (*Serviformica*) *picea* Nylander, 1846

Notes: Atanassov and Dlusskij (1992)

Formica (*Serviformica*) *glauca* Ruzsky, 1896

Notes: Atanassov and Vasileva (1976)

Formica (*Serviformica*) *rufibarbis* Fabricius, 1793

Notes: Forel (1892)

Polyergus rufescens (Latreille, 1798)

Notes: Forel (1892)

Proformica kobachidzei K. Arnoldi, 1968

Notes: Atanassov and Dlusskij (1992); a Ponto-Caucasian subendemic.

Proformica korbi (Emery, 1909)

Notes: Dlussky (1969); a Balkan-Anatolian subendemic.

Proformica pilosiscapa Dlussky, 1969

Notes: Dlussky (1969), paratype locality

Proformica striaticeps (Forel, 1911)

Notes: Forel (1892); a Balkan-Anatolian subendemic.

Tribe Lasiini

Lasius (*Austrolasius*) *carniolicus* Mayr, 1861

Notes: Atanassov and Dlusskij (1992)

Lasius (*Austrolasius*) *reginae* Faber, 1967

Conservation status: Vu A2c

Notes: Lapeva-Gjonova and Borowiec (2022)

Lasius (*Cautolasius*) *flavus* (Fabricius, 1782)

Notes: Atanassov (1934)

Lasius (*Cautolasius*) *myops* Forel, 1894

Notes: Atanassov (1952)

Lasius (*Chthonolasius*) *balcanicus* Seifert, 1988

Notes: Seifert (1988a), type locality

***Lasius* (*Chthonolasius*) *bicornis* (Förster, 1850)**

Notes: Atanassov (1964)

***Lasius* (*Chthonolasius*) *citrinus* Emery, 1922**

Notes: Seifert (1988a)

***Lasius* (*Chthonolasius*) *distinguendus* (Emery, 1916)**

Notes: Vassilev (1984)

***Lasius* (*Chthonolasius*) *jensi* Seifert, 1982**

Notes: Seifert (1988a)

***Lasius* (*Chthonolasius*) *meridionalis* (Bondroit, 1920)**

Notes: Agosti and Collingwood (1987)

***Lasius* (*Chthonolasius*) *mixtus* (Nylander, 1846)**

Notes: Emery (1914)

***Lasius* (*Chthonolasius*) *nitidigaster* Seifert, 1996**

Notes: Agosti and Collingwood (1987) (as *L. rabaudi*), type locality

***Lasius* (*Chthonolasius*) *umbratus* (Nylander, 1846)**

Notes: Forel (1892)

***Lasius* (*Dendrolasius*) *fuliginosus* (Latreille, 1798)**

Notes: Forel (1892)

***Lasius* (*Lasius*) *alienus* (Förster, 1850)**

Notes: Forel (1892)

***Lasius* (*Lasius*) *bombycina* Seifert & Galkowski, 2016**

Notes: Seifert and Galkowski (2016)

***Lasius* (*Lasius*) *brunneus* (Latreille, 1798)**

Notes: Forel (1892)

***Lasius* (*Lasius*) *emarginatus* (Olivier, 1792)**

Notes: Atanassov (1964)

***Lasius* (*Lasius*) *illyricus* Zimmermann, 1935**

Notes: Seifert (2000)

***Lasius* (*Lasius*) *neglectus* Van Loon, Boomsma & Andrasfalvy, 1990**

Notes: Seifert (1992)

***Lasius* (*Lasius*) *niger* (Linnaeus, 1758)**

Notes: Forel (1892)

***Lasius* (*Lasius*) *paralienus* Seifert, 1992**

Notes: Seifert (1992)

***Lasius* (*Lasius*) *platythorax* Seifert, 1991**

Notes: Antonova and Penev (2006)

***Lasius* (*Lasius*) *psammophilus* Seifert, 1992**

Notes: Antonova and Penev (2006)

Tribe Plagiolepidini

***Lepisiota frauenfeldi* (Mayr, 1855)**

Notes: Atanassov (1936)

***Lepisiota nigra* (Dalla Torre, 1893)**

Notes: Agosti and Collingwood (1987)

***Plagiolepis pallescens* Forel, 1889**

Notes: Atanassov (1964)

Plagiolepis pygmaea (Latreille, 1798)

Notes: Forel (1892)

Plagiolepis xene Stärcke, 1936

Notes: Lapeva-Gjonova and Borowiec (2022)

Prenolepis nitens (Mayr, 1853)

Notes: Atanassov (1936)

Subfamily Myrmicinae

Tribe Attini

Pheidole balcanica Seifert, 2016

Notes: Seifert (2016); a Balkan-Anatolian subendemic.

Pheidole pallidula (Nylander, 1849)

Notes: Forel (1892)

Strumigenys argiola (Emery, 1869)

Notes: Lapeva-Gjonova and Ljubomirov (2020)

Strumigenys baudueri (Emery, 1875)

Notes: Bezděčka and Bezděčková (2009)

Strumigenys tenuipilis Emery, 1915

Notes: Lapeva-Gjonova and Ljubomirov (2020)

Tribe Crematogastrini

Anergates atratulus (Schenck, 1852)

Conservation status: Vu D2

Notes: Atanassov and Dlusskij (1992)

Cardiocondyla bulgarica Forel, 1892

Notes: Forel (1892), type locality; a Balkan-Anatolian subendemic.

Cardiocondyla dalmatica Soudek, 1925

Notes: Seifert (2003); a Balkan endemic.

Cardiocondyla nigra Forel, 1905

Notes: Agosti and Collingwood (1987)

Cardiocondyla stambuloffii Forel, 1892

Notes: Forel (1892), type locality

Chalepoxenus muellerianus (Finzi, 1922)

Conservation status: Vu D2

Notes: Buschinger and Douwes (1993)

Crematogaster gordani Karaman, 2008

Notes: Borowiec (2014); a Balkan endemic.

Crematogaster ionia Forel, 1911

Notes: Lapeva-Gjonova and Borowiec (2022)

Crematogaster lorteti Forel, 1910

Notes: Lapeva-Gjonova (2011)

Crematogaster schmidti (Mayr, 1853)

Notes: Forel (1892)

Crematogaster scutellaris (Olivier, 1792)

Notes: Agosti and Collingwood (1987)

Crematogaster sordidula (Nylander, 1849)

Notes: Forel (1892)

***Formicoxenus nitidulus* (Nylander, 1846)**

Conservation status: Vu A2c

Notes: Atanassov (1936)

***Harpagoxenus sublaevis* (Nylander, 1849)**

Conservation status: Vu A2c

Notes: Antonova (2009)

***Leptothorax acervorum* (Fabricius, 1793)**

Notes: Forel (1892)

***Leptothorax muscorum* (Nylander, 1846)**

Notes: Atanassov (1952)

***Myrmecina graminicola* (Latreille, 1802)**

Notes: Forel (1895)

***Myrmoxenus gordiagini* Ruzsky, 1902**

Conservation status: Vu D2

Notes: Buschinger and Douwes (1993)

***Myrmoxenus kraussei* (Emery, 1915)**

Conservation status: Vu D2

Notes: Ljubomirov (2019)

***Myrmoxenus ravouxi* (André, 1896)**

Conservation status: Vu D2

Notes: Buschinger and Douwes (1993)

***Strongylognathus afer* Emery, 1884**

Conservation status: Vu D2

Notes: Lapeva-Gjonova and Radchenko (2021)

Strongylognathus bulgaricus Pisarski, 1966

Notes: Viehmeyer (1922), type locality; a Bulgarian endemic.

Strongylognathus huberi subsp. *dalmaticus* Baroni Urbani, 1969

Notes: Lapeva-Gjonova and Radchenko (2021)

Strongylognathus italicus Finzi, 1924

Conservation status: Vu D2

Notes: Lapeva-Gjonova and Radchenko (2021)

Strongylognathus karawajewi Pisarski, 1966

Conservation status: Vu D2

Notes: Lapeva-Gjonova and Radchenko (2021)

Strongylognathus testaceus (Schenck, 1852)

Notes: Atanassov (1964)

Teleutomyrmex buschingeri Lapeva-Gjonova, 2017

Notes: Kiran et al. (2017), type locality; a Bulgarian endemic.

Temnothorax aeolius (Forel, 1911)

Notes: Lapeva-Gjonova and Borowiec (2022)

Temnothorax affinis (Mayr, 1855)

Notes: Forel (1892)

Temnothorax bulgaricus (Forel, 1892)

Notes: Forel (1892)

Temnothorax cf. *exilis* (Emery, 1869)

Notes: Lapeva-Gjonova and Borowiec (2022)

Temnothorax cf. *korbi* (Emery, 1924)

Notes: Lapeva-Gjonova et al. (2010)

Temnothorax clypeatus (Mayr, 1853)

Notes: Atanassov (1964)

Temnothorax corticalis (Schenck, 1852)

Notes: Atanassov (1964)

Temnothorax crasecundus (Seifert & Csősz, 2015)

Notes: Seifert and Csősz (2015)

Temnothorax crassispinus (Karavaiev, 1926)

Notes: Seifert (1995)

Temnothorax finzii (Menozzi, 1925)

Notes: Lapeva-Gjonova and Borowiec (2022)

Temnothorax flavicornis (Emery, 1870)

Notes: Lapeva-Gjonova et al. (2014)

Temnothorax graecus (Forel, 1911)

Notes: Lapeva-Gjonova et al. (2010); a Balkan-Anatolian subendemic.

Temnothorax helenae Csősz, Heinze & Mikó, 2015

Notes: Csősz et al. (2015); a Balkan endemic.

Temnothorax interruptus (Schenck, 1852)

Notes: Atanassov and Dlusskij (1992)

Temnothorax lichtensteini (Bondroit, 1918)

Notes: Csősz et al. (2014)

Temnothorax nadigi (Kutter, 1925)

Notes: Czechowska et al. (1998)

Temnothorax nigriceps (Mayr, 1855)

Notes: Agosti and Collingwood (1987)

Temnothorax parvulus (Schenck, 1852)

Notes: Forel (1892)

Temnothorax recedens (Nylander, 1856)

Conservation status: LR/LC

Notes: Forel (1892)

Temnothorax rogeri Emery, 1869

Notes: Lapeva-Gjonova and Borowiec (2022); a Balkan endemic.

Temnothorax semiruber (André, 1881)

Notes: Forel (1892)

Temnothorax sordidulus (Müller, 1923)

Notes: Seifert (2006)

Temnothorax strymonensis Csősz et al. 2018

Notes: Csősz et al. (2018), type locality; a Balkan-Anatolian subendemic.

Temnothorax tauricus Ruzsky, 1902

Notes: Radchenko (1994)

Temnothorax tergestinus (Finzi, 1928)

Notes: Csősz et al. (2015)

Temnothorax tuberum (Fabricius, 1775)

Notes: Forel (1892)

Temnothorax unifasciatus (Latreille, 1798)

Notes: Forel (1892)

Tetramorium caespitum (Linnaeus, 1758)

Notes: Forel (1892)

Tetramorium cf. *punicum* (Smith, 1861)

Notes: Lapeva-Gjonova and Borowiec (2022)

Tetramorium chefketi Forel, 1911

Notes: Atanassov (1952)

Tetramorium diomedeum Emery, 1908

Notes: Csősz and Schulz (2010)

Tetramorium ferox Ruzsky, 1903

Notes: Atanassov and Vasileva (1976)

Tetramorium hungaricum Röszler, 1935

Notes: Atanassov (1936)

Tetramorium immigrans Santschi, 1927

Notes: Wagner et al. (2017)

Tetramorium impurum (Förster, 1850)

Notes: Wagner et al. (2017)

Tetramorium indocile Santschi, 1927

Notes: Kiran et al. (2017)

Tetramorium moravicum Kratochvil, 1941

Notes: Steiner et al. (2005)

Tetramorium staerckei Kratochvíl, 1944

Notes: Wagner et al. (2017)

Tribe Myrmicini

***Manica rubida* (Latreille, 1802)**

Notes: Forel (1892)

***Myrmica constricta* Karavaiev, 1934**

Notes: Seifert et al. (2009)

***Myrmica curvithorax* Bondroit, 1920**

Notes: Sadil (1952)

***Myrmica gallienii* Bondroit, 1920**

Notes: Vassilev (1984)

***Myrmica hellenica* Finzi, 1926**

Notes: Seifert (1988b)

***Myrmica lobicornis* Nylander, 1846**

Notes: Forel (1892)

***Myrmica lonae* Finzi, 1926**

Notes: Seifert (2000)

***Myrmica rubra* (Linnaeus, 1758)**

Notes: Forel (1892)

***Myrmica ruginodis* Nylander, 1846**

Notes: Forel (1892)

***Myrmica rugulosa* Nylander, 1849**

Notes: Forel (1892)

***Myrmica sabuleti* Meinert, 1861**

Notes: Atanassov (1952)

Myrmica scabrinodis Nylander, 1846

Notes: Forel (1892)

Myrmica schencki Viereck, 1903

Notes: Atanassov (1952)

Myrmica specioides Bondroit, 1918

Notes: Atanassov and Vasileva (1976)

Myrmica sulcinodis Nylander, 1846

Notes: Forel (1892)

Myrmica vandeli Bondroit, 1920

Notes: Stankiewicz and Antonova (2005)

Tribe Solenopsidini

Monomorium monomorium Bolton, 1987

Notes: Lapeva-Gjonova and Borowiec (2022)

Monomorium pharaonis (Linnaeus, 1758)

Notes: Atanassov (1965)

Solenopsis fugax (Latreille, 1798)

Notes: Forel (1892)

Tribe Stenammini

Aphaenogaster epirotes (Emery, 1895)

Notes: Atanassov and Dlusskij (1992)

Aphaenogaster festae Emery, 1915

Notes: Borowiec et al. (2019); a Balkan-Anatolian subendemic.

Aphaenogaster illyrica Bračko et al., 2019

Notes: Bračko et al. (2019), paratype locality; a Balkan endemic.

Aphaenogaster radchenkoi Kiran, Aktaç & Tezcan, 2008

Notes: Borowiec et al. (2019); a Balkan-Anatolian subendemic.

Aphaenogaster subterranea (Latreille, 1798)

Notes: Forel (1892)

Aphaenogaster subterraneoides Emery, 1881

Notes: Borowiec et al. (2019)

Messor atanassovii Atanassov, 1982

Notes: Atanassov (1982), type locality; a Balkan endemic. Apart from Bulgaria, it is also found in Greek Thrace (L. Borowiec, pers. comm.).

Messor hellenius Agosti & Collingwood, 1987

Notes: Lapeva-Gjonova and Borowiec (2022); a Balkan-Anatolian subendemic.

Messor ibericus Santschi, 1925

Notes: Steiner et al. (2018)

Messor mcarthuri Steiner et al., 2018

Notes: Lapeva-Gjonova and Borowiec (2022); a Balkan-Anatolian subendemic.

Messor oertzeni Forel, 1910

Notes: Atanassov (1934); a Balkan-Anatolian subendemic.

Messor ponticus Steiner et al., 2018

Notes: Steiner et al. (2018), type locality

Messor structor (Latreille, 1798)

Notes: Forel (1892)

***Messor wasmanni* Krausse, 1910**

Notes: Atanassov (1936)

***Oxyopomyrmex krueperi* Forel, 1911**

Notes: Lapeva-Gjonova and Kiran (2012)

***Stenamma debile* (Förster, 1850)**

Notes: Emery (1914)

***Stenamma striatulum* Emery, 1895**

Notes: Lapeva-Gjonova and Kiran (2012)

Subfamily Ponerinae

Tribe Ponerini

***Cryptopone ochracea* (Mayr, 1855)**

Notes: Atanassov and Dlusskij (1992)

***Hypoponera eduardi* (Forel, 1894)**

Notes: Atanassov and Dlusskij (1992)

***Hypoponera punctatissima* (Roger, 1859)**

Notes: Atanassov (1936)

***Ponera coarctata* (Latreille, 1802)**

Notes: Emery (1914)

***Ponera testacea* Emery, 1895**

Notes: Csősz and Seifert (2003)

Subfamily Proceratiinae

Tribe Proceratiini

Proceratium melinum (Roger, 1860)

Notes: Forel (1895)

Proceratium numidicum Santschi, 1912

Notes: Agosti and Collingwood (1987)

Discussion

The current checklist contains 195 species of ants from Bulgaria belonging to six subfamilies and 43 genera. This places Bulgaria amongst the European countries with the highest richness of ant species after Greece (315), Spain (275), Italy (267) and France (215), despite its significantly smaller area (Janicki et al. 2016, Guénard et al. 2017, Salata and Borowiec 2018a,Schifani 2022).

The distribution of species by subfamilies and genera is typical of European myrmecofauna. The richest in genera and species is the subfamily Myrmicinae, containing 23 genera and 106 species, followed by the subfamily Formicinae with 10 genera and 73 species. Thus, the two subfamilies represent 92% of the myrmecofauna in Bulgaria. The most speciose ant genera are *Temnothorax* (Myrmicinae) and *Lasius* (Formicinae) with 27 and 24 species, respectively. More than 10 species are also represented by *Formica* (18), *Camponotus* (16), *Myrmica* (15) and *Tetramorium* (11). Out of all the 43 genera, 26 contain one or two species only.

In this study, records for 24 previously reported species have been re-assessed following taxonomic revisions or reconsideration of available material. The list of excluded species from the current list with remarks and references is given in Table 1.

Table 1.

Ant species excluded from the list of Bulgaria.

Excluded species (by subfamilies)	**Remarks and references**
Dolichoderinae	
Bothriomyrmex gibbus Soudek, 1925	a junior synonym of *Bothriomyrmex corsicus* Santschi, 1923 (Seifert 2012)
Bothriomyrmex menozzii Emery, 1925	a junior synonym of *Bothriomyrmex corsicus* Santschi, 1923 (Seifert 2012)

Excluded species (by subfamilies)	**Remarks and references**
Bothriomyrmex meridionalis (Roger, 1863)	occurs in Western Europe (France, Spain) (Seifert 2012)
Formicinae	
Camponotus sanctus Forel, 1904	known from Afghanistan, Cyprus, Greece (Aegean Islands, Dodecanese), Iran, Israel, Lebanon, Syria and Turkey (Borowiec and Salata 2020)
Camponotus pilicornis (Roger, 1859)	distributed in the Iberian Peninsula and France; the records from Bulgaria are based on misidentification and refer to *Camponotus oertzeni* Forel, 1889 (Lapeva-Gjonova and Borowiec 2022)
Camponotus sylvaticus (Olivier, 1792)	the records from Bulgaria (Vassilev and Evtimov 1973) probably are based on misidentification (Borowiec 2014)
Cataglyphis livida bulgarica Atanassov, 1982	a junior synonym of *Cataglyphis viaticoides* (André, 1881) (Salata et al. 2021b)
Cataglyphis bicolor rufiventris Emery, 1925	a junior synonym of *Cataglyphis nodus* (Brullé, 1833) (Borowiec and Salata 2013)
Proformica nasuta (Nylander, 1856)	a Western Mediterranean species as the records from Bulgaria (Atanassov 1934, Atanassov 1936) are based on misidentifications (Borowiec 2014)
Plagiolepis taurica Santschi, 1920	a junior synonym of *Plagiolepis pallescens* Forel, 1889 (Salata et al. 2018a)
Myrmicinae	
Aphaenogaster gibbosa (Latreille, 1798)	distributed only in the western part of the Mediterranean Basin (Salata and Borowiec 2018b)
Aphaenogaster pallida (Nylander, 1849)	distributed only in the western part of the Mediterranean Basin (Salata and Borowiec 2018b)
Messor barbarus (Linnaeus, 1767)	found only in the Western Palaearctic (Borowiec 2014)
Messor caducus (Motschoulsky, 1839)	restricted to Armenia, Georgia, Iran, Kazakhstan and Turkey (Khalili-Moghadam et al. 2019)
Messor capitatus (Latreille, 1798)	a western Mediterranean species and it is likely that data from the Balkans refer to *M. hellenius* Agosti & Collingwood, 1987 (Salata and Borowiec 2019)
Messor concolor Santschi, 1927	most likely endemic to Crete (Salata and Borowiec 2019

Excluded species (by subfamilies)	**Remarks and references**
Crematogaster auberti Emery, 1869	known from the north-western and western Mediterranean regions; its records from Bulgaria (Lapeva-Gjonova 2011) should be assigned to *C. lorteti* Forel, 1910 (Lapeva-Gjonova and Borowiec 2022)
Crematogaster scutellaris (Olivier, 1792)	so far, confirmed findings from the western Mediterranean to the Western Balkans (Croatia) (Borowiec and Salata 2017)
Temnothorax melanocephalus (Emery, 1870)	a junior synonym of *Temnothorax tuberum* (Fabricius, 1775) (Casevitz-Weulersse 1990)
Temnothorax nylanderi (Förster, 1850)	known from Central and West Europe: Italy, Austria, Germany and further west; only two species from *Temnothorax nylanderi* species-complex occur in Bulgaria – *T. crasecundus* Seifert & Csősz 2014 and *T. crassispinus* (Karavaiev, 1926) (Csősz et al. 2015)
Temnothorax saxonicus (Seifert, 1995)	a junior synonym of *Temnothorax tergestinus* (Finzi, 1928) Csősz et al. 2015)
Cardiocondyla elegans Emery, 1869	a western Mediterranean species; data from the Balkans refer to *Cardiocondyla dalmatica* Soudek, 1925 (Seifert 2018)
Strongylognathus kratochvili Silhavy, 1937	restricted to Czech Republic and Slovakia; *Strongylognathus bulgaricus* Pisarski, 1966 is revived from synonymy with *S. kratochvili* (Lapeva-Gjonova and Radchenko 2021)

Due to lack of their exact locality in Bulgaria, four species, namely *Lepisiota nigra* (Dalla Torre, 1893), *Temnothorax nigriceps* (Mayr, 1855), *Cardiocondyla nigra* Forel, 1905 and *Proceratium numidicum* Santschi, 1912 (Agosti and Collingwood 1987), seem of doubtful occurrence and their confirmation is needed.

Ant specimens from Bulgaria have been used as holotypes and paratypes for 12 species. Descriptions of three species (*Cardiocondyla bulgarica* Forel, 1892, *C. stambuloffii* Forel, 1892 and *Temnothorax bulgaricus* (Forel, 1892)), still valid today, were already present in the first publication on the ants of Bulgaria from 130 years ago (Forel 1892). Two other species (*Strongylognathus bulgaricus* Pisarski, 1966 and *Teleutomyrmex buschingeri* Lapeva-Gjonova, 2017) have not yet been reported outside Bulgaria, despite the high probability that they can be found elsewhere in the Balkans.

The Bulgarian myrmecofauna includes 23 endemic and subendemic species, which constitute nearly 12% of all registered ant species in the country. These species are distributed in the two large subfamilies, namely - 17 from Myrmicinae and six from Formicinae. The largest number of species with limited distribution are members of the genera *Messor* (4), *Temnothorax* (4), *Aphaenogaster* (3), *Cardiocondyla* (3), *Camponotus* (3) and *Proformica* (3). Endemics are represented by two species found only in Bulgaria and six species restricted to the Balkans. Both Bulgarian endemics (*Strongylognathus bulgaricus* and *Teleutomyrmex buschingeri*) are permanent social parasites that are

usually extremely rare, although their ant hosts can be common. All six Balkan endemics have records of occurrence only in the southern parts of Bulgaria, where the sub-Mediterranean climatic influence is the strongest. The subendemics are a wider group that includes 14 species distributed over a restricted territory in the Balkan Peninsula and North-West Asia Minor (Balkan-Anatolian species) and one Ponto-Caucasian species.

The presence of rare species and those of great importance for the environment determines the high conservation importance of the ants found in the territory of Bulgaria. In total, 19 ant species have conservation status. Almost all of them (18) are included in the IUCN Red List of Threatened Species (IUCN 2022) and nine are categorised as Vulnerable D2, three as Vulnerable A2c, five as Lower Risk/Near Threatened and one (*Temnothorax recedens*) as Lower Risk/Least Concern. The red wood ants are included both in Annex 4 of CORINE biotopes (2000) checklist and in the IUCN Red List (except for *Formica truncorum*, which is absent from the latter). Additionally, *Formica rufa* is listed in Annexes 2 and 3 of the Bulgarian Biodiversity Act (2002) as protected on the entire Bulgarian territory. The vulnerable species are not currently endangered, but are in a high risk of endangerment in the near future due to threats to natural habitats, declining population, restriction in their area of occupancy or the number of locations. A recently published monitoring of the red wood ants in Bulgaria discussed the status of some of their populations (Antonova and Marinov 2021). However, further research is needed to study in more detail their population dynamics and threats.

An up-to-date assessment of the conservation status of the regional myrmecofauna is needed to reflect both status and taxonomic changes. Thus, potential candidates, such as *Strongylognathus bulgaricus*, *S. huberi dalmaticus* and *Teleutomyrmex buschingeri*, remain off the list for now.

So far, the presence of exotic ant species in Bulgaria is relatively low. These are four species - *Linepithema humile*, *Lasius neglectus*, *Monomorium pharaonis* and *Hypoponera punctatissima*. All of them are introduced, synanthrope species as *L. humile* and *M. pharaonis* are known only indoors and from greenhouses, while *H. punctatissima* may be found also outdoors in southern parts of Bulgaria (Atanassov and Dlusskij 1992). *Lasius neglectus* is an invasive urban species, but recently, its colonies have been declining in the country (Tartally et al. 2016).

Ant research in Bulgaria dates back to 1892, has continued with variable intensity over the decades and has resulted in 195 species at present (Fig. 1). After Forel's foundational paper with 54 species, more crucial progress in Bulgarian ant research occurred after World War II and with the work of Neno Atanasov. After the 1980s, a number of foreign scientists also contributed to the progress in myrmecological studies. During the last decade, important taxonomic revisions (which included materials from Bulgaria), as well as more intensive research in the southern territories of the country, led to a significant increase in the number of known species in Bulgaria, including descriptions of new ones. However, the number is expected to increase with upcoming surveys and taxonomic revisions.

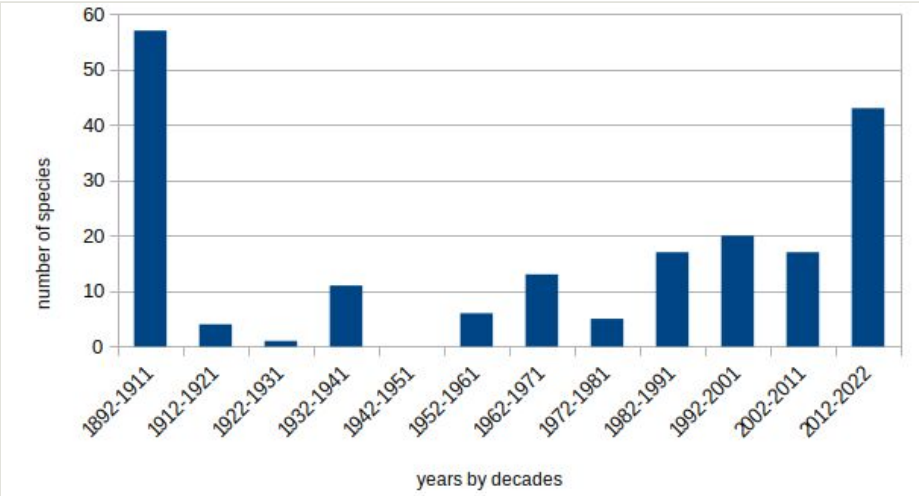

Figure 1. doi

Number of newly-reported ant species from Bulgaria by decades (only currently valid species are considered).

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