

New investigation and a revised checklist of the ants (Hymenoptera: Formicidae) of the Republic of Macedonia

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Abstract. The Balkan Peninsula harbours perhaps the richest but least investigated ant fauna of Europe. The Republic of Macedonia is especially poorly investigated. In 2010 we sampled ants from 19 sites in south-eastern and central part of the country, applying four different collection methods. We identified a total of 80 species, 32 of which are firstly recorded for Macedonia, i.e. *Hypoponera eduardi*, *Aphaenogaster epirotes*, *A. finzii*, *A. splendida*, *A. subterraneoides*, *Myrmica curvithorax*, *M. hellenica*, *M. lonae*, *Temnothorax bulgaricus*, *T. exilis*, *T. finzii*, *T. graecus*, *T. near interruptus*, *T. near parvulus*, *T. recedens*, *T. semiruber*, *T. unifasciatus*, *Tetramorium near hippocrate*, *T. hungaricum*, *T. moravicum*, *T. sp. D*, *T. sp. E*, *T. sp. F*, *Bothriomyrmex communis*, *Camponotus aegaeus*, *C. atricolor*, *C. gestroi*, *C. ionius*, *Lasius balcanicus* or *L. distinguendus*, *L. platythorax*, *Plagiolepis taurica*, *P. xene*. A revised checklist of the 99 ant species thus far documented for the country is presented, based on our collected material and the critical analysis of the available literature of the Macedonian ant fauna.

Key words: ants, Balkan Peninsula, Republic of Macedonia, checklist, faunistics.

Introduction

Even though the European ant fauna is relatively well known, in certain parts of the continent this insect group is still insufficiently investigated. This is true for the Balkan Peninsula, especially its southern part. The Republic of Macedonia, located in the south-central part of the Balkan Peninsula, is one of European least investigated countries in relation to its ant fauna. There were only a few published studies on Macedonian ants so far.

Doflein (1920, 1921) provided the first studies on Macedonian ants, focusing primarily on the biology and ecology of the genus *Messor*. He mentioned 33 ant species from different parts of current territory of the Republic of Macedonia. Santschi (1926) presented a list of ants collected in the Greece region of Macedonia and in the southern part of the current Republic of Macedonia. As a part of former Yugoslavia, the territory of the Republic of Macedonia was also included in the studies of the ant fauna by Agosti & Collingwood (1987) and Petrov & Collingwood (1992). However, these authors omitted the details of the sites where the species were collected. The scarcity of ant studies in the Republic of Macedonia contin-

ues after the declaration of its independence in 1991. Petrov (1994) reported 28 ant species, most of them were from Dojran. Karaman (2000-2001, 2002) presented investigations of the myrmecofauna of the Demir Kapija area. Based on previously published papers on Macedonian ants, Karaman (2009) listed 78 species for the country. Beside these publications, individual records of Macedonian ants can be found in Maidl (1921), Vogrin (1955), Gösswald et al. (1965), Harkness (1977), Markó & Csósz (2002), Seifert (2003), Csósz & Markó (2005), Csósz et al. (2007) and Wagner (2012).

In the Fauna Europaea website, 120 ant species and subspecies are listed for "Macedonia" (Radchenko 2012). However, the list is largely incorrect, since it is based on the literature sources which are not referring to the territory of the Republic of Macedonia, but presumably to Croatia, Montenegro and/or Greek Macedonia. Moreover, the list has not been updated for many years, therefore the data concerning Macedonia should be ignored (A. Radchenko, pers. comm. 2012). Some authors have recently used the data for Macedonia from this list. Lapeva-Gjonova (2011) mentions *Crematogaster auberti savinae* for Mace-

donia, but the species has not been recorded in this country so far. In the checklist of Greek ants (Borowiec & Salata 2012), Macedonia is mentioned as a part of the general distribution of many ant species and 108 species are assigned to this country. These data were actually obtained from the lists of Karaman (2009) and Fauna Europaea (L. Borowiec, pers. comm. 2012). The latter must be treated as incorrect.

The Republic of Macedonia is located in the south-central part of the Balkan Peninsula. It is a predominantly mountainous country that is cut by many depressions and valleys. The mountains belong to two main ranges, the Šar Mountains in the west and the Rhodope Mountains in the east (Bertić 1987). The climate in Macedonia is characterized by the mixed influences of mild Mediterranean climate from the south, i.e. from the Aegean Sea, and continental climate from the north, resulting in cold and wet winters and dry and hot summers. More distinct Mediterranean climate with hot, dry summers and mild winters is present only in the Vardar valley south of Veles gorge, the Strumica valley and Dojran Lake area (Urošević 1962, Bertić 1987). Two biogeographic regions can be distinguished in Macedonia: Continental and Alpine; and one subregion: Sub-Mediterranean (European Environment Agency 2010).

Since our field work was part of the Biology Students Research Camp held in Star Dojran in April 2010, our investigation focused on the ant fauna of the south-eastern and, to a lesser extent, the central part of the Republic of Macedonia. Based on the results of our sampling and the critical analysis of the available literature data, we compiled a revised checklist of ant species for the whole country.

Materials and methods

We sampled ants in the second half of April 2010 from several sites in the south-eastern and central part of the Republic of Macedonia (Table 1, Fig. 1).

Four different collection methods were applied: hand collecting, litter sifting, pitfall trapping, and baiting. At all sites we searched for ant nests and individual specimens on the ground, in leaf litter, under stones, in dead wood, and on tree trunks and twigs. At most sites where leaf litter was present, we collected the litter from several places on the ground and put it in the sifter with 1 × 1 cm wire mesh. The sifted material was placed on a white sheet and ants were collected. As pitfall traps we used 7 cm diameter plastic pots placed in the ground with propylene glycol as the killing agent. Ten traps were set 10 m apart

in one line in sites C, SD1 and SD5, and in two lines with 10 traps each in SD4. The traps were collected after four days at C, SD1 and SD5, and after three days at SD4. A few meters from each pitfall trap at SD4 and SD5, baits were placed, consisted of peanut butter on a small piece of paper, and left for one to two hours prior to gathering. All collected specimens were preserved in 70% EtOH.

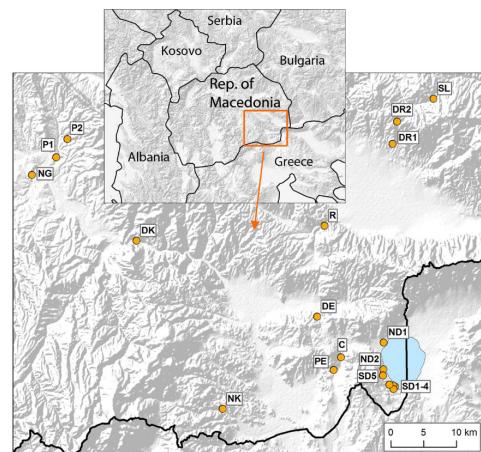


Figure 1. Sampling sites of ants in the Republic of Macedonia.

Most of the sampling sites were situated in the area with a more expressed Mediterranean climate (Urošević 1962). The climate can be characterized as Sub-Mediterranean or combined Sub-Mediterranean/ Continental (Bergant 2006). Biotopes at those sites were in most cases dry thermophilous shrublands and grasslands or open thermophilous forests. Mesic forests were sampled in NK (in part), C and R (in part). The sampling site SL differs from other observed areas for it is situated on a higher elevation of 1180 m a.s.l., and is covered mostly with mixed mountain forest.

The bulk of collected material was identified by the first author, samples of the *Tetramorium caespitum/impurum* complex were identified by the second and third author, other *Tetramorium* groups, *Lepisiota*, *Oxyopomyrmex*, *Temnothorax* and some *Aphaenogaster* by the third author, *Bothriomyrmex* and species of the subgenus *Chthonolasius* by B. Seifert, *Camponotus ionius* by K. Kiran, and *Messor cf. structor* by B. Markó. The identification of the ant species was conducted by comparing the original descriptions of some species, type material which were used for other studies, as well as using mostly newer taxonomic literature such as: Atanassov and Dlusskij (1992), Csősz & Markó (2004), Csősz et al. (2007), Csősz & Schulz (2010), Dlusskij (1969), Radchenko (1997), Radchenko & Elmes (2010), Seifert (2002, 2003, 2007), Seifert et al. (2009), Seifert & Schultz (2009) and Steiner et al. (2006).

The following references were used to assess the distribution of the listed species: Arakelian (1994), Arnoldi (1976), Baroni Urbani (1971), Borowiec & Salata (2012),

Table 1. Data on the ant sampling in the Republic of Macedonia (initials of the collectors: G.B. – Gregor Bračko, E.G. – Erika Gioahin, J.M. – Janja Matićić, A.T. – Ana Tratnik, H.C.W. – Herbert C. Wagner, T.K. – Tea Knapić).

Site abbreviation	Site	Coordinates, altitude	Date	Collectors	Collecting method
C	2 km SW of Crničani, Bogdanci	41°13.5'N, 22°38.1'E, 160 m	26.-30.04.2010	G.B., E.G., J.M., A.T., T.K.	hand collecting, litter sifting, pitfall trapping
DE	0,5 km SW of Dedeli, Valandovo	41°17.0'N, 22°35.9'E, 160 m	29.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting
DK	3 km E of Demir Kapija town	41°24.5'N, 22°17.0'E, 110 m	30.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting
DR1	1,5 km NW of Drvoš, Strumica	41°30.6'N, 22°45.8'E, 480 m	27.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting
DR2	4,5 km N of Drvoš, Strumica	41°32.4'N, 22°46.5'E, 920 m	27.04.2010	G.B., E.G., J.M., A.T.	hand collecting
ND1	around Campsite Acicot, 2,5 km NE of Nov Dojran	41°14.4'N, 22°42.9'E, 160 m	21.04.2010, 24.04.2010	H.C.W.	hand collecting
ND2	1 km S of Nov Dojran	41°12.2'N, 22°42.6'E, 160 m	23.04.2010	H.C.W.	hand collecting
NG	2,5 km N of Negotino	41°30.6'N, 22°6.2'E, 130 m	30.04.2010	G.B., E.G., J.M., A.T.	hand collecting
NK	2,5 km NW of Novo Konjsko, Gevgelija	41°10.1'N, 22°24.8'E, 240 m	28.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting
P1	2 km NE of Pepelište, Negotino	41°31.9'N, 22°9.0'E, 180 m	30.04.2010	G.B., E.G., J.M., A.T.	hand collecting
P2	5,5 km NE of Pepelište, Negotino	41°33.3'N, 22°10.4'E, 270 m	30.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting
PE	near Palusko Ezero, Bogdanci	41°12.5'N, 22°37.2'E, 130 m	28.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting
R	2,5 km NE of Raborci, Strumica	41°24.4'N, 22°37.6'E, 320 m	27.04.2010	G.B., E.G., J.M., A.T.	hand collecting
SD1	around Campsite Partizan, Star Dojran	41°10.7'N, 22°43.7'E, 150 m	25.-30.04.2010	G.B., E.G., J.M., A.T., T.K.	hand collecting, pitfall trapping
SD2	Star Dojran	41°10.8'N, 22°43.5'E, 150 m	15.04.2010, 17.04.2010, 18.04.2010	H.C.W.	hand collecting
SD3	S of Star Dojran	41°10.5'N, 22°43.5'E, 210 m	20.04.2010, 22.04.2010	H.C.W.	hand collecting
SD4	W of Star Dojran	41°10.9'N, 22°43.1'E, 240 m	26.-29.04.2010	G.B., E.G., J.M., A.T., H.C.W.	hand collecting, litter sifting, pitfall trapping, baiting
SD5	1,5 km NW of Star Dojran	41°11.7'N, 22°42.5'E, 200 m	25.-29.04.2010	G.B., E.G., J.M., A.T.	hand collecting, litter sifting, pitfall trapping, baiting
SL	1,5 km NE of Suvi Laki, Ogražden Mountains	41°34.0'N, 22°50.7'E, 1180 m	27.04.2010	G.B., E.G., J.M., A.T.	hand collecting

Bračko (2006, 2007), Casevitz-Weulersse & Galkowski (2009), Csósz et al. (2007), Csósz & Schulz (2010), Csósz et al. (2011), Czechowski et al. (2012), Dlusskij et al. (1990), Gratiashvili & Barjadze (2008), Karaman (2011), Kiran & Karaman (2012), Lapeva-Gjonova et al. (2010), Lapeva-Gjonova & Santamaria (2011), Legakis (2011), Markó et al. (2006), Paknia et al. (2008), Petrov (2004), Poldi et al. (1995), Radchenko & Elmes (2010), Ruzsky (1905), Schlick-Steiner et al. (2006b), Schultz et al. (2006), Seifert (2007, 2012), Tarbinskij (1976), Vonshak & Ionescu-Hirsch (2009) and Werner & Weizik (2007).

Digital photographs of some collected specimens were taken with a table tripod and a Canon 60D with the MP-E65mm macro lens. The pictures were processed with the program CombineZM (<http://www.hadleyweb.pwp.blueyonder.co.uk>).

Results

List of ant species

We present the revised list of ant species known for the whole territory of the Republic of Macedonia, based on our collected material and published data. Some previously cited species are excluded from the list, since they have not been confirmed for the country after the taxonomic revisions, or the status of their name is unclear, or they are not likely to be found in this region, but at the same time we cannot verify their true identity. For this study, we did not validate the voucher specimens mentioned in older references (e.g. Doflein

1920, Santschi 1926) and we were not able to get the samples of the "problematic" species listed by Petrov (1994) and Karaman (2002).

The list contains the information on the sampling sites of the collected ants (sites abbreviations are explained in Table 1), the references of the published records, and the general distribution of the listed species. For some species, we give notes with additional information on the taxonomic status, ecology and distribution. New records for the country are marked with an asterisk (*), while (x) is used for the species which were already mentioned in the references, but under a different, currently unavailable, wrong or incomplete name.

Subfamily PONERINAE

Hypoponera eduardi (Forel, 1894) *

Sampling site: SD2.

Distribution: Mediterranean, Caucasus, known as tramp species.

Ponera coarctata (Latreille, 1802)

Reference: Maidl (1921), Karaman (2002).

Distribution: Central Europe, southern part of Eastern Europe, Mediterranean, Caucasus, Kopet Dag Mts.

Subfamily PROCERATIINAE

Proceratium melinum (Roger, 1860)

Reference: Karaman (2000-2001).

Distribution: eastern part of Central Europe, southern part of Eastern Europe, Mediterranean, Caucasus.

Subfamily MYRMICINAE

Aphaenogaster epirotes (Emery, 1895) * (Fig. 2)

Sampling site: DR1, ND2, SD4, SD5.

Distribution: Balkan Peninsula, Turkey.



Figure 2. A worker of *Aphaenogaster epirotes* from SD4 (photo by G. Kunz).

Aphaenogaster finzii Müller, 1921 *

Sampling site: DR1, SD4

Distribution: Balkan Peninsula.

Aphaenogaster gibbosa (Latreille, 1798)

Reference: Petrov (1994).

Distribution: Mediterranean, Caucasus, Iran, Kopet Dag Mts.

Aphaenogaster splendida (Roger, 1859) *

Sampling site: SD2, SD4.

Distribution: Mediterranean, Ukraine (Crimea), Caucasus.

Aphaenogaster subterranea (Latreille, 1798)

Sampling site: C, R.

Reference: Maidl (1921), Petrov (1994), Karaman (2002).

Distribution: Central and Southern Europe, Ukraine (Crimea), Turkey, Caucasus.

Aphaenogaster subterraneoides Emery, 1881 *

Sampling site: ND2, SD4, SD5.

Distribution: Balkan Peninsula, Ukraine (Crimea), Caucasus, Israel.

Cardiocondyla bulgarica Forel, 1892

Sampling site: SD1, SD4.

Reference: Seifert (2003).

Distribution: Southern Balkan Peninsula, Turkey (Anatolia).

Cardiocondyla elegans Emery, 1869

Sampling site: SD2.

Reference: Petrov (1994), Karaman (2002) [as *C. elegans* and *C. nigra*].

Distribution: Southern Europe, Hungary, Turkey, Caucasus, Israel, Egypt, Iran, Middle Asia, Kazakhstan.

Note: Karaman (2002) reported two workers of *C. elegans* in the nest of *C. nigra* Forel, 1905. According to Seifert (2003) *C. nigra* is not present on the Balkan Peninsula, but distributed in North Africa, Cyprus, and eastern Turkey. We presume *C. nigra* reported by Karaman was misidentified and in fact it was *C. elegans*.

Crematogaster schmidti (Mayr, 1853)

Sampling site: DE, DK, ND1, NK, P2, R, SD1, SD2, SD3, SD4, SD5.

Reference: Doflein (1920) [as *C. scutellaris schmidti*], Petrov (1994), Karaman (2002).

Distribution: north-eastern Italy, Balkan Peninsula, Hungary, Romania, Ukraine (Crimea), Turkey, Caucasus, Iran, Kopet Dag Mts.

Crematogaster sordidula (Nylander, 1849)

Sampling site: DE, DK, DR1, ND2, NG, NK, P2, SD2, SD4.

Reference: Doflein (1920) [as *C. sordidula* var. *flachi*], Karaman (2002) [as *C. sordidula mayri*].

Distribution: Mediterranean, Romania, Turkey, Caucasus, Middle Asia.

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

Reference: Karaman (2002), Markó & Csósz (2002).

Distribution: mountains of Central and Southern Europe (excluding Iberian Peninsula), Ukraine (Crimea), Turkey, Caucasus.

***Messor capitatus* (Latreille, 1798)**

Reference: Santschi (1926) [as *M. barbarus* v. *capitatus*], Vogrin (1955) [as *M. barbarus*], Petrov (1994), Karaman (2002).

Distribution: Southern Europe, north-western part of North Africa.

Note: The species was reported by Santschi (1926) from Bitola area, by Vogrin (1955) and Karaman (2002) from Demir Kapija, and by Petrov (1994) from Dojran, however we were not able to find it during our study. There is a possibility that some of these authors actually found the less hairy and sculptured form of lineage B of *M. cf. strutor* (see the note under this species), which was collected from several sites in Macedonia in this study. This form of lineage B of *M. cf. strutor* has already been misidentified as *M. capitatus* in some other occasions (B. Markó, pers. comm. 2012).

***Messor oertzeni* Forel, 1910**

Sampling site: ND1, P1, SD2, SD4.

Reference: Doflein (1920) [as *M. oertzeni* var. *amphigea*]

Distribution: Balkan Peninsula, Turkey.

***Messor cf. strutor* (Latreille, 1798)**

Sampling site: C, DR2, ND1, NG, NK, R, SD1, SD2, SD4, SD5.

Reference: Doflein (1920) [as *M. barbarus strutor* var. *mutica*], Santschi (1926) [as *M. strutor* v. *aegeus*], Karaman (2002) [as *M. strutor*].

Distribution: ?

Note: We use this name for our and the published Macedonian records of "Messor strutor". Schlick-Steiner et al. (2006a) showed that there are two clades (lineages A and B) of *Messor strutor* in Europe, but their status is still unclear. Within lineage B there are two morphologically more or less distinguishable forms that can be separated mostly by different head sculpture, shape of the anterior clypeal margin, and pilosity (B. Markó, pers. comm. 2012), however the two forms are not supported clearly by molecular studies at this moment (B.C. Schlick-Steiner, F.M. Steiner, pers. comm. 2012). We found both forms of lineage B during our sampling in Macedonia.

***Messor wasmanni* Krausse, 1911**

Sampling site: DE, ND2, P1, PE, SD1, SD2, SD3, SD4, SD5.

Reference: Doflein (1920) [as *M. barbarus meridionalis*], Santschi (1926) [as *M. instabilis* st. *semirufus meridionalis*], Petrov (1994) [as *M. caducus* and *M. wasmanni*], Karaman (2002) [as *M. caducus* and *M. wasmanni*], Wagner (2012).

Distribution: Italy, Corsica, Balkan Peninsula, Turkey.

Note: This species belongs to a taxonomically problematic group which includes several species names that are mentioned for Europe, e.g. *M. caducus* (Victor, 1839), *M. concolor* Santschi, 1927, *M. meridionalis* (André, 1883), *M. semirufus* (André, 1883), *M. wasmanni*. Our Macedonian samples do not show noticeable differences from *M. wasmanni* samples we have collected from its type locality in Asuni (central Sardinia). Since the type specimens of *M. wasmanni* are apparently lost, a neotype needs to be designated. We decided to keep the frequently used name *M. wasmanni*, but the situation needs to be clarified. We suppose that all the published Macedonian records of the mentioned *Messor* group belong to this species.

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

Sampling site: C, DR1, P2, R, SD4.

Reference: Karaman (2002).

Distribution: Europe, Turkey, Caucasus, Israel, north-western part of North Africa.

***Myrmica curvithorax* Bondroit, 1920 ***

Sampling site: ND1.

Distribution: Central and Eastern Europe, Balkan Peninsula, southern part of West Siberia, Kazakhstan, Altai Mts.

***Myrmica hellenica* Finzi, 1926 ***

Sampling site: R, SD1, SD2.

Distribution: Italy, Balkan Peninsula, Ukraine (Crimea), Turkey, Caucasus.

***Myrmica lonae* Finzi, 1926 ***

Sampling site: SL.

Distribution: Europe (excluding western part), Caucasus, southern part of West Siberia, Kazakhstan, Altai Mts.

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

Reference: Petrov (1994).

Distribution: Europe, Turkey, Caucasus, Middle Asia, Kazakhstan, Siberia.

***Myrmica ruginodis* Nylander, 1846**

Sampling site: SL.

Reference: Doflein (1920) [as *M. rubra rugino-*

dis]

Distribution: Transpalaearctic.

Myrmica schencki Viereck, 1903

Reference: Petrov (1994).

Distribution: Europe, Turkey, Caucasus, southern part of West Siberia, Kazakhstan, Tien-Shan, Altai Mts.

Oxyopomyrmex krueperi Forel, 1911 x

Sampling site: SD4.

Reference: Petrov (1994) [as *Oxyopomyrmex* sp.]

Distribution: Southern Balkan Peninsula.

Note: The taxonomic status of the two Eastern Mediterranean species *Oxyopomyrmex krueperi* and *O. oculatus* André, 1881 is unresolved. The different number of mandibular teeth mentioned by Forel (1911) seems to be variable on a few samples that occur in the collections. Otherwise the sculpture and the scape length are distinctly different in both species. Based on these differences, our current position is to use the name *O. krueperi* for our Macedonian samples. It seems that species of *Oxyopomyrmex* are rare, limited to lower altitudes of hot and dry open land. Generally, they were found in anthropogenic landscapes. After the original description, *O. krueperi* was only mentioned in recent papers from south-eastern Bulgaria (Lapeva-Gjonova & Kiran 2012), Greece (Legakis 2011, Borowiec & Salata 2012) and Turkish Thrace (Aktaç & Kiran 2004). Petrov (1994) reported *Oxyopomyrmex* sp. from Dojran, the same area where we found *O. krueperi*. His record most probably belongs to this species.

***Pheidole pallidula* (Nylander, 1849)**

Sampling site: DE, DK, DR1, ND1, ND2, NG, NK, PE, SD2, SD3, SD4, SD5.

Reference: Doflein (1920), Santschi (1926) [as *P. pallidula* st. *orientalis*], Petrov (1994) [as *P. megacephala*], Karaman (2002).

Distribution: Mediterranean, Romania, southern part of European Russia, Turkey, Caucasus, Iran, Middle Asia, Kazakhstan.

Note: Petrov (1994) reported *P. megacephala* (Fabricius, 1793) from Dojran. This is a cosmopolitan tramp species. In temperate zones it is mostly established in heated buildings and glasshouses. We are convinced that this is an erroneous record and should be assigned as *P. pallidula*, which is one of the most common species we have found in the south-eastern part of the Republic of Macedonia. The same author reports *P. megacephala* from Montenegro (Petrov 2008), Brač Island in

Croatia (Petrov & Collingwood 1992), and from the Greek region of Macedonia (Petrov & Legakis 1996). We have checked the samples from Brač Island and found out it is *P. pallidula*. We assume that all records in these publications actually refer to *P. pallidula*. Therefore, the only European country, where *P. megacephala* was recorded is Greece, i.e. East Aegean Islands, Dodecanese Islands, and Crete (Legakis 2011).

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

Sampling site: C, DK, DR1, P2, PE, SD4, SD5.

Reference: Doflein (1920), Petrov (1994) [as *Diplorhoptrum fugax*], Karaman (2002) [as *Diplorhoptrum fugax*].

Distribution: Europe, Mediterranean, Turkey, Caucasus, Iran, Middle Asia, Kazakhstan, southern part of West Siberia.

***Temnothorax bulgaricus* (Forel, 1892) ***

Sampling site: C, DK, NK, SD4.

Distribution: Southern Balkan Peninsula, Turkey.

***Temnothorax crassispinus* (Karavaiev, 1926) x**

Sampling site: SL.

Reference: Karaman (2000-2001) [as *Leptothorax nylanderi*].

Distribution: central, eastern and south-eastern parts of Europe, Turkey, Caucasus.

Note: Seifert (1995) described the subspecies *Leptothorax nylanderi slavonicus*, and then raised its status to species rank (Seifert 1996), and eventually Radchenko (2000) synonymised it with *Leptothorax* (=*Temnothorax*) *crassispinus*. This species replaces *Leptothorax* (=*Temnothorax*) *nylanderi* in the eastern part of Europe. Evidently, *T. nylanderi* does not occur in the Balkan Peninsula (Pusch et al. 2006).

***Temnothorax exilis* (Emery, 1869) ***

Sampling site: DR1, ND2, P1, PE.

Distribution: Mediterranean, Caucasus.

***Temnothorax finzii* (Menozzi, 1925) *** (Fig. 3)

Sampling site: SD4.

Distribution: Italy, Balkan Peninsula, Turkey (Anatolia).

Note: This is a very rarely collected species. About 15 closely related species occur in North Africa and the Iberian Peninsula, mainly in hot and arid regions, but only *T. finzii* reaches Italy (Poldi et al. 1995), the Balkan Peninsula and Turkey (A. Schulz, unpublished data). Records of this inconspicuous, probably nocturnal, large eyed *Temnothorax* species are often coming from higher, but dry summer-hot, and less shady sites. Its nests

are usually deep in the soil, often with a stone at the top.

***Temnothorax flavigaster* (Emery, 1870)**

Sampling site: DR1, ND2, NG, P2, PE, SD4, SD5

Reference: Karaman (2000-2001) [as *Leptothorax flavigaster*].

Distribution: Italy, Balkan Peninsula.

***Temnothorax graecus* (Forel, 1911) *** (Fig. 4)

Sampling site: DE, SD3, SD4.

Distribution: Southern Balkan Peninsula, Turkey.



Figure 3. A worker of *Temnothorax finzii* from SD4
(photo by G. Kunz).



Figure 4. A worker of *Temnothorax graecus* from DE
(photo by G. Kunz).

***Temnothorax near interruptus* (Schenck, 1852) ***

Sampling site: DE, DK, DR1, NK, P2, SD4, SD5.

Distribution: Balkan Peninsula.

Note: This undescribed species is distinguishable from the more northern distributed *T. interruptus* by longer spines, different shape of head and frontal lobes, and by differences in sculpture aspects. *Temnothorax near interruptus* occurs in wide range habitats. It prefers warmer mesic forests, but it is also found in open land, from lowland to subalpine meadows.

***Temnothorax nadigi* (Kutter, 1925)**

Reference: Karaman (2002) [as *Leptothorax nadigi*].

Distribution: Spain, French and Swiss Alps, Slovakia, Southern Poland, Bulgaria, Turkey (Anatolia), Caucasus.

***Temnothorax near parvulus* (Schenck, 1852) ***

Sampling site: SD4.

Distribution: Southern Balkan Peninsula.

Note: Csósz & Schulz (in prep.) worked on the taxonomy of *Temnothorax* species related to *T. parvulus* from Balkan Peninsula and Turkey. In this area, about five species related to *T. parvulus* occur. All of them share the pale yellowish colour and the distinct metanotal groove, but distinguished from *T. parvulus* by the length of the propodeal spines and by a combination of other morphometric traits. The species listed here nests in warmer mesic forested habitats, or in the shadow of single trees in higher altitudes. Its northern distribution border is probably in southern Bulgaria, Albania and the Republic of Macedonia.

***Temnothorax recedens* (Nylander, 1856) ***

Sampling site: DE, DK, DR1, NK, PE, SD4, SD5.

Distribution: Mediterranean, Caucasus, Kopet Dag Mts.

***Temnothorax semiruber* (André, 1881) ***

Sampling site: DE, DK, DR1, NG, NK, P2, SD2, SD5.

Distribution: Balkan Peninsula, Turkey, Israel.

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

Sampling site: SD5.

Distribution: Europe (except northern part), Turkey, Caucasus, Israel, Kopet Dag Mts.

***Tetramorium chefketi* Forel, 1911**

Sampling site: P1, SD3.

Reference: Doflein (1920) [as *T. caespitum* var. *fortis*], Karaman (2002) [as *T. forte*], Csósz et al. (2007).

Distribution: Southern Balkan Peninsula, southern part of Eastern Europe, Turkey, Caucasus, Middle Asia, Kazakhstan.

Note: Güsten et al. (2006) pointed out that *T. forte* is a western Mediterranean species, while the records applied to that name from south-eastern Europe refer mainly to *T. chefketi* (Csósz et al. 2007).

***Tetramorium ferox* Ruzsky, 1903 x**

Sampling site: P2.

Reference: Karaman (2002) [as *T. cf. perspicax*].

Distribution: eastern part of Central Europe, southern part of Eastern Europe, Balkan Peninsula, Turkey, Caucasus, Middle Asia.

Note: In the revision of the *T. ferox* species complex (Csósz & Schulz 2010), *T. perspicax* Radchenko, 1992 is synonymized with *T. ferox*.

***Tetramorium* near *hippocrate* Agosti and Collingwood, 1987 ***

Sampling site: DR1.

Distribution: Greece, Turkey (Anatolia).

Note: The taxonomic status of many *Tetramorium* species is still unresolved. With the exception of recent revisions of *T. chefketi* species complex (Csósz et al. 2007), *T. ferox* species complex (Csósz & Schulz 2010), and *T. caespitum/impurum* species complex (Schlick-Steiner et al. 2006b, Steiner et al. 2006), there are no adequate taxonomic papers available. Our sample belongs to the species we provisionally name as *T. near hippocrate*, and which evidently does not belong to one of the above mentioned revised groups. This Macedonian record is important as the species has so far only been recorded from southern Greece and Anatolia.

***Tetramorium hungaricum* Röszler, 1935 ***

Sampling site: DR2, P1, SD1, SD2, SD4.

Distribution: Austria, Slovakia, Hungary, Balkan Peninsula, Romania.

***Tetramorium moravicum* Kratochvil, 1941 ***

Sampling site: DR1, DR2, SL.

Distribution: Central and Southern Europe, Ukraine (Crimea), Turkey, Caucasus.

***Tetramorium* cf. *punctatum* Santschi, 1927 x**

Sampling site: ND1, SD4, SD5.

Reference: Petrov (1994) [as *T. lucidulum*], Karaman (2002) [as *T. lucidulum*].

Distribution: Southern Balkan Peninsula, Turkey (Anatolia).

Note: This species belongs to the *Tetramorium* species-group with exceptionally small workers and sexuals. Three to four species from this group are known, distributed from southern Italy to Israel and Iran. The nests occur in hot Mediterranean grasslands, shrublands and steppe-like habitats. We consider, that the species mentioned in the Macedonian references as *T. lucidulum* is identical to the species we name here as *T. cf. punctatum*. The name *T. lucidulum* Menozzi, 1933 refers to one of the species of the "*T. punctatum* group". The species was described from Israel, and after the examination of the type material and large ant collections, we are able to exclude this name from the fauna of the Balkan Peninsula.

***Tetramorium semilaeve* André, 1883**

Sampling site: DK, DR1, ND1, ND2, NG, PE, SD2,

SD3, SD4, SD5.

Reference: Doflein (1920) [as *T. caespitum semileve*], Karaman (2002).

Distribution: Mediterranean, Turkey, Caucasus.

***Tetramorium* sp. D sensu Schlick-Steiner et al.**

(2006b) *

Sampling site: SD2.

Distribution: Spain, Austria, Hungary, Bulgaria, Middle Asia.

***Tetramorium* sp. E sensu Schlick-Steiner et al.**

(2006b) *

Sampling site: C, ND1, SD2.

Distribution: Central and Southern Europe, southern part of Eastern Europe, Caucasus.

***Tetramorium* sp. ***

Sampling site: DE, DR2, P2.

Distribution: ?

Note: Due to the unclear taxonomic status we are not able to give a concrete name for this *Tetramorium* species. It has a more or less shiny head, but it is not related to *T. semilaeve* or *T. diomedea*, and not identical to *T. hungaricum*, but it seems to be morphologically similar to the *T. caespitum/impurum* species group.

Subfamily DOLICHODERINAE

***Bothriomyrmex communis* Santschi, 1919 ***

Sampling site: NK, P2, SD2.

Distribution: Southern France, Italy, Austria, Czech Republic (Moravia), Slovakia, Hungary, Balkan Peninsula, Turkey, Ukraine (Crimea), southern part of European Russia.

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

Sampling site: C, DK, NK.

Reference: Karaman (2000-2001).

Distribution: Europe (except northern part), Turkey, Caucasus, southern part of West Siberia, Tien-Shan, Altai Mts.

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

Sampling site: DK.

Reference: Doflein (1920).

Distribution: Italy, eastern part of Central Europe, Balkan Peninsula, southern part of Eastern Europe, Turkey, Caucasus, Israel, Iran.

***Tapinoma erraticum* (Latreille, 1798)**

Sampling site: C, DE, DR1, ND1, ND2, NK, P1, P2, PE, SD1, SD2, SD3, SD4, SD5.

Reference: Doflein (1920), Petrov (1994), Karaman (2002).

Distribution: Central Europe, southern part of Eastern Europe, Mediterranean, Turkey, Cauca-

sus, Kopet Dag Mts., Kazakhstan, Tien-Shan.

***Tapinoma nigerrimum* (Nylander, 1856)**

Reference: Petrov (1994), Karaman (2002).

Distribution: Southern Europe, north-western part of North Africa, Ukraine (Crimea), southern part of European Russia, Turkey, Caucasus, Middle Asia.

Subfamily FORMICINAE

***Camponotus aegaeus* Emery, 1915 ***

Sampling site: DE.

Distribution: south-western Bulgaria, Greece, Turkey.

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

Sampling site: DE, DK, DR1, ND1, ND2, NG, NK, P1, P2, SD1, SD2, SD3, SD4, SD5.

Reference: Doflein (1920) [as *C. (Myrmoturba) maculatus aethiops* and *C. (Myrmoturba) maculatus aethiops* var. *marginata*], Santschi (1926) [as *C. aethiops* and *C. aethiops* v. *marginatus*], Petrov (1994), Karaman (2000-2001), Wagner (2012).

Distribution: Central Europe, southern part of Eastern Europe, Mediterranean, Turkey, Caucasus, Kopet Dag Mts., Middle Asia.

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

Sampling site: DE, ND1, ND2, SD2.

Distribution: eastern part of Central Europe, Balkan Peninsula, southern part of Eastern Europe, Turkey, Caucasus.

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

Sampling site: C, DE, DK, ND2, NK, SD2, SD4

Reference: Doflein (1920) [as *C. (Orthonotomyrmex) lateralis* var. *dalmatica*].

Distribution: Italy, Balkan Peninsula, Turkey, Israel.

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

Sampling site: NK.

Reference: Karaman (2002).

Distribution: Europe (except northern part), north-western part of North Africa, Turkey, Caucasus, Kazakhstan, southern part of West Siberia.

***Camponotus gestroi* Emery, 1878 ***

Sampling site: DK, P2, SD2, SD3, SD4, SD5.

Distribution: Southern Europe, Turkey, Caucasus, Israel, Iran.

***Camponotus ionius* Emery, 1920 *** (Fig. 5)

Sampling site: DK, PE.

Distribution: Southern Balkan Peninsula, Turkey (Anatolia).

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

Sampling site: C, DE, DR1, ND1, NK, SD1, SD4.



Figure 5. A worker of *Camponotus ionius* from PE (photo by G. Kunz).

Reference: Doflein (1920).

Distribution: Mediterranean, Hungary, Romania, Ukraine (Crimea), Caucasus, Kopet Dag Mts.

Note: Seifert (2007) gives characteristics of an undescribed species, named *C. lateralis* sp. 2, which is morphologically similar to *C. lateralis*. Our samples were identified as *C. lateralis* (from the sites C, DE, ND1, NK and SD4) and as *C. lateralis* sp. 2 (from DR1 and SD1), but here we treat all records as the single species *C. lateralis*, for the unresolved taxonomic status of these sibling taxa.

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

Sampling site: SL.

Reference: Doflein (1920) [as *C. (s.str.) herculeanus ligniperda*].

Distribution: Europe, Turkey, Caucasus.

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

Sampling site: DR1, DR2, NK, P2, SD4.

Reference: Doflein (1920) [as *C. (Orthonotomyrmex) lateralis merula*], Petrov (1994), Karaman (2000-2001).

Distribution: Central Europe, southern part of Eastern Europe, Mediterranean, Turkey, Caucasus.

***Camponotus pilicornis* (Roger, 1859)**

Reference: Doflein (1920) [as *C. (Myrmoturba) maculatus pilicornis* var. *sicula*].

Distribution: Iberian Peninsula, France, Sicily, south-western Bulgaria, Greece (?).

***Camponotus truncatus* (Spinola, 1808)**

Sampling site: ND1, SD2, SD4.

Reference: Karaman (2000-2001).

Distribution: Central Europe, Mediterranean, Romania, Ukraine (Crimea), Caucasus, Kopet Dag Mts.

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

Sampling site: NK, SL.

- Reference: Doflein (1920), Petrov (1994), *Formica lugubris* Zetterstedt, 1838
Karaman (2002).
 Distribution: Europe, north-western part of North Africa, Turkey, Caucasus, Kazakhstan, Altai Mts.
- Cataglyphis aenescens* (Nylander, 1849)**
 Sampling site: DE, P1, P2.
 Reference: Doflein (1920) [as *C. cursor aenescens*], Santschi (1926) [as *C. cursor* st. *aenescens*], Karaman (2002).
 Distribution: eastern part of Central Europe, southern part of Eastern Europe, Balkan Peninsula, Turkey, Caucasus, Iran, Middle Asia, Kazakhstan, southern part of West Siberia, Altai Mts.
- Cataglyphis nodus* (Brullé, 1832)**
 Sampling site: DE, DK, ND1, NK, PE, SD1, SD2, SD3, SD4, SD5.
 Reference: Doflein (1920) [as *C. bicolor* var. *orientalis*], Santschi (1926) [as *C. bicolor* v. *nodus*], Harkness (1977) [as *C. bicolor*], Petrov (1994), Karaman (2002).
 Distribution: eastern part of Central Europe, Balkan Peninsula, Romania, Turkey, Caucasus, Iran, Kopet Dag Mts.
- Formica cinerea* Mayr, 1853 x**
 Sampling site: DR2, R.
 Reference: Petrov (1994) [as *F. balcanina*].
 Distribution: Europe, Turkey, Caucasus, West Siberia.
 Note: All our samples correspond to *F. balcanina* Petrov and Collingwood, 1993, which is a synonym of *F. cinerea* according to Seifert (2002).
- Formica cunicularia* Latreille, 1798**
 Sampling site: DR2, ND1, SD1, SD2, SD4.
 Reference: Santschi (1926) [as *F. fusca* st. *glebaria*], Petrov (1994), Karaman (2002).
 Distribution: Europe, Turkey, Caucasus, Kazakhstan.
- Formica exsecta* Nylander, 1846**
 Reference: Doflein (1920), Gösswald et al. (1965).
 Distribution: Transpalaearctic.
- Formica fusca* Linnaeus, 1758**
 Sampling site: SL.
 Reference: Doflein (1920), Petrov (1994).
 Distribution: Transpalaearctic.
- Formica gagates* Latreille, 1798**
 Sampling site: C, NK.
 Reference: Santschi (1926).
 Distribution: eastern part of Central Europe, Southern Europe, southern part of Eastern Europe, Turkey, Caucasus.
- Formica lugubris* Zetterstedt, 1838**
 Reference: Gösswald et al. (1965).
 Distribution: mountains of Central and Southern Europe, Northern Europe, Siberia.
- Formica pratensis* Retzius, 1783**
 Reference: Santschi (1926) [as *F. rufa* st. *pratensis*], Gösswald et al. (1965).
 Distribution: Europe, Turkey, Caucasus, Kazakhstan, Siberia.
- Formica rufa* Linnaeus, 1761**
 Sampling site: SL.
 Reference: Doflein (1920), Gösswald et al. (1965).
 Distribution: Europe, Turkey, Caucasus, Kazakhstan, Siberia.
- Formica rufibarbis* Fabricius, 1793**
 Sampling site: DR2.
 Reference: Santschi (1926).
 Distribution: Europe, Turkey, Caucasus, Iran, Kazakhstan, southern part of West Siberia.
- Formica sanguinea* Latreille, 1798**
 Sampling site: ND1.
 Reference: Doflein (1920), Karaman (2000-2001).
 Distribution: Transpalaearctic.
- Formica truncorum* Fabricius, 1804**
 Reference: Gösswald et al. (1965).
 Distribution: Transpalaearctic.
- Lasius balcanicus* Seifert, 1988 or *L. distinguendus* (Emery, 1916) ***
 Sampling site: ND1, SD2, SD3.
 Distribution: ?
 Note: The discrimination between *L. balcanicus* and *L. distinguendus* is not reliable without gynes (B. Seifert, pers. comm. 2011), which we did not collect.
- Lasius brunneus* (Latreille, 1798)**
 Sampling site: SD4, SL.
 Reference: Santschi (1926), Karaman (2000-2001).
 Distribution: Europe, Turkey, Caucasus, Iran.
- Lasius emarginatus* (Olivier, 1792)**
 Sampling site: DR2, NK, SD1.
 Reference: Santschi (1926), Karaman (2002).
 Distribution: Central and Southern Europe, southern part of Eastern Europe, Turkey, Caucasus.
- Lasius flavus* (Fabricius, 1781)**
 Reference: Doflein (1920) [as *Formicina* (s.str.) *flava*], Karaman (2000-2001), Csósz & Markó (2005)

Distribution: Transpalaearctic.

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

Reference: Doflein (1920) [as *Formicina (Dendrolasius) fuliginosa*].

Distribution: Europe, Turkey, Caucasus, southern part of West Siberia, Kazakhstan.

***Lasius lasiooides* (Emery, 1869)**

Sampling site: NK.

Reference: Karaman (2002).

Distribution: Mediterranean, Caucasus, Iran, Middle Asia, Kazakhstan.

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

Reference: Doflein (1920) [as *Formicina mixta*].

Distribution: Transpalaearctic.

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

Sampling site: SD1, SD2.

Reference: Doflein (1920) [as *Formicina (Donthorpea) nigra*], Santschi (1926), Karaman (2002).

Distribution: Europe, Turkey, Caucasus, Kazakhstan, Siberia.

Note: The records of Doflein (1920) and Santschi (1926) refer to either *L. niger* or *L. platythorax*.

***Lasius paralienus* Seifert, 1992**

Sampling site: ND1.

Reference: Karaman (2000-2001).

Distribution: Europe, Turkey, Caucasus.

***Lasius platythorax* Seifert, 1991 ***

Sampling site: NK, SL.

Distribution: Europe, Turkey, Caucasus, Iran, Siberia.

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

Reference: Karaman (2002).

Distribution: Transpalaearctic.

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

Sampling site: DE, ND1, PE, SD1, SD2, SD4.

Reference: Petrov (1994) [as *Acantholepis caucasica* and *A. frauenfeldi*].

Distribution: Mediterranean, Turkey, Caucasus.

***Plagiolepis pygmaea* (Latreille, 1798)**

Sampling site: C, DK, DR1, ND2, NK, P1, P2, PE, SD2, SD3, SD4, SD5.

Reference: Doflein (1920), Maidl (1921), Karaman (2002).

Distribution: Central Europe, Mediterranean, Romania, Turkey, Caucasus.

***Plagiolepis taurica* Santschi, 1920 ***

Sampling site: DE, DK, DR2, ND1, P1, P2, PE, SD2, SD3, SD4, SD5.

Distribution: Central and Southern Europe, southern part of Eastern Europe, Turkey, Iran, Middle Asia.

***Plagiolepis xene* Stärcke, 1936 ***

Sampling site: SD2.

Distribution: Central and Southern Europe.

***Polyergus rufescens* (Latreille, 1798)**

Reference: Petrov (1994), Karaman (2002).

Distribution: Europe (except northern part), Turkey, Caucasus, Kazakhstan, southern part of West Siberia, Tien-Shan, Altai Mts.

***Prenolepis nitens* (Mayr, 1853)**

Sampling site: C, DR1, NK, R.

Reference: Karaman (2002).

Distribution: eastern part of Central Europe, Balkan Peninsula, Romania, Turkey, Caucasus.

***Proformica striaticeps* (Forel, 1911) x (Fig. 6)**

Sampling site: P1, P2.

Reference: Santschi (1926) [as *Formica (Proformica) nasuta*].



Figure 6. A worker of *Proformica striaticeps* from P1 (photo by G. Kunz).

Distribution: Southern Balkan Peninsula, Turkey, Caucasus.

Note: *Proformica* is one of the most enigmatic ant genera in the Palaearctic, concerning its taxonomy, biology and ecology. We consulted the old revision of the genus by Dlusskij (1969) and the key of Bulgarian *Proformica* by Atanassov & Dlusskij (1992), and our samples corresponded to *P. striaticeps*, but the true identity could only be confirmed after a complete revision of the genus. *Proformica nasuta* (Nylander, 1856), mentioned for Macedonia by Santschi (1926), is distributed in the western Mediterranean, e.g. Spain and France (Casevitz-Weulersse & Galkowski 2009). Its reports from the eastern part, for instance Bulgaria, should refer to *P. striaticeps* (Atanassov & Dlusskij 1992).

Species excluded from the list

***Aphaenogaster sangiorgii* (Emery, 1901)**

Reference: Karaman (2002).

Note: We exclude *A. sangiorgii* from our checklist, due to the unclear status of this name. The description is based on a very small gyne without associated workers, and it is possible that the holotype specimen is an aberrant individual of *A. finzii*, a smaller specimen of *A. subterraneoides*, or it can be other species, which we cannot specify.

***Messor aralocaspicus* Ruzsky, 1902**

Reference: Karaman (2002).

Note: The only two European countries from where *M. aralocaspicus* is reported are Montenegro (Karaman 2011) and the Republic of Macedonia (Karaman 2002). The species is known from Iran (Firouzi et al. 2011), Arabian Peninsula (Collingwood & Agosti 1996) and Middle Asia (Arnoldi 1977, Dlusskij et al. 1990, Schultz et al. 2006). In relation to the general distribution of *M. aralocaspicus* and general zoogeographic aspects in the genus *Messor*, the occurrence of this species in Macedonia is improbable.

***Messor denticulatus* Santschi, 1927**

Reference: Petrov (1994), Karaman (2002).

Note: This species is known from southern Turkey (Kiran & Karaman 2012), Caucasus and southern part of European Russia (Dlusskij et al. 1990), Israel (Vonshak & Ionescu-Hirsch 2009), Iran (Paknia et al. 2008) and Middle Asia (Arnoldi 1977, Dlusskij et al. 1990, Schultz et al. 2006). It was also reported from some Balkan countries, i.e. from Serbia (Petrov 2004), Montenegro (Karaman 2011), the Republic of Macedonia (Petrov 1994, Karaman 2002) and Greece (Dodecanese Islands and Crete), but the true identity of the records from the latter European country is not clear (Legakis 2011, Borowiec & Salata 2012). Considering the geographic distribution of *Messor* species and the problematic taxonomic situation of the genus with inadequate identification keys, the Macedonian records, and probably also those from Serbia and Montenegro, are doubtful.

***Tennothorax tuberum* (Fabricius, 1775)**

Reference: Karaman (2002) [as *Leptothorax tuberum*].

Note: In southern Europe *T. tuberum* is mostly limited to montane and alpine zone. The record by Karaman (2002) from Demir Kapija town, at the altitude of 110 m a.s.l. in the area influenced by the Mediterranean climate, most probably is a misidentification. This species occurs with higher probability in the mountains of this country, but until we get more reliable data, we suggest omitting it from the checklist.

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

Reference: Doflein (1920), Petrov (1994), Karaman (2002).

Note: Considering the study by Schlick-Steiner et al. (2006b), eight morphologically very similar species of the *T. caespitum/impurum* complex occur in Europe. We cannot say to which of the species from this complex, *T. caespitum* mentioned in the listed references belongs to. Referring to our material, three species of the complex can be confirmed for Macedonia (*T. hungaricum*, *T. sp. D.* and *T. sp. E.*).

***Tetramorium schmidti* Forel, 1904**

Reference: Doflein (1920) [as *Tetramorium caespitum* var. *schmidti*].

Note: This species is described from Israel and most certainly has not been recorded from the Balkan Peninsula. The old report by Doflein (1920) must be excluded from the list of Macedonian ants.

***Lasius alienus* (Foerster, 1850)**

Reference: Doflein (1920) [as *Formicina (Donisthorpea) nigra aliena*], Santschi (1926) [as *L. niger* st. *alienus*], Petrov (1994).

Note: The records mentioned by the listed authors refer to at least one of the three species from the *L. alienus* complex, i.e. *L. alienus*, *L. paralienus* and *L. psammophilus* Seifert, 1992. So far, only *L. paralienus* can be confirmed for the country.

***Plagiolepis schmitzii* Forel, 1895**

Reference: Karaman (2002).

Note: This species is apparently absent from the Balkan Peninsula (it is known from Sicily (Poldi et al. 1995), Madeira, Spain, North Africa and Saudi Arabia (Sharaf et al. 2011)). Its presence in the Republic of Macedonia is improbable.

Discussion

During our investigation in the south-eastern and central part of the Republic of Macedonia, 80 ant species were recorded, 32 of them (40%) are firstly reported for the country. Our sampling was most intense in the Dojran Lake area, where we found 55 species. Only 13 of them were recorded there by Petrov (1994). Karaman (2000-2001, 2002) focused his ant sampling in the area of Demir Kapija gorge and reported 50 species, 42 of which are treated in our checklist as confirmed. We conducted sampling in only one site of that area and found 18 species, nine of them were not recorded

by Karaman. Resulting from the use of several collecting methods, our study was very successful since we considerably improved the knowledge on the ant fauna of the south-eastern part of Macedonia and many collected species are new records for the country.

If we critically analyse the ant lists from the available references and combine them with our findings, then 99 species are confirmed for the whole territory of the Republic of Macedonia. However, this number of ant species is still lower than in some neighbouring countries. Thus, 141 species were recorded in Serbia (Petrov 2004), 140 in Montenegro (Karaman 2011) and 163 in Bulgaria (Lapeva-Gjonova et al. 2010). In the checklist of Greek ants, 291 species are listed (Borowiec & Salata 2012). About 160 of them were found in the northern Greece region of Macedonia, an area adjacent to and somewhat comparable in size to the Republic of Macedonia. The main reason for the distinctly lower number of the recorded ant species in the Republic of Macedonia is the poor status of the investigation compared to neighbouring areas.

The geographic position of the Republic of Macedonia and the influence of Mediterranean climate especially in the south-eastern part, influence the composition of its ant fauna. As the consequence, about 40% of the known Macedonian ant species are mostly distributed south of 46° N, therefore they are absent in Central Europe. These are either the species that are widespread in the different parts of the Mediterranean area (i.e. Southern Europe, Mediterranean parts of Northern Africa, Near East and Turkey) and usually also further towards the east (i.e. Caucasus, Iran, Middle Asia), such as *Aphaenogaster gibbosa*, *Camponotus gestroi*, *Lasius lasiooides*, *Messor capitatus*, *Temnothorax exilis*, *Tetramorium semilaeve*, or the species with smaller ranges, distributed on the Balkan Peninsula and the adjacent regions (i.e. Italy and Turkey), such as *Aphaenogaster epirotea*, *A. finzii*, *Camponotus aegaeus*, *Messor oertzeni*, *Oxyopomyrmex krueperi*, *Temnothorax bulgaricus*, *T. flavigaster*. For the species *Camponotus aegaeus*, *C. ionius*, *Oxyopomyrmex krueperi*, *Temnothorax bulgaricus*, *T. graecus*, *T. near parvulus* and *Tetramorium near hippocrate* the Macedonian territory, together with southern and eastern parts of Bulgaria (Lapeva-Gjonova et al. 2010), probably presents the northern border of their ranges. Another component of the Macedonian ant fauna are species with more northern distribution. These species also occur in Central

Europe and may have a larger distribution in the Palaearctic. Among our collected species, *Temnothorax finzii* is the only one which has not been mentioned in the literature for the Balkan Peninsula.

In our list, the identity or name of some species is unclear, i.e. *Messor cf. strutor*, *Temnothorax near interruptus*, *T. near parvulus*, *Tetramorium near hippocrate*, *T. cf. punctatum*, *T. sp. D*, *T. sp. E* and *T. sp.*, which reflects the unresolved taxonomic status of many ant taxa. In future studies, when the status of these species becomes clearer, it will be important to find out their distribution in the Balkan Peninsula.

We hope that our updated list will stimulate further studies on ants in the Republic of Macedonia, as they remain insufficiently investigated. Even if we combine our current investigation and previously recorded data, no more than about 60 sites were observed for ant species and from many of these sites only single species are reported. The south-eastern part of the country is best studied, while the north-eastern and western parts remain totally unexplored. The Republic of Macedonia lies at the transition between Mediterranean and Continental part of the Balkan Peninsula, the region that harbours perhaps the richest ant fauna of Europe. Therefore we expect that still many unregistered ant species are present in this country and to find them is essential, if we want to complete the knowledge on their distribution in the Balkan Peninsula.

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