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Specimens from the palaeobotanical collection of National Institution Museum of Natural History of Republic of North Macedonia, Skopje

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Abstract
The palaeobotanical collection of the NI Museum of Natural History of RN Macedonia in Skopje is presented. It contains 159 specimens, representing mainly leaf imprints of angiosperms and leafy twigs of gymnosperms. The taxa found in the collection are 60. The fossil material was collected by Spasa Stojanovič from four localities in RN Macedonia. According to previous information, the age of the deposits, that of Sudik is late Eocene, and of the other three - Oslomej, Suvodol and Vitolište is late Neogene. The difference in the taxonomic and quantitative composition of the Palaeogene flora and those of the late Neogene flora shows the evolution of the flora and vegetation during the Neogene on the territory of RN Macedonia.

Key words: Eocene, Miocene**,** Oslomej, palaeobotanical collection**,** Pliocene, Sudik, Suvodol, Vitolište

NTRODUCTION

The fossil materials from previous studies of the macro palaeoflora of RN Macedonia (Table 1) are in most cases unknown whether and where they are stored.

Table 1. An alphabetical list of authors, palaeomacroflora locality in RN Macedonia and their age after the authors.

Author	Locality	Age after the source
Dumurdzanov et al., 1981	Vitolište	Late Pliocene
Kitanov, 1993	Lukovo	Pliocene
Kitanov, 1996	Zhivoyno	Pliocene
Mihajlovich & Lazarevich, 2004	Suvodol	Late Neogene
Mihajlovich & Ljubotenski, 1994	Nemanjica, Bekirli, Šeoba, Krivi Dol, Ramadanica, Sudik	Late Eocene
Milakovich, 1955	Krivi Dol	Paleogene
Milovanovich, 1968	Kočani area	Paleogene
Milovanovich & Mihajlovich, 1988	Sokolarci, Spachevo	Oligocene
Pantich, 1954	Nemanjica, Bekirli, Šeoba, Ramadanica	Eocene
Pantich, 1956	Pulich	Late Pliocene
Pantich & Nikolich, 1956	Oslomej, Zhivoyno	Pliocene
Stojanova et al., 2017	Nerezi Formation (Mariovo Basin)	Late Miocene

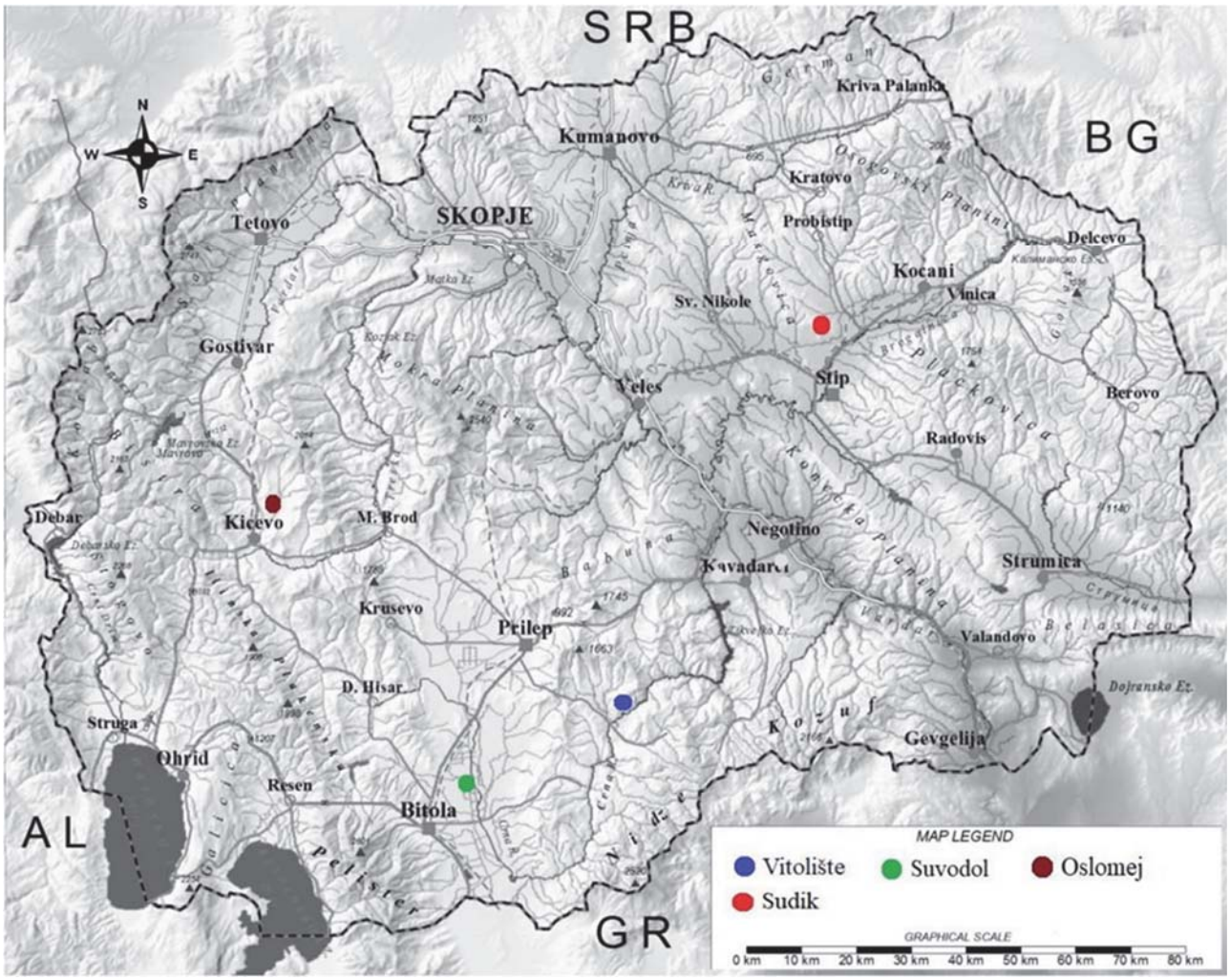

Figure 1. A map showing studied palaeoflora localities.

Materials determined by Kitanov (1993, 1996) from the Lukovo and Zhivoyno localities are stored in the palaeobotanical collection of Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences.

The creation of a palaeobotanical collection in the fund of Museum of Natural History in Skopje (MNH Skopje) is a new stage in the development of the research of the fossil flora of RN Macedonia. The basis of this palaeobotanical collection was fossil material collected in the period 1984-1989 by Spasa Stoyanovich from the localities Sudik (Štip area), Oslomej (Kičevo area), Suvodol (Bitola area), Vitolište (Mariovo area) (Fig. 1). For the palaeofloras of Sudik (late Eocene) and Oslomej (Pliocene) there are already data published by Mihajlovic and Lubotenski (1994) and Pantich and Nikolich (1956), respectively. Data on fossil flora from Vitolište (late Pliocene) are presented by Dumurdzanov et al., (1981), Mihajlovich & Lazarevich (2004) published data on late Neogene flora from the Suvodol coal mine.

Locality **Sudik** is situated about 10 km north of town Štip, and belongs to eastern part of the Vardar zone in the territory of the Republic of North Macedonia (Fig. 2).

The largest space of locality belongs to the Tertiary sediments which include Eocene and Neogene sediments and vulcanite with ignimbrite and andesite, also tuffs and breccias. In several places between Ovče Pole, river Bregalnica, and Slan Dol on Tertiary sediment are found abundant macro, microfauna, and flora which is considered as Upper Eocene – Priabonian geological age (Rakikevich et al., 1976).

The Sudik site belongs to the Ovče Pole Basin, which is a large Paleogene sedimentary mass with NW-SE trend that is superimposed on varied rocks. It is composed of 3.5 km thick succession, which is subdivided into five lithostratigraphical units: basal

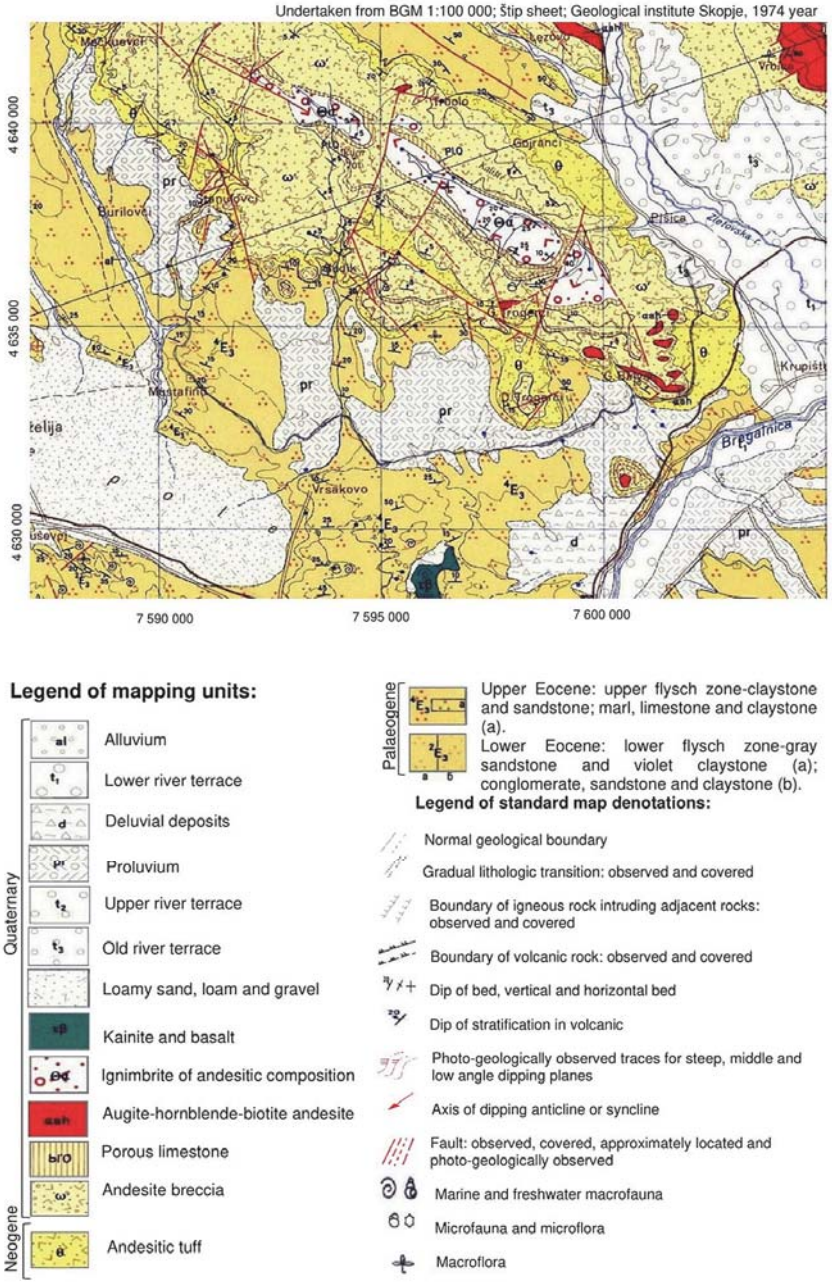

Figure 2. Geological map of the locality Sudik.

unit, lower flysch unit, unit of yellow sandstones, upper flysch unit and carbonate-sandy unit). Lithologic composition of basal lithozone is represented by conglomerates, sandstones, clays and carbonate layers (represented by limestones and marls). The lower flysch lithozone is represented by rhythmic occurrence and prevalence of sandstones over conglomerates and with rare interlayers of clays, marls and siltstones. Lithologic composition of the lithozone of yellow sandstones is represented with sandstones with yellow -brown colour and thininterlayers of clays. Lithologic composition of the upper flysch lithozone is represented with clay-marly layers that rhythmically alternate with sandstones, siltstones, clays, and carbonate-sandy unit is represented by with marly clays and oolitic limestones (Maksimovič et al., 1954; Stojanova et al., 2012). The age of the studied sediments (Late Eocene–Early Oligocene) has been deter-mined by means of macrofossils and microfossils (planctonic and benthic foraminifers).

Neogene is represented with Pliocene andesitic tuffs found through Upper Eocene sediments. Andesitic tuffs are gray-white, yellow, and rosy rocks with a large percentage (about 70%) of shattered grains, decomposed, kaolinization and limonization. The composition and structure of andesitic tuffs show that they have accu-mulated in an aqueous environment. Pliocene-Quaternary andesitic breccias cover a larger area than tuffs. The andesitic breccias contain tuffs, ignimbrites, andesites, and porous limestones with fossils, which are found in certain Lithological units. This indicates the existence of multiple phases of volcanic activity. According to Rakikevich et al. (1976) in the breccias and between breccias and ignimbrite there are fossils, algae, gastropods, bones of birds, and silicified wood found near the villages of Sudik, Trogerci, Trolo, and Gorni Balvan. Porous limestones are thick about 10-15 m and represent cessation of volcanic activity. Cyanites and basalts are breakthrough Paleogene sediments and strongly opalized on surrounding sediments. The young Holocene deposits occupy a large area and are represented by old, lower, and upper river terraces, proluvial, alluvial and diluvial deposits which are made of gravel, sand, and clay.

Locality **Oslomej** is placed in Kičevo valley, about 5 km north of the town of Kičevo (Fig. 3). The site are characterized by lithological structure represented

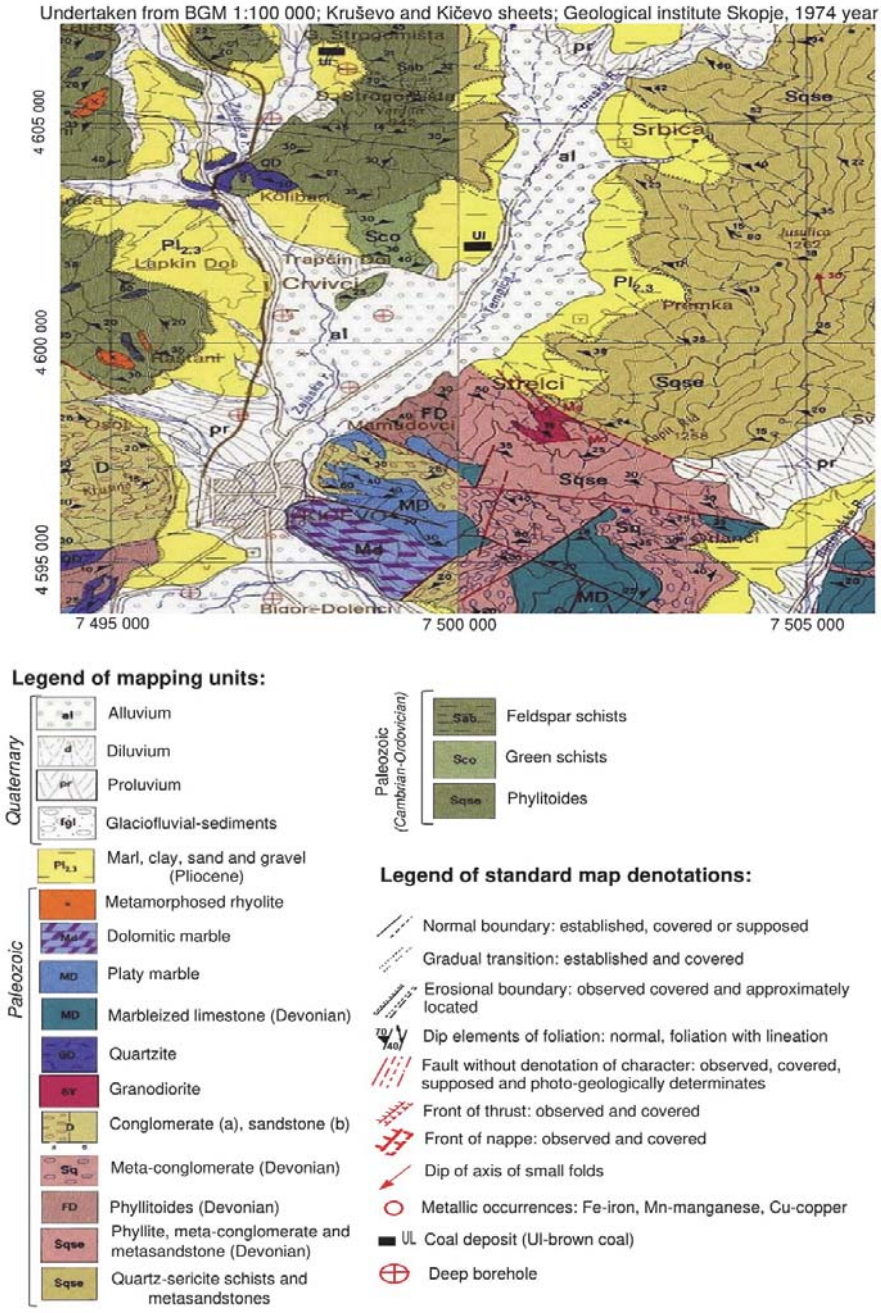

Figure 3. Geological map of the locality Oslomej.

with different rocky types on metamorphic and magmatic rocks of the Paleozoic complex, and Neogene - Quaternary sediments. Pliocene sediments are located on the peripheral parts of the Kičevo valley, and the central part is covered with Quaternary sediments. Paleozoic is presented with Cambrian – Ordovician and Devonian metamorphic and magmatic rocks (phyllitoide, feldspar schists, metasandstones, metaconglomerates, quartz, etc. Pliocene sediments are represented by gravel and sand, which in the upper layers pass in green and gray, and there are brown clay sands, clays, sands with traces of gravel. According to Petkovski et Ivanovski (1980), Quaternary sedi-ments are formed of alluvial, diluvial, proluvial, and glaciofluvial materials, which are represented by clay, sand, and gravel. Pliocene sediments of transgressively border the Paleozoic schists, and the thickness of the rocks in the Kicevo valley is around 250 m.

There are layers of coal in the Pliocene sedimentary complex. Same coal layers are found downstream of river Temnica. Coal appearance is connected with Pliocene Lake which was spared between the towns of Kičevo and Makedonski Brod, downstream of rivers Treska and Zajaska (Dumurdzanov et al. 1979). According to the investigated fossil flora in coal sediments by Pantich et Nikolich (1956) it was confirmed that the formation of coal in the Kičevo valley is in the Middle Pliocene.

The **Suvodol** site belongs to the Pelagonian basin, and is located about 19 km northeast of the town of Bitola (Fig. 4). The lithological structure is represented with different rocky types of Paleozoic complex, Mesozoic rocks, and Neogene-Quarter sediments. The Paleozoic rocks are presented with phyllite and carbonate series. Phyllite series breaks younger magmatic rocks (schistose granodiorite, granite, etc.) and is covered with carbonate series in the upper flow of the river Crna (Karajanovich et Ivanovski, 1979). The Mesozoic rocks are presented with conglomerates, diabase, granite, etc. According to the lithological composition Neogene and Quaternary complex is heterogenic, and can be stand out two genetic types alluvial sediments and proluvial coastal sediments. The alluvial sediments are composed of gravel and variegated sand and clay materials. The proluvial coastline sediments are composed of clay-sand materi-

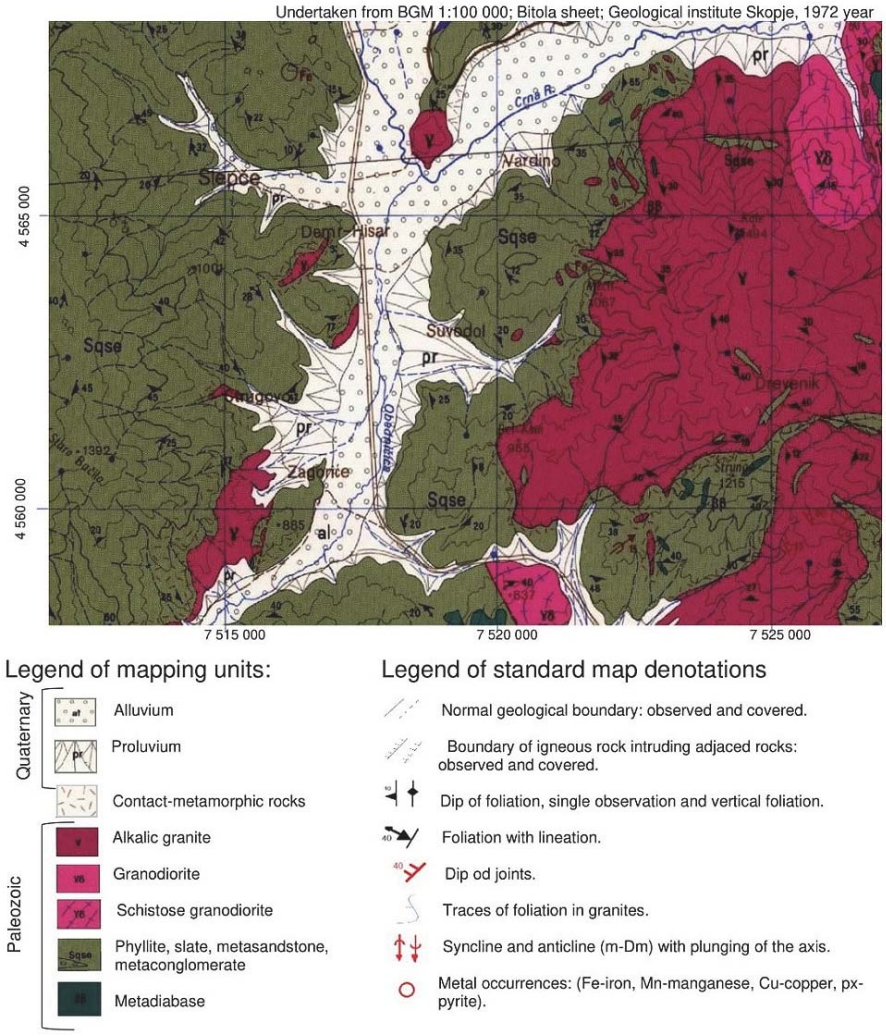

Figure 4. Geological map of the locality Suvodol.

al which thickness is between 5-10 m. The Suvodol site was formed in the so-called Suvodol Bay which enters the slopes of the Selecka mountain. According to Karajanovich et Ivanovski (1979), the pitch is built by Quaternary sediments. These sediments lay on Pliocene sediments along with valley river Crna.

The area of the **Vitolište** is located about 46 km SE of the town of Prilep (Fig. 5). Geological composition is diverse, and there are separated complexes of Precambrian, Cambrian, and Paleozoic metamorphic rocks. Also, there are Tertiary and Quaternary sediments and magmatic rocks. The Precambrian metamorphic complex is characterized by gneisses – the mica schists series, where the most dominant are diverse types of gneisses, as well as, marble series composed of dolomite and calcite marbles (Dumurdzanov et al., 1981). The Cambrian sediments lay transgressive over the Precambrian rocks, and are presented with phyllite-mica schist, carbonaceous schists, and marbles. The Mesozoic complex is composed of Jurassic magmatic rocks, ophiolites presented with gabbro, peridotite, serpentinite, and cretaceous sediments (sandstones, shales, clay shales, conglomerates, etc.).

The Tertiary – Quaternary complex is composed of Pliocene sediments, Pliocene – Pleistocene, and Holocene rocks. After lithostratigraphical studies of the Pliocene sediments in the basin of Mariovo, two units had been determined:

- Lower facies of gravel, sand, and clay with layers of coal,
- Upper facies of gravel, sands, and silty clays material.

According to Dumurdzanov et al. (1981), in the Lower facies in the locality Vitolište are found fossil plants similar to those of Zhivoyno village (*Castanea sativa, Taxodium distichum, Quercus pseudocastanea*, etc.).

This facies begins with a transgressive material of gravel and siltstone which is covered with layers of sand, sandy clay, siltstone and clay. According to the geological map (Fig. 5) comes to changes of sediments without any rule in a vertical and horizontal row.

The Upper Pliocene facies is presented by yellow gravel and gravel clay.

At one part of the locality, there is Pliocene – Pleistocene complex, presented by andesites modified by hydrothermal activities, volcanogenic – sediment formation, breccia, quartzlatites, and tuffs. In this complex is found fossil flora with late Pliocene age.

The andesite appearance is connected with volcano activities of Kozuf area and can be found on several sites which penetrate Triassic sediments. The volcanic sediments appear in several places as an extension of sedimentation in Pliocene Lake.

At the beginning of the Upper Pliocene the mountains surounding Mariovo (Vitolište) has been

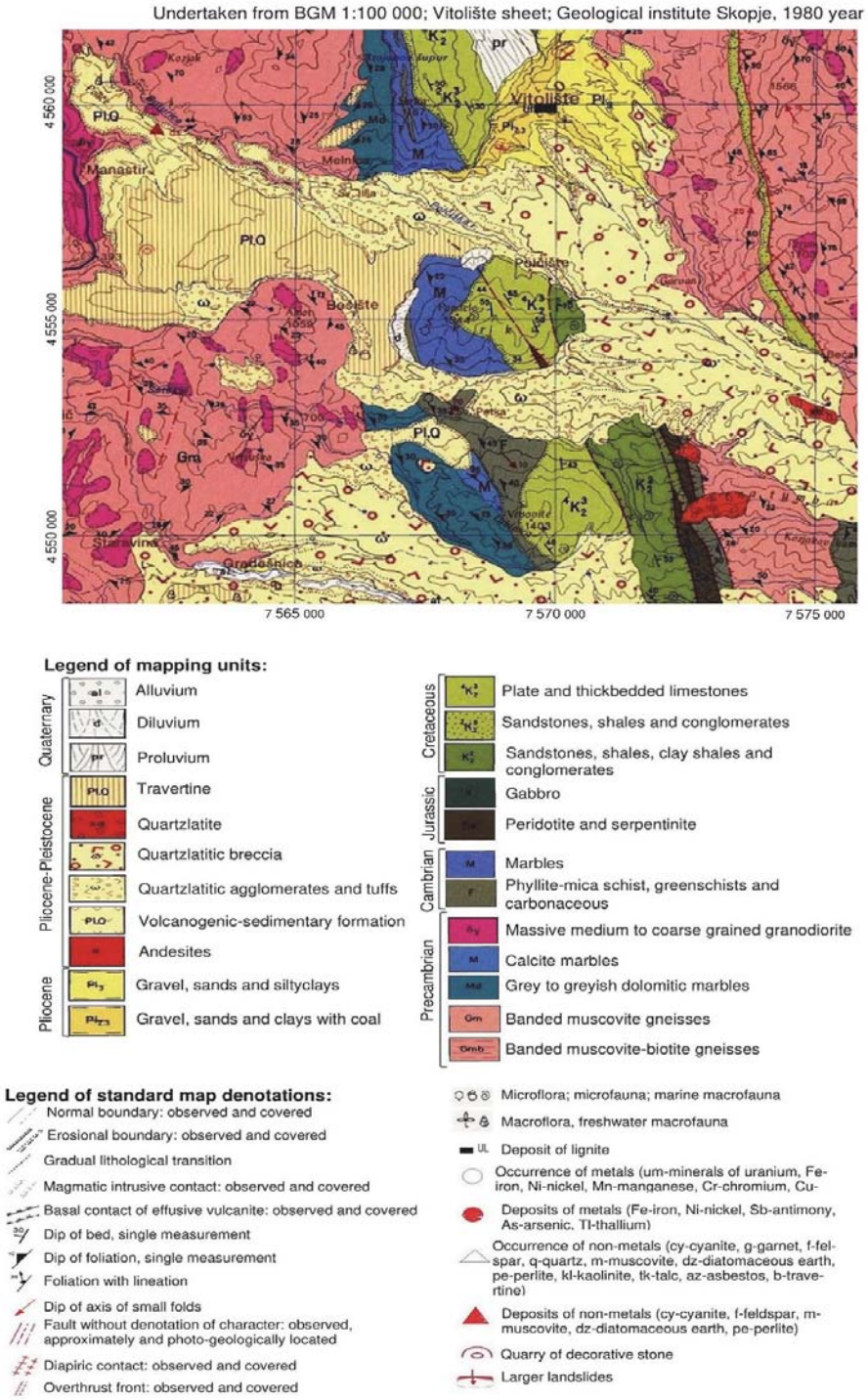

Figure 5. Geological map of the locality Vitolište.

uplifted again and at the future lake bottom coarse terrigenous material was accumulated. Tectonic movements, accompanied by the intensive activity of volcanoes Nidze and Kozuf producing tephra material, filed up to Pliocene Lake by tuff, agglomerate and volcanic breccia. Because of the volcanic activity comes to deposition of volcanic breccia and quartzlatite in the Pliocene Lake. Most probably the last phase of sedimentation in Pliocene Lake is the deposition of porous limestone. Holocene is present with alluvial and diluvial deposits.

MATERIAL AND METHODS

The palaeobotanical collection of the MNH Skopje consists of 159 fossils with inventory numbers from 4001618 to 4001777. The fossil material from the palaeobotanical collection of the museum is mainly imprints of leaves of angiosperms. A small part of them are leafy twigs of gymnosperms, and there are only three imprints of disseminules, respectively: a cone of the genus *Pinus*, a samara of the genus *Fraxinus* and an acorn of the genus *Quercus*.

The sedimentary rocks that preserved the leaf imprints has a different composition at the individual localities, as mentioned above. These are mainly diatomite and clays.

The fossil material from the Sudik locality was determined by S. Stoyanovich, and the one from the other three sites was determined or revised by V. Bozukov. The determination of leaf types followed the scheme for leaf morphology of the angiosperms plants of Dilcher (1974).

In some cases, when fossil material is determined and where there are not enough morphological features for its exact identification, we have used the abbreviations “aff.” (short for "species affinis") and “cf.” (short for "confer", *meaning* "compare"). The first abbreviation is used when the fossil material is to be compared and it is the closest relative of a recent species. The second abbreviation is used when fossil species are compared. According to Palamarev & Petkova (1987), when the fossil specimens display all leaf morphological features typical of contemporary

species, it is difficult to determine a separate fossil species. This is the reason why the authors add "fossilis" (foss.) following the species name of the recent species. That way, the fossil form of the contemporary species is separated from the recent one (for example, *Castenea sativa* foss.). The current paper applies the same approach.

RESULTS

The botanical identification of the fossil material yielded 60 taxa (Table 2), of which 53 are determined until species level, while five are determined to a genus level and one to a class level.

The most abundant is the material from Suvodol locality - 84 specimens. It includes 15 families and 23 genera. The most common family here is the Fagaceae with four genera. The genera *Quercus, Fagus* and *Castanea* dominate the number of imprints over other tree species in this local palaeoflora. The family Lauraceae is represented by three genera, but is very weak in quantitative terms. The families Betulaceae and Taxodiaceae follow with two genera each and a relatively significant presence. Family Myricaceae with two genera dominates quantitatively over other shrubs.

Thirty-one fossils have been preserved from the Vitolište locality. It registered 15 families and 17 genera. The two genera *Quercus* and *Fagus*, which are members of the family Fagaceae, dominate the number of imprints over other tree species. Family Lauraceae is represented by two genera, but is very weak in quantitative terms. Family Myricaceae with genus *Myrica* dominates quantitatively over other shrubs.

The fossil material from the Oslomej locality represents 24 imprints. Seven families and 10 genera are registered in it. Again, the family Fagaceae dominates among tree species with the genera *Quercus* and *Fagus*. Family Salicaceae is represented by two genera. Family Lauraceae is represented by two genera, but is very weak in quantitative terms.

The poorest in composition and quantity is the Sudik locality - 19 imprints. Seven families and nine genera are registered in it. Family Lauraceae dominates both taxonomically with 2 genera and 3 species and quantitatively. Second in importance is the family Fagaceae with two extinct genera – *Eotrigonobalanus* and *Trigonobalanopsis*. The other families have one fossil of one species. An exception is the family Rhamnaceae, whose species *Ziziphus ziziphoides* is represented by 4 fossils, which testifies to its relatively wider distribution.

DISCUSSION

The difference between the Paleogene (late Eocene) flora from Sudik (Mihajlovic & Lyubotenski 1994) and the late Neogene flora from Oslomei,

Table 2. An alphabetical list of taxa in the collection, their geographical and stratigraphical distribution and specimen inventory number.

Taxon	Eocene	Pliocene		
	Sudik	Oslomej	Suvodol	Vitolište
Alnus aff. *glutinosa* Gaertn.			4001731	
A. gaudinii (Heer) Knobloch & Kvaček			4001722 4001766 4001767	
Ampelopsis hibschii Bužek, Kvaček & H. Walther			4001733	
Betula subpubescens Goepp.			4001748	
Bumelia aff. *lanuginosa* (Michx.) Pers.				4001688
Callitriche aff. *cophocarpa* Sendtn. (Fig. 6)	4001636			
Castanea sativa Mill. foss.			4001698 4001700 4001724 4001727 4001756 4001763 4001777	

Celastrus sp.	4001631			
Cephalotaxus fortunei Hook. foss.			4001706	
Comptonia diffformis (Sternb.) Berry			4001741	
Daphnogene bilinica (Unger) Kvaček & Knobloch	4001620 4001622		4001747	
D. cinnamomea (Rossm.) Knobl.	4001618 4001619	4001660		
Daphnogene lanceolatum Ung.				4001678
Dicotiledonae gen. set spec. indet.	4001635			
Eotrigonobalanus cf. *furcinervis* (Rossm.) Walth. et	4001634			
Eotrigonobalanus furcinervis (Rossm.) Walth.			4001707	
"Eucalyptus" oceanica Ung. The systematic affinity to genus *Eucalyptus* is questiona-	4001624			4001674
Fagus gussonii Masal.		4001637 4001638 4001642 4001643 4001645 4001646 4001647 4001650	4001703 4001705 4001717 4001719 4001746 4001751 4001770 4001771	4001690 4001665
Ficus congener Pilar				4001680
Fraxinus sp. - samara			4001776	
Glyptostrobus europaeus (Brongn.) Ung.			4001711 4001754 4001760 4001772	4001675
Laurophyllum acutimontanum Mai	4001633			
Laurophyllum sp.	4001629			
Libocedrites salicornioides (Ung.) Endl.				4001676
Lauraceophyllum (*Litsea*) *primigenia* (Unger.) Givulescu			4001710	
Magnolia dsundzaeana (Palb.)Takht.			4001704	
M. mirabilis Kolak.		4001658		4001689
Myrica banksiaefolia Ung.			4001697 4001708 4001713 4001714 4001715 4001718 4001733 4001734	4001684 4001685 4001691 4001692

			4001736 4001737 4001738 4001739 4001740 4001749	
Nyssa ornithobroma Ung.				4001686
Paleolobium heterophyllum Ung. = *Sloanea olmediaefolia* (Unger) Kvaček et Hably				4001683
Persea braunii Heer		4001657		
Persea pliocenica (Laurent) Kolak.			4001693	4001672
Phragmites sp.				4001661
Pinus aff. *halpensis* Mill.			4001758	
Populus alba L. foss.			4001696	
P. nigra L. foss.		4001639		
P. populina (Brongn.) Knobloch				4001663
Potamogeton sp.			4001728	
Quercus aff. *ilex* L. - acorn				4001664
Q. cardanii Mass.		4001648 4001649 4001651	4001695 4001712 4001716 4001721 4001725 4001729 4001730 4001757 4001759 4001768 4001769 4001775	4001666 4001669 4001671 4001681
Q. cf. *lukidensis* Knobloch et Velitzelos				4001673
Q. kubinyi (Kovats ex Ettingsh.) Czeczott			4001744 4001750 4001752 4001753	
Q. mediterranea Ung.			4001699 4001702 4001723 4001726 4001733 4001764 4001765 4001774	4001662
Q. neriifolia A. Braun			4001733	
Q. pseudocastanea Goepp.			4001755	
Q. sosnowskyi Kolak.				4001667 4001670
Rhododendron ponticum L. foss.			4001709 4001720	
Ruppia pannonica Ung.				4001679

Typha latissima A. Braun		4001656	4001745	4001668
Ulmus carpinoides Goepp.		4001654		
Vitis sylvestris C.C. Gmel. foss.		4001644		
Ziziphus ziziphoides (Ung.) Weyland	4001623 4001628 4001630 4001632			4001687

Figure 6. *Callitriche* aff. *cophocarpa* Sendtn. (measuring bar 1 cm).

Suvodol and Vitolište is significant. It is in line with the changes in the European flora in time. These changes are related to the gradual disappearance of paleotropic elements and their replacement by arctotertiary ones. Climate change during the transition from the Paleogene to the Neogene has led to changes in the flora and vegetation of the European continent, to finally reach their modern appearance. Despite the small amount of fossil material from Sudik, it is clear that arctotertiary elements are missing. The composition of this palaeoflora includes exotic genera and their species, whose recent analogues are not found in Europe today or have completely disappeared. Extinct genera from the families Lauraceae (*Daphnogene*, *Laurophyllum*) and Fagaceae (*Eotrigonobalanus, Trigonobalanopsis*) played a dominant role here.

In contrast, the three late Neogene floras are dominated by species close in morphology to modern European ones (Pantich & Nikolich, 1956; Dumurdzanov et al., 1981; Mihajlovich & Lazarevich 2004). The role of the family Lauraceae, for example, is greatly reduced and there are single specimens. The families Fagaceae and Betulaceae are represented by species that are related to the recent ones of genera *Quercus, Fagus*, *Castanea*, *Alnus, Betula*. But there are still members of the family Taxodiaceae, whose role in the formation of coal deposits is great.

Regarding the age of some of the late Neogene flora considered here, it is necessary to make a refinement that takes into account the changes made in the geochronological scale in recent decades (Popov et al 2004, 2006). In particular, it is a question of the transfer of Pontian from the Pliocene epoch to the Miocene epoch. This means that the palaeoflora of Oslomej should be considered as early Pliocene (Dacian) and not as defined by Pantich and Nikolich (1956) middle Pliocene. Moreover, the same authors compare the palaeoflora from Oslomej and that from Kurilo (Sofia Basin, Bulgaria) (Stoyanoff & Stefanoff, 1929), declaring the first one to be younger. According to the latest data, the flora from Kurilo is late Pontian-early Dacian age (Palamarev et al. 2005), Which means that the palaeoflora from Oslomej should be late Miocene (late Pontian) age.

The age of Vitolište palaeoflora is determined by Dumurzhanov et al. (1981) as late Pliocene. The authors compare it with that of Zhivoyno (Kitanov 1996), but the relatively large presence of fossils of the genus Myrica and the lack of such from Zhivoyno suggests the possibility that the age is the Miocene-Pliocene boundary (late Pontian-early Dacian). A similar composition of the fossil flora from Vitolište is possessed by the palaeoflora from Garmen, Gotse Delchev Basin (Kitanov 1984a), which was discovered in SW Bulgaria and is dated as late Pontian-early Dacian age (Kitanov 1984b).

The palaeoflora from Suvodol deserves special attention, as the material from it in the collection is the most abundant both in taxonomic and quantitative terms. The flora-bearing sediments from the Suvodol coal mine were studied by palynological analysis (Ivanov 2002) and diatom analysis (Ognianova-Rumenova 2005). The results show that their age is the boundary between the Miocene and Pliocene. Fossil macroflora from this locality was studied by Mihajlovich and Lazarevich (2004).

CONCLUSIONS

One of the main goals of museums is to present scientific facts in a shape convenient for perception by its various visitors. Based on the presence of the palaeobotanical collection, the MNH Skopje can present to the citizens of the capital and its guests an interesting exposition. In this way the visitors will be able to learn about the possibilities for fossilization of plant parts and see traces of plants that existed millions of years ago. With the opportunity to present fossils from different geological periods - Paleogene and Neogene, it can clearly and easily present the course and trends in the evolution of flora and vegetation on the territory of RN Macedonia. This will certainly expand people's knowledge of the nature that surrounds them.

From a scientific point of view, the palaeobotanical collection of the museum will be a database for palaeobotanical research in RN Macedonia. Information from it should be used to clarify the stratigraphy of the various flora-bearing sediments in the country and neighboring countries.

The increase of the collection, the inclusion of more fossils in it from more localities will contribute to the increase of its scientific significance and will make the exposition of phytofossils more attractive.

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Contribution to the knowledge on the gastropods (Mollusca, Gastropoda) of the Mountains Ilinska and Plakenska (Republic of North Macedonia). Part 2.

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Abstract
The work presents the second part of the results of a collecting trip in July 2008 in the mountains Ilinska and Plakenska (Republic of North Macedonia). Eleven species are added to the malacofauna of the mountains. Currently, thirty taxa are known as inhabitants of the area.

Key words: terrestrial gastropods, new data, Ilinska and Plakenska mountains, Republic of North Macedonia

Introduction

Ilinska (Liska, 1908 m) and Plakenska (Stalev Kamen, 1998 m) Mountains are medium-high mountains located in remote area of the south-western parts of Republic of North Macedonia. For this reason, the information on the gastropods fauna of these mountains is scarce. In the first publication for the region Dedov and Subai (2012) described a new species *Gyralina* (*Gyralina*) *nautilopsis*. Dedov (2015) reports 19 species collected in one of the two mountains or in both mountains: *Allaegopis skandergianus* (Polinski, 1924), *Bulgarica vetusta* (Rossmässler, 1836), *Candidula rhabdotoides* (A.J. Wagner, 1928), *Chilostoma* (*Dinarica*) *serbica* (Kobelt, 1872), *Chondrulara microtragus* (Rossmässler, 1839), *Gyralina nautilopsis* Dedov and Subai, 2012, *Gyralina* (*Gyralina*) cf. *velkovrhi* Riedel, 1985, *Daudebardia rufa* (Draparnaud, 1805), *Deroceras* cf. *turcicum* (Simroth, 1894), *Helix lucorum* Linnaeus, 1758, *Jaminia quadridens* (Müller, 1774), Limacidae, *Monacha* sp., *Morlina* cf. *glabra* (Rossmässler, 1835), *Tandonia* sp., *Triloba thaumasia* (Sturany, 1907), *Vitrina pellucida* (Müller, 1774), *Xerolenta obvia* (Menke, 1828) and *Zebrina detrita* (Müller, 1774). These two publications summarize all available data on the land gastropods fauna of the two mountains.

Material and Methods

The materials were collected by the author on 14-16 July 2008. The snails were collected by hand and soil -sifting. The material is deposited in the collection of the Institute of Biodiversity and Ecosystems Research, B.A.S. The localities are presented in Tab. 1. and Fig. 1.

Results and discusion

Ilinska Mountain is a comparatively high mountain among the medium-high mountains in Macedonia. The highest peak of the mountain is Liska (1908 m). Ilinska mountain has a complex geology, the bedrock is generally composed of Devonian marbles and phylitic schist which is similar to other medium-high mountains in this broader region. Ilinska Planina is characterized by moderate continental climate and mountainous climate on its upper parts. Average altitude is 1159 m. Total area 293.65 km2. (Melovski et al. 2013)

Plakenska Planina represents the middle part of the Ilinska Planina-Plakenska Planina-Bigla range. Unlike Ilinska Planina on the north, Plakenska Planina is almost exclusively composed of silicate bedrock. Moderate continental climate is dominant in the region, and mountainous climate prevails on higher elevations. Average altitude is 1288 m. Total area 191.57 km2. (Melovski et al. 2013)

Currently, the 19 species of land gastropods are known from the mountains of Ilinska and Plakenska (Dedov and Subai 2012, Dedov 2015). The newly reported data are presented in Tab. 2. Eleven species of terrestrial gastropods are newly reported for the region of Ilinska and Plakenska Mountains. Together with already published data thirty taxa are known as inhabit-

ants of the mountains. For 10 species already announced by Dedov (2015) new localities are provided (Tab. 2).

All reported species are newly found for both mountains and expand the knowledge for the species distribution in the region. Despite the relatively high number of species, the information for these regions is still scarce and both mountains are poorly studied. For example, vitrinid shells were found that seem to belong to the genus *Eucobresia*. If this will be confirmed by the anatomical survey – it will be a new genus and species for the Republic of North Macedonia. The new collection efforts will enrich the knowledge of the malacofauna in the area. The number of the species for both mountains is expected to increase, and additional regional endemics is possible to be find, especially in the carbonate parts of Ilinska Mountain.

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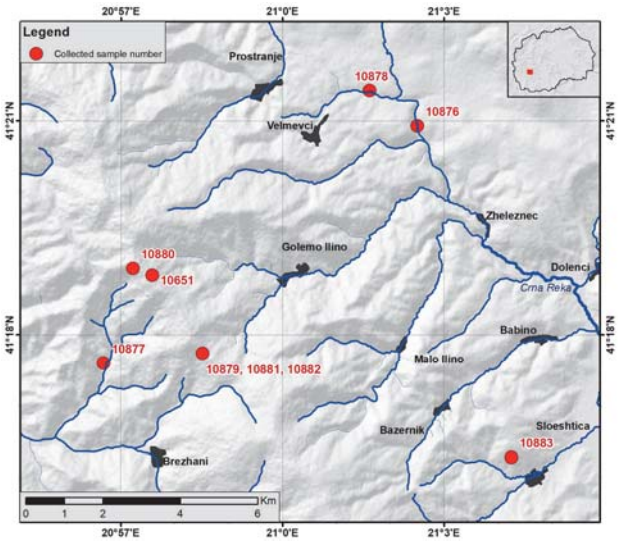

Fig. 1.

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Tab. 1. Localities of the mountains Ilinska and Plakenska, Republic of Macedonia, leg., det. I. Dedov. The geocoordinates are restored and not represent the specific point of collection.

Coll.No.	Locality/data	Habitat	Altitude (m)
Ilinska mountain			
10651	Strmna area, 14 VII 2008, N41.314024 E20.95981	Fagus forest, in rotten trunks	1500 – 1650
10876	Lasejca ridge, Zli Dol river's gorge (drained), road-split to vill. Golemo Ilino, 15 VII 2008, N41.34891 E21.041861	*Quercus*, *Carpinus*, limestones	800 – 820
10877	Near Jaorec cave (=Yaorets), 16 VII 2008 N41.293402 E20.944787	limestone rocks, bushes	1030
10878	Road Golemo Ilino – Velmevci (=Velmevtsi), Zli Dol river valley, 15 VII 2008 N41.35713 E21.027043	limestone rocks	900 – 950
10879, 10881, 10882	Iglar area, up to "Ilinska crkva" camp, 14-16 VII 2008, N41.295667 E20.975414	limestone rocks, under stones	1550
10880	Strmna area, 14 VII 2008, N41.315556 E20.953862	limestone pastures	1650 – 1850
Plakenska mountain			
10883	Up to vill. Sloeshtitsa, Zmejova cave, 15 VII 2008, N41.271291 E21.070871	limestone, nearby cave	950

Tab. 2. Terrestrial gastropod species from the mountains Ilinska and Plakenska, Republic of Macedonia (in alphabetic order). Used abbreviations: ad – adult, jv – juvenile, d – dead, l – alive, spm – specimens.

№	species	Coll.No./specimens	data source
1.	*Aegopinella minor* (Stabile, 1864)	10876/4; 10883/4	new data
2.	*Alinda (Pseudalinda) serbica* (Moellendorff, 1873)	10651/5add	new data
3.	*Allaegopis skandergianus* (Polinski, 1924)	see Dedov (2015)	Dedov (2015)
4.	*Bulgarica vetusta* (Rossmässler, 1836)	see Dedov (2015)	Dedov (2015)
5.	*Candidula rhabdotoides* (A. J. Wagner, 1928)	10877/4jvd; 10879/13add; 10882/10add	new data, Dedov (2015)
6.	*Chilostoma* (*Dinarica*) *serbica* (Kobelt, 1872)	10876/1jvl	new data, Dedov (2015)
7.	*Chondrulara microtragus* (Rossmässler, 1839)	10876/5add; 10877/20add	new data, Dedov (2015)
8.	*Cochlodina (Cochlodina) laminata* (Montagu, 1803)	10651/4add	new data
9.	*Daudebardia rufa* (Draparnaud, 1805)	see Dedov (2015)	Dedov (2015)
10.	*Deroceras* cf. *turcicum* (Simroth, 1894)	see Dedov (2015)	Dedov (2015)
11.	*Gyralina* (*Gyralina*) *nautilopsis* Dedov & Subai, 2012	see Dedov and Subai (2012), Dedov (2015)	Dedov and Subai (2012), Dedov (2015)

12.	*Gyralina* (*Gyralina*) cf. *velkovrhi* Riedel, 1985	see Dedov and Subai (2012), Dedov (2015)	Dedov and Subai (2012), Dedov (2015)
13.	*Helix lucorum* Linnaeus, 1758	10876/1dd, 1jvd	new data, Dedov (2015)
14.	*Jaminia quadridens* (Müller, 1774)	10877/29add; 10878/1add; 10879/11add; 10882/19add	new data, Dedov (2015)
15.	Limacidae indet.	see Dedov (2015)	Dedov (2015)
16.	*Merdigera obscura* (O. F. Müller, 1774)	10876/5add; 10878/2add; 10883/3spm	new data
17.	*Monacha* sp.	10876/3add	new data, Dedov (2015)
18.	*Monachoides incarnatus incarnatus* (O. F. Muller, 1774)	10876/1add	new data
19.	*Morlina* cf. *glabra* (Rossmässler, 1835)	10876/2add, 3jvd; 10878/1; 10879/2add; 10880/1add; 10883/1add	new data, Dedov (2015)
20.	*Punctum* (*Punctum*) *pygmaeum* (Draparnaud, 1801)	10879/1add	new data
21.	*Pyramidula cephalonica* (Westerlund, 1898)	10879/5spm	new data
22.	*Sphyradium doliolum* (Bruguiere, 1792)	10876/3add	new data
23.	*Tandonia* sp.	see Dedov (2015)	Dedov (2015)
24.	*Triloba thaumasia* (Sturany, 1907)	see Dedov (2015)	Dedov (2015)
25.	*Truncatellina claustralis* (Gredler, 1856)	10879/ many, mix with T. cylindrica	new data
26.	*Truncatellina cylindrica* (A. Ferussac, 1807)	10879/ many, mix with T. claustralis; 10882/1add	new data
27.	Vitrinidae cf. *Eucobresia* sp.	10876/1add; 10881/3add; 10882/4spm	new data
28.	*Vitrina pellucida* (Müller, 1774)	10879/1spm	new data, Dedov (2015)
29.	*Xerolenta obvia* (Menke, 1828)	10877/1add; 10880/8add	new data, Dedov (2015)
30.	*Zebrina detrita* (Müller, 1774)	10876/1add; 10877/18add; 10878/4add; 10879/2add; 10882/6add	new data, Dedov (2015)

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Ground beetles (Coleoptera: Carabidae) in the collection of the National Museum Dr. Nikola Nezlobinski in Struga, Republic of North Macedonia

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Abstract
The collection of ground beetles (Coleoptera: Carabidae) in the National Museum „Dr. Nikola Nezlobinski" of Struga (North Macedonia) was reviewed in 2011 and 2013. The collection was established by Dr. Nikola Nezlobinski. Most of the specimens were collected in the period 1924-1935. A total of 130 species were identified originating from the surroundings of Struga town, Jablanica mountain, Korab mountain, Bistra mountain, Ohrid city, etc. Specimens from former Struga wetland give special value to the collection.

Key words: ground beetles, Carabidae, collection, museum, Nikola Nezlobinski, Struga

Introduction

The collection of the museum in Struga was initiated by Dr. Nikola Nezlobinski (Nezlobinsky in Russian transliteration). Nikola Nezlobinski was born in Pyatigorsk (Russia) on 14.05.1885. He lived in Kriva Palanka from 1921 to 1924 and moved to Struga in August 1924 as a medical doctor in the hospital unit for fighting of malaria (Cvetkovski and Joseska, 2012). The first exhibitions of his zoological collection were held in 1927 and 1928. The year of the establishment of the museum is considered to be 1928 (Georgievski, 1976) while the formal foundation of the museum was in 1937 as a Zoological museum of the Health department in Struga. The present formal name of the museum is National Museum „Dr. Nikola Nezlobinski".

The number of preserved specimens of ground beetles in the collection is small (436) but with great historic and paleoecological value. This collection holds the oldest ground beetle material preserved in the museum collections in North Macedonia. It is interesting that large part of the collection consisted of specimens from the former Struga wetland which was completely dried out in 1960s.

Materials and methods

The determination of the ground beetle species in the collection of the National Museum „Dr. Nikola Nezlobinski" in Struga was carried out during several visits in 2011 and 2013. A Lomo MBS10 stereomicroscope was used.

The original labels in the collection (sometimes referring to several specimens) are glued under the specimens. These labels were kept as they were. New labels with the correct species names were placed on each of the pinned specimens (Fig. 1).

Figure 1 Part of the collection of ground beetles (Box #1)

Results and discussion

The collection contains 436 specimens and all of them are displayed for visitors. They are placed in nine boxes (#1, #3, #5, #11, #12, #15, #17, #20 and #21)

The oldest specimen collected (*Bembidion fumigatum*) dates from March 1922 whereas the oldest specimen in the collection of Macedonian Natural History Museum in Skopje dates from 12.06.1928 (Hristovski et al., 2016). The last collected specimen dates from October 1952 (the only specimen collected after the death of Nikola Nezlobinski). The majority of specimens were collected in the period 1924-1935 (Fig. 2).

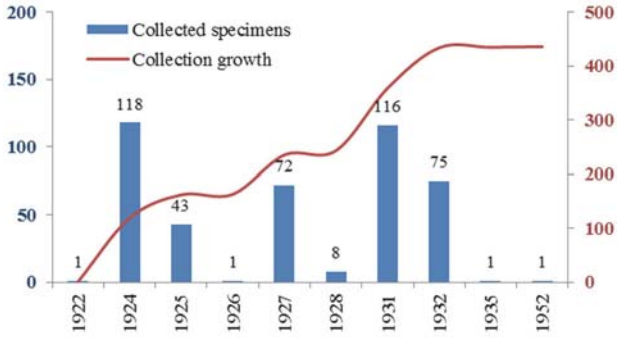

Figure 2. Number of the collected specimens per year in the Carabidae collection of the National Museum Dr. Nikola Nezlobinski in Struga

None of the labels has the name of the collector. However, all of the labels have the same handwriting, except for the above mentioned specimen from 1952. Based on the original handwriting of Nezlobinsky presented in his biography (Cvetkovski and Joseska, 2012) we believe that all of these labels were written by Nikola Nezlobinski.

However, it remains uncertain who was the original collector of the specimens since some labels show dates between March 1922 and June 1924. According to his biography he moved to Struga in August 1924 (Cvetkovski and Joseska, 2012).

The majority of specimens were collected from Struga area. In total, 235 specimens were collected from "Struga" and 108 from "Jablanica" mountain (including the area of "Rujan" in the south part of the mountain) which consist 78.7% of the whole collection. The rest of the specimens originate from Korab, Bistra, Ohrid, etc. (Fig. 3).

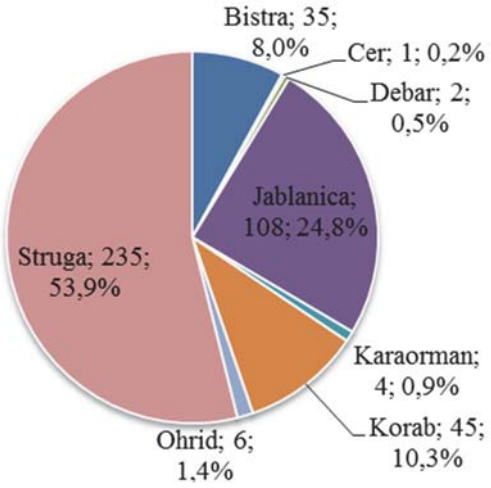

Figure 3. Origin of the collected specimens in the Carabidae collection of the National Museum Dr. Nikola Nezlobinski in Struga

Some of the labels contain the name of the genus (e.g. *Carabus* sp., *Procerus* sp., *Calosoma* sp., *Ophonus* sp., *Amara* sp.), however many of them incorrect.

Many of the specimens of ground beetles are in poor condition due to mould or missing body parts. This disabled the determination of 17 specimens (belonging to eight genera). Out of the remaining 419 specimens we identified 130 species.

The ground beetles from "Struga" are represented by 85 species. Most of them are characteristic for wetland habitats. Thus, we can assume that most of them were collected in the former Struga wetlands. The exceptions are some mountainous and xerothermic species which were probably mislabelled or collected from the surrounding habitats (*Tapinopterus rambousekianus, Cymindis axillaris* and *Cymindis lineata*).

There are 42 species from Jablanica mountain. All of them were already reported for this mountain (Hristovski et al., 2010; Hristovski and Guéorguiev, 2015). There are also 15 and 13 species from Korab and Bistra mountains, respectively. Other regions are represented by fewer species: Ohrid (5), Karaorman (2), Cer (1) and Debar (1).

The following species can be considered as very rare in the Macedonian fauna since they were reported solely on the specimens from the collection of the museum in Struga: *Elaphrus weissi, Chlaenius tristis, Ophonus rupicola, Philorhizus sigma* and *Amara majuscula*. However, some of them are already found in

other regions in North Macedonia (unpublished data).

Checklist of ground beetle species in the collection of the Museum Dr. Nikola Nezlobinski in Struga

The following is the list of species and localities of the ground beetle specimens deposited in the Museum Dr. Nikola Nezlobinski in Struga. Already published data (Hristovski and Guéorguiev, 2015) are marked with an asterisk (*).

***Leistus rufomarginatus* (Duftschmid, 1812)**
Jablanica, IV.1927, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)*
***Nebria brevicollis* (Fabricius, 1792)**
Struga, IV.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, VI.1925, 1 s., leg. N. Nezlobinsky (Box #12)*
***Nebria kratteri kratteri* Dejean, 1831**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
Jablanica, Rujan, IX.1931, 7 s., leg. N. Nezlobinsky (Box #3)
***Nebria macedonia rambouseki* Mařan, 1938**
Jablanica, IX.1931, 2 s., leg. N. Nezlobinsky (Box #3)
Jablanica, VII.1931, 1 s., leg. N. Nezlobinsky (Box #3)
***Cicindela campestris* Linnaeus, 1758**
Bistra, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Jablanica, Rujan, VIII.1924, 1 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Jablanica, Rujan, VIII.1924, 2 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Karaorman, VI.1927, 2 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Karaorman, VII.1928, 1 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Korab, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Struga, IV.1924, 2 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
Struga, VII.1925, 1 s., leg. N. Nezlobinsky; sub: *Cicindela* sp. (Box #11)
***Calosoma relictum* Apfelbeck, 1918**
Korab, VII.1931, 16 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)
Korab, VII.1932, 3 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)
***Calosoma sycophanta* (Linnaeus, 1758)**
Jablanica, Rujan, VI.1924, 3 s., leg. N. Nezlobinsky; sub: *Calosoma* sp. (Box #20)*
***Carabus cavernosus cavernosus* I. Frivaldszky von Frivald, 1838**
Korab, VII.1932, 3 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)*
***Carabus convexus dilatatus* Dejean, 1826**
Jablanica, Rujan, IX.1931, 5 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)
Struga, VI.1925, 2 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)
***Carabus coriaceus excavatus* Charpentier, 1825**
Jablanica, IX.1931, 3 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
Jablanica, Vevchani, X.1952, 1 s., leg. unknown; sub: *Carabus* sp. (Box #20)
Struga, V.1924, 3 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
Struga, VI.1925, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
Struga, VII.1925, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
***Carabus gigas* Creutzer, 1799**
Jablanica, V.1924, 1 s., leg. N. Nezlobinsky; sub: *Procerus* sp. (Box #20)
***Carabus granulatus interstitialis* Duftschmid, 1812**
Struga, X.1924, 2 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)*
***Carabus intricatus* Linnaeus, 1761**
Jablanica, IX.1931, 2 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
Jablanica, Rujan, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
Jablanica, Rujan, X.1924, 3 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
***Carabus neumeyeri* Schaum, 1856**
Jablanica, Rujan, IX.1931, 3 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
Korab, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)*
***Carabus scabriusculus bulgarus* Lapouge, 1908**
Struga, VII.1925, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)*
***Carabus violaceus dryas* Gistl, 1857**
Jablanica, VIII.1925, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)

***Cychrus semigranosus albanicus* Hopp, 1929**
Jablanica, Rujan, IX.1931, 2 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #20)
***Elaphrus weissii* Dostal, 1996**
Struga, V.1927, 3 s., leg. N. Nezlobinsky; sub: *Elaphrus* sp. (Box #15)*
***Omophron limbatum* (Fabricius, 1777)**
Struga, VI.1932, 1 s., leg. N. Nezlobinsky; sub: *Omophron* sp. (Box #11)*
***Aptinus merditanus merditanus* Apfelbeck, 1918**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
***Brachinus explodens* Duftschmid, 1812**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky; sub: *Brachynus* sp. (Box #21)*
Struga, VI.1925, 1 s., leg. N. Nezlobinsky; sub: *Brachynus* sp. (Box #21)*
Struga, VI.1932, 1 s., leg. N. Nezlobinsky; sub: *Brachynus* sp. (Box #21)*
***Dyschirius globosus* (Herbst, 1784)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Asaphidion flavipes* (Linnaeus, 1761)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Elaphrus* sp. (Box #15)*
Struga, X.1924, 2 s., leg. N. Nezlobinsky; sub: *Elaphrus* sp. (Box #15)
***Bembidion assimile* Gyllenhal, 1810**
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #5)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Bembidion balcanicum* Apfelbeck, 1899**
Bistra, VII.1932, 2 s., leg. N. Nezlobinsky (Box #5)
***Bembidion biguttatum* (Fabricius, 1779)**
Struga, V.1928, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Bembidion caucasicum* (Motschulsky, 1844)**
Jablanica, VII.1931, 8 s., leg. N. Nezlobinsky (Box #5)
***Bembidion dalmatinum dalmatinum* Dejean, 1831**
Jablanica, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Paecilus* sp. (Box #21)
***Bembidion deletum deletum* Audinet-Serville, 1821**
Korab, VII.1932, 1 s., leg. N. Nezlobinsky (Box #3)*
***Bembidion fumigatum* (Duftschmid, 1812)**
Struga, III.1922, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
***Bembidion lampros* (Herbst, 1784)**
Jablanica, IX.1932, 2 s., leg. N. Nezlobinsky (Box #5)
***Bembidion properans* (Stephens, 1828)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Paecilus* sp. (Box #21)*
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Elaphrus* sp. (Box #15)*
***Bembidion subcostatum vau* Netolitzky, 1913**
Bistra, VII.1932, 14 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Bistra, VIII.1932, 2 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Bembidion tetracolum tetracolum* Say, 1823**
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
***Bembidion vseteckai dissimile* (G. Müller, 1943)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #15)*
Struga, VI.1932, 3 s., leg. N. Nezlobinsky (Box #15)*
***Bembidion* sp.**
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Paecilus* sp. (Box #21)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Paratachys bistriatus* (Duftschmid, 1812)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Trechus priapus priapus* K. Daniel, 1902**
Korab, VII.1932, 1 s., leg. N. Nezlobinsky (Box #3)
***Trechus quadristriatus* (Schrank, 1781)**
Jablanica, IX.1932, 1 s., leg. N. Nezlobinsky (Box #5)
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)
***Trechus* sp.**
Bistra, VII.1932, 1 s., leg. N. Nezlobinsky (Box #5)
***Callistus lunatus lunatus* (Fabricius, 1775)**
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Callistus* sp. (Box #15)*
***Chlaenius tristis* (Schaller, 1783)**
Struga, VIII.1931, 1 s., leg. N. Nezlobinsky (Box #12)*
***Chlaenius vestitus* (Paykull, 1790)**
Struga, IV.1925, 1 s., leg. N. Nezlobinsky; sub: *Chlaenius* sp. (Box #21)
***Anisodactylus binotatus* (Fabricius, 1787)**
Korab, VII.1932, 1 s., leg. N. Nezlobinsky (Box #3)*
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #3)*
Struga, II.1927, 2 s., leg. N. Nezlobinsky (Box #12)
***Anisodactylus nemorivagus* (Duftschmid, 1812)**
Jablanica, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)

***Diachromus germanus* (Linnaeus, 1758)**
Korab, VII.1932, 3 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
Struga, IV.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
***Carterus dama* (Rossi, 1792)**
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, XI.1931, 1 s., leg. N. Nezlobinsky (Box #12)*
***Acinopus picipes* (Olivier, 1795)**
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky; sub: *Percus* sp. (Box #21)
***Gynandromorphus etruscus* (Quensel, 1806)**
Struga, XI.1931, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Harpalus affinis* (Schrank, 1781)**
Bistra, VIII.1932, 2 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Jablanica, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
Struga, I.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VI.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Harpalus dimidiatus* (P. Rossi, 1790)**
Ohrid, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VI.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Harpalus distinguendus distinguendus* (Duftschmid, 1812)**
Ohrid, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, III.1924, 3 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, III.1927, 2 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, V.1928, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, VI.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, VI.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, XI.1931, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, XI.1931, 2 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Harpalus pumilus* Sturm, 1818**
Struga, IV.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
***Harpalus rubripes* (Duftschmid, 1812)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
***Harpalus rufipes* (DeGeer, 1774)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VIII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Harpalus saxicola* Dejean, 1829**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky (Box #3)*
***Harpalus serripes* (Quensel, 1806)**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky (Box #3)
Struga, IV.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
***Harpalus smaragdinus* (Duftschmid, 1812)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
***Harpalus taciturnus* Dejean, 1829**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
***Harpalus* sp.**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Ophonus azureus* (Fabricius, 1775)**
Cer, IX.1928, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
Struga, XI.1931, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
***Ophonus cribricollis* (Dejean, 1829)**
Korab, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Ophonus diffinis* Dejean, 1829**
Struga, V.1925, 1 s., leg. N. Nezlobinsky (Box #12)*
***Ophonus puncticeps* Stephens, 1828**
Jablanica, III.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
Jablanica, IV.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
***Ophonus puncticollis* (Paykull, 1798)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
***Ophonus rufibarbis* (Fabricius, 1792)**
Jablanica, IV.1927, 1 s., leg. N. Nezlobinsky; sub:

Calathus sp. (Box #15)*
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Calathus* sp. (Box #15)*
Struga, VI.1925, 1 s., leg. N. Nezlobinsky (Box #12)*
***Ophonus rupicola* (Sturm, 1818)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, IX.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
***Ophonus sabulicola* (Panzer, 1796)**
Struga, VII.1925, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
***Ophonus subquadratus* (Dejean, 1829)**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky (Box #3)*
Ohrid, VII.1925, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, IX.1925, 1 s., leg. N. Nezlobinsky (Box #21)*
***Ophonus* sp.**
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, IX.1925, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Parophonus maculicornis* (Duftschmid, 1812)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, V.1925, 1 s., leg. N. Nezlobinsky (Box #12)
***Acupalpus maculatus* (Schaum, 1860)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)
Struga, X.1924, 2 s., leg. N. Nezlobinsky (Box #5)
***Acupalpus meridianus* (Linnaeus, 1761)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
***Anthracus longicornis* Schaum, 1857**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Stenolophus abdominalis persicus* Mannerheim, 1844**
Struga, I.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #12)
***Stenolophus discophorus* (Fischer von Waldheim, 1823)**
Struga, IV.1926, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Stenolophus mixtus* (Herbst, 1784)**
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VIII.1931, 3 s., leg. N. Nezlobinsky (Box #12)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Stenolophus steveni* Krynicki, 1832**
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
***Stenolophus teutonus* (Schrank, 1781)**
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
***Stenolophus* sp.**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #12)
***Cymindis axillaris axillaris* (Fabricius, 1794)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Struga, IV.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #21)
***Cymindis humeralis* (Geoffroy, 1785)**
Jablanica, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Cymindis lineata* (Quensel, 1806)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
Struga, III.1932, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
Struga, IV.1924, 1 s., leg. N. Nezlobinsky (Box #12)
***Cymindis miliaris* (Fabricius, 1801)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)*
***Cymindis scapularis* Schaum, 1857**
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)*
***Demetrias atricapillus* Linnaeus, 1758**
Struga, X.1924, 3 s., leg. N. Nezlobinsky; sub: *Demetrias* sp. (Box #21)*
***Philorhizus sigma* P. Rossi, 1790**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Lebia cyanocephala* (Linnaeus, 1758)**
Karaorman, VI.1927, 1 s., leg. N. Nezlobinsky; sub: *Lebia* sp. (Box #21)*
***Syntomus obscuroguttatus* (Duftschmid, 1812)**
Bistra, VII.1932, 1 s., leg. N. Nezlobinsky (Box #5)*
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #5)*
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
Struga, X.1924, 2 s., leg. N. Nezlobinsky (Box #5)*
***Badister collaris* Motschulsky, 1844**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Badister peltatus* (Panzer, 1796)**
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #5)*
Struga, III.1931, 1 s., leg. N. Nezlobinsky (Box #3)*
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)
***Badister sodalis* Duftschmid, 1812**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Licinus silphoides* (P. Rossi, 1790)**
Ohrid, VII.1928, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)*

Struga, XI.1931, 1 s., leg. N. Nezlobinsky (Box #3)*
***Odacantha melanura* (Linnaeus, 1767)**
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
***Panagaeus cruxmajor* (Linnaeus, 1758)**
Jablanica, IV.1927, 1 s., leg. N. Nezlobinsky (Box #21)*
***Agonum antennarium* (Duftschmid, 1812)**
Jablanica, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Agonum hypocrita* (Apfelbeck, 1904)**
Struga, I.1927, 1 s., leg. N. Nezlobinsky (Box #3)*
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, II.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, IV.1924, 1 s., leg. N. Nezlobinsky (Box #12)*
***Agonum lugens* Duftschmid, 1812**
Struga, IX.1931, 1 s., leg. N. Nezlobinsky (Box #12)*
***Agonum monachum* (Duftschmid, 1812)**
Korab, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Agonum muelleri* (Herbst, 1784)**
Jablanica, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, X.1924, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Agonum sexpunctatum* (Linnaeus, 1758)**
Struga, V.1928, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Agonum thoreyi* (Dejean, 1828)**
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, III.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, III.1927, 2 s., leg. N. Nezlobinsky (Box #12)*
***Agonum viridicupreum viridicupreum* (Goeze, 1777)**
Bistra, VIII.1932, 2 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Agonum* sp.**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky (Box #12)
Jablanica, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Jablanica, VI.1932, 1 s., leg. N. Nezlobinsky (Box #12)
Jablanica, VII.1932, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VII.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, X.1924, 2 s., leg. N. Nezlobinsky (Box #12)
***Anchomenus dorsalis* (Pontoppidan, 1763)**
Jablanica, VIII.1932, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
Struga, VIII.1935, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Oxypselaphus obscurus* (Herbst, 1784)**
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #5)*
Struga, X.1924, 2 s., leg. N. Nezlobinsky (Box #5)*
***Limodromus assimilis* (Paykull, 1790)**
Jablanica, VII.1931, 5 s., leg. N. Nezlobinsky (Box #3)
Molops rufipes* Chaudoir, 1843 ssp. *?
Korab, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)
Korab, VII.1932, 2 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)
***Molops rufipes steindachneri* Apfelbeck, 1908**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)
***Myas chalybaeus* (Palliardi, 1825)**
Jablanica, Rujan, VI.1925, 6 s., leg. N. Nezlobinsky; sub: *Myas* sp. (Box #15)
***Poecilus cupreus* (Linnaeus, 1758)**
Ohrid, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, II.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, IV.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
Struga, IX.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, VI.1927, 1 s., leg. N. Nezlobinsky; sub: *Diachromus* sp. (Box #17)
***Poecilus lepidus* (Leske, 1785)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)*
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky; sub: *Ophonus* sp. (Box #17)
***Pterostichus anthracinus anthracinus* (Illiger, 1798)**
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #12)
***Pterostichus leonisi* Apfelbeck, 1904**
Struga, I.1927, 1 s., leg. N. Nezlobinsky (Box #3)*
Struga, II.1924, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, X.1924, 1 s., leg. N. Nezlobinsky (Box #12)
***Pterostichus lumensis litae* Csiki, 1940**
Korab, VII.1932, 3 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)

***Pterostichus niger niger* (Schaller, 1783)**
Struga, V.1927, 1 s., leg. N. Nezlobinsky; sub: *Carabus* sp. (Box #15)
***Pterostichus nigrita* (Paykull, 1790)**
Bistra, VII.1932, 1 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)
***Tapinopterus dochii* (Apfelbeck, 1906)**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky (Box #3)
***Tapinopterus rambousekianus* (Apfelbeck, 1906)**
Struga, IV.1924, 1 s., leg. N. Nezlobinsky; sub: *Broscus* sp. (Box #21)
***Calathus albanicus* Apfelbeck, 1906**
Jablanica, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Calathus ambiguus* (Paykull, 1790)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #12)*
Struga, IV.1927, 1 s., leg. N. Nezlobinsky (Box #12)*
***Calathus distinguendus* Chaudoir, 1846**
Jablanica, Rujan, IX.1931, 2 s., leg. N. Nezlobinsky (Box #3)
***Calathus fuscipes fuscipes* (Goeze, 1777)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
Jablanica, Rujan, IX.1931, 2 s., leg. N. Nezlobinsky (Box #3)
Korab, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, IX.1931, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VII.1925, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VII.1927, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, X.1924, 2 s., leg. N. Nezlobinsky (Box #12)
***Calathus melanocephalus melanocephalus* (Linnaeus, 1758)**
Jablanica, IX.1931, 2 s., leg. N. Nezlobinsky; sub: *Calathus* sp. (Box #15)
Jablanica, IX.1931, 3 s., leg. N. Nezlobinsky; sub: *Calathus* sp. (Box #15)
Jablanica, VI.1932, 1 s., leg. N. Nezlobinsky (Box #12)
Struga, II.1925, 1 s., leg. N. Nezlobinsky; sub: *Calathus* sp. (Box #15)
Struga, VIII.1925, 1 s., leg. N. Nezlobinsky; sub: *Calathus* sp. (Box #15)
Struga, X.1924, 5 s., leg. N. Nezlobinsky; sub: *Calathus* sp. (Box #15)
***Amara aenea* (DeGeer, 1774)**
Struga, II.1924, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, III.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
Struga, VI.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Amara anthobia* A. Villa & G. B. Villa, 1833**
Struga, VII.1927, 2 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
Struga, VIII.1932, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)
***Amara apricaria* (Paykull, 1790)**
Jablanica, Rujan, IX.1931, 1 s., leg. N. Nezlobinsky (Box #3)
Jablanica, Rujan, IX.1931, 2 s., leg. N. Nezlobinsky (Box #12)
***Amara consularis* (Duftschmid, 1812)**
Bistra, VIII.1932, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Amara equestris equestris* (Duftschmid, 1812)**
Korab, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)*
Korab, VII.1932, 1 s., leg. N. Nezlobinsky (Box #3)
***Amara fulva* (O. F. Müller, 1776)**
Struga, XI.1931, 2 s., leg. N. Nezlobinsky (Box #3)*
***Amara lucida* (Duftschmid, 1812)**
Jablanica, Rujan, VII.1927, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Amara majuscula* Chaudoir, 1850**
Korab, VII.1932, 1 s., leg. N. Nezlobinsky (Box #3)*
***Amara nitida* Sturm, 1825**
Struga, VI.1925, 1 s., leg. N. Nezlobinsky; sub: *Amara* sp. (Box #1)*
***Amara proxima* Putzeys, 1866**
Struga, II.1927, 1 s., leg. N. Nezlobinsky (Box #3)*
***Amara* sp.**
Korab, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Zabrus albanicus jablanicensis* Mařan, 1939**
Jablanica, VII.1931, 1 s., leg. N. Nezlobinsky (Box #12)
***Zabrus incrassatus incrassatus* (Ahrens, 1814)**
Debar, VII.1928, 2 s., leg. N. Nezlobinsky; sub: *Zabrus* sp. (Box #21)*
Struga, IV.1924, 1 s., leg. N. Nezlobinsky; sub: *Zabrus* sp. (Box #21)*
Struga, IX.1924, 1 s., leg. N. Nezlobinsky (Box #21)*
Struga, VI.1925, 4 s., leg. N. Nezlobinsky; sub: *Zabrus* sp. (Box #21)*
***Zabrus* sp.**
Struga, IV.1924, 1 s., leg. N. Nezlobinsky (Box #12)

Conclusions

The collection of ground beetles (Coleoptera: Carabidae) in the National Museum „Dr. Nikola Nezlobinski" in Struga (North Macedonia) was reviewed in 2011 and 2013. The collection holds a total of 436 specimens, mostly collected from Struga wetland area and Jablanica mountain. Most of the specimens were collected in the period 1924-1935. A total of 130 species were identified originating from the surroundings of Struga (85), Jablanica mountain (42), Korab mountain (15), Bistra mountain (13), Ohrid (5), etc. Species from former Struga wetland give special value to the collection. The following species in the Macedonian fauna were reported solely on the specimens from the collection of the museum in Struga: *Elaphrus weissi, Chlaenius tristis, Ophonus rupicola, Philorhizus sigma* and *Amara majuscula*.

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The ground beetles (Coleoptera: Carabidae) of the Monospitovo wetland (southeastern part of North Macedonia)

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Abstract

The ground beetle (Coleoptera: Carabidae) fauna of the Monospitovo wetland (southeastern Republic of North Macedonia) is presented in this paper. Collection of the material was carried out in the period 2004-2010 in different types of habitats: swamps, marshes, wet meadows and seminatural and anthropogenic habitats. In total 1,834 adult specimens were collected by hand and pitfall trapping. We recorded 129 species of ground beetles. Two taxa are recorded for the first time in the fauna of the Republic of North Macedonia – *Dyschirius* (*Dyschiriodes*) *chalybeus gibbifrons* Apfelbeck, 1899 and *Acupalpus* (*Acupalpus*) *planicollis* Schaum, 1857. The importance of the Monospitovo wetland for the diversity of ground beetles in the Republic of North Macedonia is supported by the presence of 49 species that are known from 1-3 localities in the country. Comments on some interesting ground beetle taxa are also provided.

Key words: Carabidae, wetland habitats, Republic of North Macedonia

Introduction

The ground beetle (Coleoptera: Carabidae) fauna of the lowland wetlands in the Republic of North Macedonia has not been systematically studied. There are some data on the ground beetles of the Belčišta wetland (Hieke 1981), the Ohrid and the former Struga wetlands (Hristovski and Mihajlova 2021), Lepenec River riparian habitats (Hristovski 2017), as well as a few data on other wetlands in the country (Hristovski and Guéorguiev 2015).

Monospitovo wetland is the largest wetland in the Republic of North Macedonia (Melovski et al. 2010). It is listed in the group of the most threatened national wetlands (MoEPP 2018). So far, only few records were published (Melovski et al. 2010; Hristovski and Guéorguiev 2015) from the region in question, which were a part of this investigation. In this paper we will present the complete results of research on the diversity of ground beetle fauna of the Monospitovo wetland.

Study area

Monospitovo wetland is situated in the Strumica valley in the southeastern part of the Republic of North Macedonia at altitudes between 202 and 240 m a.s.l. (Fig. 1). The total wetland area was estimated at ca. 400 ha (Melovski et al. 2010).

The average annual temperature of the Strumica valley is 12.9°C, with July being the warmest (23.8°C) and January being the coldest month (1.6°C). The average annual precipitation (583 mm) is low (Lazarevski 1993).

The vegetation of the Monospitovo wetland is represented by permanently or temporarily flooded marsh vegetation, wet meadows with cloves (*Trifolium* spp.), sedges (*Carex* spp.) and royal fern (*Osmunda regalis* L.), as well as swamp vegetation of alder and willow woodlands (Melovski et al. 2010).

Materials and Methods

The material of ground beetles was collected by hand and pitfall trapping in the period 2004-2010 at the

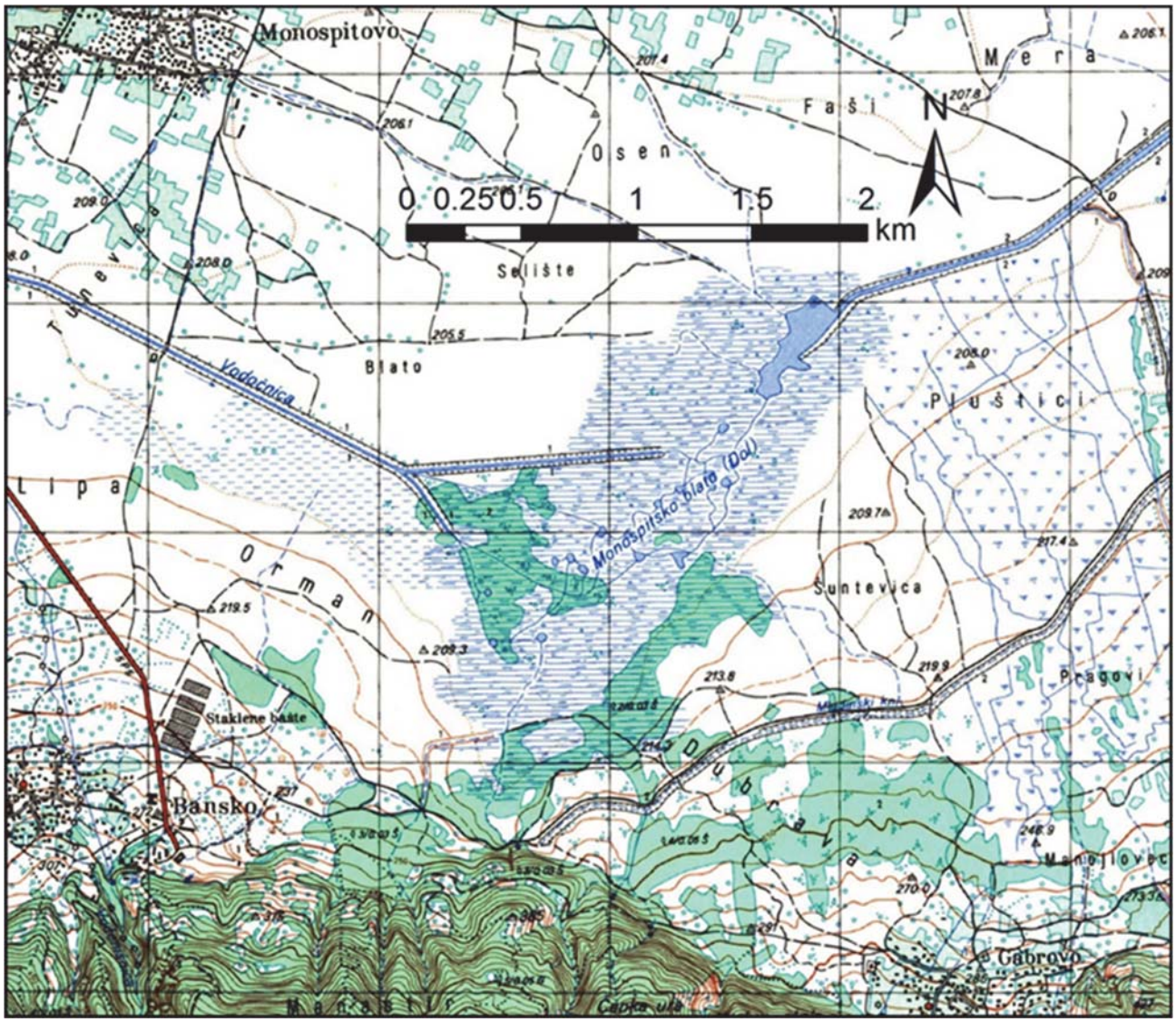

Fig. 1. A topographic map of the Monospitovo wetland.

following habitats: swamps (poplar stand, willow stand, alder woodland), marsh (reed beds, cattail stand, dry pond), wet meadows (sedges, royal fern stand) and other seminatural and anthropogenic habitats (acres, ruderal sites, channels, home gardens).

Most samples were collected at altitudes between 205 and 230 m a.s.l., with the exception of localities near the village of Bansko (260-270 m a.s.l.). The material was collected by Gjorgje Ivanov, Slavčo Hristovski, Marjan Komnenov and Trajče Mitev. The following list presents the sampled sites and habitats and sampling dates:

M01: Bansko, meadow, 260 m a.s.l., 23.05.2008, leg.: S. Hristovski

M02: Bansko, ruderal site, 270 m a.s.l., 24.09.2004, leg.: S. Hristovski

M03: Bansko-Dubrava, ruderal site, 220 m a.s.l., 17.06.2007, leg.: S. Hristovski

M04: Bansko (Garlieva Češma), *Osmunda* stand (pitfall traps), 225 m a.s.l., 12.09.2007, leg.: M. Komnenov

M05: Bansko (Garlieva Češma), *Osmunda* stand (pitfall traps), 225 m a.s.l., 17.06-03.07.2007, leg.: S. Hristovski & M. Komnenov

M06: Bansko (Garlieva Češma), *Osmunda* stand (pitfall traps), 225 m a.s.l., 03.07-10.09.2007, leg.: S. Hristovski & M. Komnenov

M07: Bansko (Garlieva Češma), *Osmunda* stand (pitfall traps), 225 m a.s.l., 03.2008, leg.: Gj. Ivanov

M08: Bansko (Garlieva Češma), meadow (pitfall traps), 225 m a.s.l., 17.06-03.07.2007, leg.: S. Hristovski & M. Komnenov

M09: Bansko (Garlieva Češma), meadow (pitfall traps), 225 m a.s.l., 03.07-10.09.2007, leg.: S. Hristovski & M. Komnenov

M10: Bansko (Garlieva Češma), meadow (pitfall traps),

225 m a.s.l., 12.09.2007, leg.: S. Hristovski & M. Komnenov
M11: Bansko (Garlieva Češma), meadow (pitfall traps), 225 m a.s.l., 22.04.2008, leg.: Gj. Ivanov
M12: Bosilovo, yard, 210 m a.s.l., 20.06.2004, leg.: Gj. Ivanov
M13: Bosilovo, yard, 210 m a.s.l., 01-05.07.2005, leg.: Gj. Ivanov
M14: Bosilovo, yard, 210 m a.s.l., 02.07.2007, leg.: Gj. Ivanov
M15: Bosilovo, ruderal site, 210 m a.s.l., 08-10.08.2007, leg.: Gj. Ivanov
M16: Bosilovo, ruderal site, 210 m a.s.l., 08.08.2009, leg.: Gj. Ivanov
M17: Bosilovo, ruderal site, 210 m a.s.l., 20-30.08.2010, leg.: Gj. Ivanov
M18: Dubrava, sedges, 230 m a.s.l., 22.04.2008, leg.: S. Hristovski
M19: Dubrava, alder woodland, 230 m, 23.04.2008, leg.: S. Hristovski
M20: Gabrovo, dry pond, 240 m a.s.l., 23.04.2008, leg.: S. Hristovski
M21: Kolešino, alder woodland, 240 m a.s.l., 23.05.2008, leg.: S. Hristovski
M22: Orman, wet meadow, 210 m a.s.l., 24.04.2006, leg.: S. Hristovski
M23: Orman, wet acres, 210 m a.s.l., 23.04.2008, leg.: S. Hristovski
M24: Parking near the Vodočnica stream, 205 m a.s.l., cattail stand (pitfall traps), 24.04.2008, leg.: Gj. Ivanov
M25: Prosenikovo graveyard, grassland, 225 m a.s.l., 15.06.2008, leg.: Gj. Ivanov
M26: Ribnik, wet acres, 210 m a.s.l., 17.05.2007, leg.: S. Hristovski
M27: Ribnik, cattail stand, 210 m a.s.l., 03.07.2007, leg.: S. Hristovski
M28: Ribnik, poplar stand (pitfall traps), 210 m a.s.l., 12.09.2007, leg.: S. Hristovski & M. Komnenov
M29: Ribnik, willow stand (pitfall traps), 210 m a.s.l., 11.09.2007, leg.: S. Hristovski & M. Komnenov
M30: Ribnik, willow stand (pitfall traps), 210 m a.s.l., 12.09.2007, leg.: S. Hristovski & M. Komnenov
M31: Ribnik, poplar stand (pitfall traps), 210 m a.s.l., 17.06-03.07.2007, leg.: S. Hristovski & M. Komnenov
M32: Ribnik, willow stand (pitfall traps), 210 m a.s.l., 03.07-09.08.2007, leg.: S. Hristovski & M. Komnenov
M33: Ribnik, willow stand (pitfall traps), 210 m a.s.l., 09.08-23.12.2007, leg.: S. Hristovski & M. Komnenov
M34: Ribnik, willow stand (pitfall traps), 210 m a.s.l., 17.06-03.07.2007, leg.: S. Hristovski & M. Komnenov
M35: Ribnik, willow stand (pitfall traps), 210 m a.s.l., 22.04.2008, leg.: Gj. Ivanov
M36: Selište, meadow (pitfall traps), 205 m a.s.l., 24.04-04.05.2006, leg.: S. Hristovski & Gj. Ivanov
M37: Selište, acres (pitfall traps), 205 m a.s.l., 04-26.05.2006, leg.: S. Hristovski & Gj. Ivanov
M38: Selište, reed bed (pitfall traps), 205 m a.s.l., 04-26.05.2006, leg.: S. Hristovski & Gj. Ivanov
M39: Selište, acres, 205 m a.s.l., 17.06.2007, leg.: S.

Table 1. A list of recorded ground beetle species in the Monospitovo wetland [abbreviations of localities M1-M55 are presented in the Materials and Methods chapter].

Species/subspecies	Localities (number of adult specimens)	Total adult specimens
Abax (*Abacopercus*) *carinatus carinatus* (Duftschmid, 1812)	M10 (1)	1
Acupalpus (*Acupalpus*) *brunnipes* (Sturm, 1825)	M05 (3); M08 (1)	4
Acupalpus (*Acupalpus*) *exiguus* Dejean, 1829	M34 (1)	1
Acupalpus (*Acupalpus*) *luteatus* (Duftschmid, 1812)	M21 (1)	1
Acupalpus (*Acupalpus*) *maculatus* (Schaum, 1860)	M05 (1); M20 (1); M23 (2); M36 (1)	5
Acupalpus (*Acupalpus*) *meridianus* (Linnaeus, 1761)	M36 (1)	1
Acupalpus (*Acupalpus*) *parvulus* (Sturm, 1825)	M19 (1); M22 (1)	2
Acupalpus (*Acupalpus*) *planicollis* Schaum, 1857	M22 (1); M55 (1)	2

Species/subspecies	Localities (number of adult specimens)	Total adult specimens
Acupalpus (*Acupalpus*) *suturalis* Dejean, 1829	M23 (1)	1
Agonum (*Agonum*) *marginatum* (Linnaeus, 1758)	M22 (4)	4
Agonum (*Agonum*) *muelleri* (Herbst, 1784)	M22 (3); M31 (1)	4
Agonum (*Olisares*) *permoestum* Puel, 1938	M22 (5); M24 (6); M34 (18); M36 (1); M51 (2)	32
Agonum (*Olisares*) *viridicupreum viridicupreum* (Goeze, 1777)	M18 (3); M22 (24); M23 (4); M26 (1); M35 (1); M42 (1); M45 (3); M46 (1)	38
Agonum (*Olisares*) *angustatum* Dejean, 1828	M11 (2); M18 (5); M22 (16); M24 (18); M29 (1); M34 (17); M35 (11); M36 (1); M51 (12); M52 (6)	89
Amara (*Amara*) *aenea* (De Geer, 1774)	M04 (1); M08 (1); M11 (1); M16 (1); M17 (1); M35 (1); M36 (1); M39 (2); M41 (7); M53 (1); M55 (1)	18
Amara (*Amara*) *anthobia* A. Villa & G. B. Villa, 1833	M55 (2)	2
Amara (*Amara*) *littorea* C. G. Thomson, 1857	M34 (1)	1
Amara (*Amara*) *lucida* (Duftschmid, 1812)	M54 (1)	1
Amara (*Amara*) *ovata* (Fabricius, 1792)	M24 (1); M34 (2); M55 (4)	7
Amara (*Amara*) *similata* (Gyllenhal, 1810)	M36 (1)	1
Amara (*Bradytus*) *apricaria* (Paykull, 1790)	M17 (1)	1
Amara (*Zezea*) *plebeja* (Gyllenhal, 1810)	M08 (1)	1
Amblystomus metallescens (Dejean, 1829)	M34 (1)	1
Anisodactylus (*Anisodactylus*) *binotatus* (Fabricius, 1787)	M22 (2); M24 (4); M32 (3); M36 (1); M54 (1)	11
Anisodactylus (*Anisodactylus*) *nemorivagus* (Duftschmid, 1812)	M06 (1); M08 (1); M11 (1); M34 (1)	4
Anisodactylus (*Pseudodichirus*) *intermedius* Dejean, 1829	M10 (1)	1
Anisodactylus (*Pseudanisodactylus*) *signatus* (Panzer, 1796)	M13 (2); M31 (1); M45 (1)	4
Anthracus longicornis (Schaum, 1857)	M18 (1); M22 (1); M54 (1)	3
Asaphidion flavipes (Linnaeus, 1761)	M24 (1); M28 (5); M30 (3); M31 (37); M32 (2); M33 (1); M34 (39); M40 (7); M54 (2); M55 (3)	100
Badister (*Badister*) *lacertosus* Sturm, 1815	M28 (1); M40 (1); M 54(1)	3
Badister (*Badister*) *meridionalis* Puel, 1925	M31 (3)	3
Badister (*Baudia*) *collaris* Motschulsky, 1844	M34 (1)	1
Bembidion (*Bembidion*) *quadrimaculatum quadrimaculatum* (Linnaeus, 1760)	M34 (1)	1
Bembidion (*Emphanes*) *tenellum tenellum* Erichson, 1837	M18 (2); M22 (1); M23 (8)	11
Bembidion (*Metallina*) *lampros* (Herbst, 1784)	M05 (1); M08 (1); M22 (1); M23 (8); M36 (1); M42 (1)	13
Bembidion (*Metallina*) *properans* (Stephens, 1828)	M12 (3); M22 (2); M34 (4); M41 (1)	10
Bembidion (*Nepha*) *vseteckai dissimile* G. Müller, 1943	M01 (1); M19 (2); M20 (2); M22 (1)	6
Bembidion (*Notaphus*) *varium* (Olivier, 1795)	M23 (1)	1

Species/subspecies	Localities (number of adult specimens)	Total adult specimens
Bembidion (*Philochthus*) *biguttatum* (Fabricius, 1779)	M24 (1); M31 (1); M34 (3); M35 (2); M36 (3); M40 (1); M51 (1); M52 (1)	13
Bembidion (*Philochthus*) *inoptatum* Schaum, 1857	M22 (3); M35 (2); M52 (1)	6
Bembidion (*Philochthus*) *lunulatum* (Geoffroy, 1785)	M22 (1); M23 (1)	2
Bembidion (*Princidium*) *punctulatum punctulatum* Drapiez, 1820	M22 (1)	1
Bembidion (*Trepanes*) *articulatum* (Panzer, 1796)	M18 (8); M19 (1); M22 (16); M24 (1); M32 (1)	27
Bembidion (*Trepanes*) *octomaculatum* (Goeze, 1777)	M23 (1)	1
Brachinus (*Brachinus*) *crepitans* (Linnaeus, 1758)	M17 (1)	1
Brachinus (*Brachinus*) *elegans* Chaudoir, 1842	M54 (1)	1
Brachinus (*Brachinus*) *psophia* Audinet-Serville, 1821	M45 (1)	1
Brachinus (*Brachynidius*) *explodens* Duftschmid, 1812	M13 (1)	1
Broscus cephalotes (Linnaeus, 1758)	M14 (1); M17 (1)	2
Calathus (*Calathus*) *fuscipes* (Goeze, 1777)	M17 (2); M25 (2)	4
Calathus (*Neocalathus*) *cinctus* Motschulsky, 1850	M17 (4); M30 (2)	6
Carabus (*Carabus*) *granulatus interstitialis* Duftschmid, 1812	M11 (1); M24 (16); M35 (3); M38 (2); M42 (1); M49 (30); M52 (1)	54
Carabus (*Procrustes*) *coriaceus cerisyi* Dejean, 1826	M10 (1)	1
Chlaenius (*Chlaeniellus*) *nigricornis* (Fabricius, 1787)	M06 (2); M22 (4); M32 (1); M38 (2); M51 (1)	10
Chlaenius (*Chlaeniellus*) *nitidulus* (Schrank, 1781)	M05 (1); M22 (1); M55 (2)	4
Chlaenius (*Chlaeniellus*) *tristis tristis* (Schaller, 1783)	M22 (2)	2
Chlaenius (*Chlaeniellus*) *vestitus* (Paykull, 1790)	M22 (1); M54 (3)	4
Chlaenius (*Chlaenius*) *festivus festivus* (Panzer, 1796)	M22 (1)	1
Cicindela (*Cicindela*) *campestris campestris* Linnaeus, 1758	M11 (3)	3
Clivina (*Clivina*) *fossor fossor* (Linnaeus, 1758)	M11 (1); M18 (1); M28 (1)	3
Clivina (*Reichardtula*) *laevifrons* Chaudoir, 1842	M26 (1)	1
Cylindera (*Cylindera*) *germanica germanica* (Linnaeus, 1758)	M05 (1); M08 (1); M39 (2)	4
Demetrias (*Demetrias*) *monostigma* Samouelle, 1819	M22 (2)	2
Demetrias (*Aetophorus*) *imperialis* (Germar, 1823)	M44 (1)	1
Diachromus germanus (Linnaeus, 1758)	M45 (1)	1
Dolichus halensis (Schaller, 1783)	M17 (1); M32 (1)	2
Drypta (*Drypta*) *dentata* (P. Rossi, 1790)	M42 (1)	1

Species/subspecies	Localities (number of adult specimens)	Total adult specimens
Dyschirius (*Dyschiriodes*) *chalybeus gibbifrons* Apfelbeck, 1899	M18 (6); M20 (2); M22 (8); M23 (12); M31 (1)	29
Dyschirius (*Dyschiriodes*) *intermedius* Putzeys, 1846	M23 (1)	1
Dyschirius (*Eudyschirius*) *globosus* (Herbst, 1784)	M05 (2); M11 (5); M19 (1); M31 (5)	13
Elaphrus (*Elaphrus*) *weissi* Dostal, 1996	M18 (6); M22 (14); M23 (1)	21
Elaphrus (*Neoelaphrus*) *uliginosus* Fabricius, 1792	M22 (8); M34 (2); M35 (1); M53 (1)	12
Harpalus (*Cryptophonus*) *tenebrosus* Dejean, 1829	M42 (2)	2
Harpalus (*Harpalus*) *affinis* (Schrank, 1781)	M46 (1)	1
Harpalus (*Harpalus*) *atratus* Latreille, 1804	M08 (1)	1
Harpalus (*Harpalus*) *cupreus fastuosus* Faldermann, 1836	M45 (1)	1
Harpalus (*Harpalus*) *dimidiatus* (P. Rossi, 1790)	M24 (1)	1
Harpalus (*Harpalus*) *distinguendus distinguendus* (Duftschmid, 1812)	M12 (5); M18 (1); M24 (2); M26 (1); M41 (1); M45 (2); M46 (1); M53 (1)	14
Harpalus (*Harpalus*) *rubripes* (Duftschmid, 1812)	M08 (3); M10 (2); M11 (1)	6
Harpalus (*Harpalus*) *rufipalpis rufipalpis* Sturm, 1818	M09 (1); M55 (2)	3
Harpalus (*Harpalus*) *serripes serripes* (Quensel, 1806)	M12 (1); M41 (1)	2
Harpalus (*Semiophonus*) *signaticornis* (Duftschmid, 1812)	M11 (1)	1
Harpalus (*Harpalus*) *smaragdinus* (Duftschmid, 1812)	M13 (1)	1
Harpalus (*Harpalus*) *tardus* (Panzer, 1796)	M55 (1)	1
Harpalus (*Harpalus*) *zabroides* Dejean, 1829	M03 (1)	1
Harpalus (*Pseudoophonus*) *calceatus* (Duftschmid, 1812)	M15 (1); M16 (1)	2
Harpalus (*Pseudoophonus*) *griseus* (Panzer, 1796)	M02 (1); M10 (1); M15 (4); M16 (2); M34 (1)	9
Harpalus (*Pseudoophonus*) *rufipes* (De Geer, 1774)	M05 (2); M13 (2); M15 (1); M28 (3); M40 (1); M41 (1)	10
Licinus (*Licinus*) *depressus* (Paykull, 1790)	M02 (1); M28 (4); M40 (1)	6
Lionychus (*Lionychus*) *quadrillum* (Duftschmid, 1812)	M22 (1)	1
Nebria (*Nebria*) *brevicollis* (Fabricius, 1792)	M07 (1); M20 (2); M22 (7); M31 (1); M36 (1); M55 (1)	13
Odacantha (*Odacantha*) *melanura* (Linnaeus, 1767)	M44 (3)	3
Oodes helopioides helopioides (Fabricius, 1792)	M18 (1); M22 (4); M35 (7); M52 (1)	13
Ophonus (*Metophonus*) *puncticeps* Stephens, 1828	M15 (2)	2
Ophonus (*Metophonus*) *schaubergerianus* (Puel, 1937)	M10 (1)	1
Ophonus (*Metophonus*) *veluchianus* (J. Müller, 1931)	M16 (1)	1

Species/subspecies	Localities (number of adult specimens)	Total adult specimens
Ophonus (*Ophonus*) *diffinis* (Dejean, 1829)	M10 (1)	1
Oxypselaphus obscurus (Herbst, 1784)	M32 (1); M34 (1); M43 (1)	3
Paratachys bistriatus (Duftschmid, 1812)	M18 (4); M22 (3); M31 (2); M34 (3)	12
Parophonus (*Ophonomimus*) *hirsutulus* (Dejean, 1829)	M17 (1)	1
Parophonus (*Parophonus*) *dejeani* (Csiki, 1932)	M12 (1); M32 (1); M55 (4)	6
Parophonus (*Parophonus*) *maculicornis* (Duftschmid, 1812)	M54 (10)	10
Poecilus (*Poecilus*) *anatolicus* (Chaudoir, 1850)	M41 (1); M47 (1)	2
Poecilus (*Poecilus*) *cupreus cupreus* (Linnaeus, 1758)	M11 (10); M18 (2); M22 (12); M24 (10); M26 (2); M27 (2); M29 (3); M34 (20); M35 (3); M36 (12); M37 (2); M38 (43); M42 (567); M43 (29); M45 (14); M46 (2); M48 (31); M50 (2); M51 (1); M55 (1)	768
Poecilus (*Poecilus*) *rebeli* (Apfelbeck, 1904)	M34 (1)	1
Pterostichus (*Argutor*) *cursor* (Dejean, 1828)	M11 (2); M24 (1); M32 (1); M34 (1); M52 (1)	6
Pterostichus (*Argutor*) *leonisi* Apfelbeck, 1904	M34 (10); M35 (1); M36 (1)	12
Pterostichus (*Argutor*) *vernalis* (Panzer, 1796)	M36 (1); M42 (2)	3
Pterostichus (*Melanius*) *elongatus* (Duftschmid, 1812)	M22 (1)	1
Pterostichus (*Morphnosoma*) *melanarius melanarius* (Illiger, 1798)	M10 (1); M22 (1)	2
Pterostichus (*Phonias*) *strenuus* (Panzer, 1796)	M35 (3); M51 (1)	4
Pterostichus (*Platysma*) *niger niger* (Schaller, 1783)	M07 (1); M10 (1); M17 (1); M28 (1); M29 (2); M32 (1); M33 (1); M34 (2); M36 (6); M42 (2); M43 (3); M50 (15); M55 (1)	37
Pterostichus (*Pseudomaseus*) *anthracinus anthracinus* (Illiger, 1798)	M07 (1); M11 (3); M18 (1); M22 (4); M24 (3); M29 (1); M31 (5); M32 (2); M34 (10); M35 (4); M36 (3); M38 (1); M40 (1); M43 (5); M48 (30); M50 (1); M51 (8); M52 (1)	84
Pterostichus (*Pseudomaseus*) *minor* (Gyllenhal, 1827)	M19 (1); M22 (1); M32 (1); M34 (1)	4
Pterostichus (*Pseudomaseus*) *nigrita* (Paykull, 1790)	M22 (1)	1
Scarites (*Parallelomorphus*) *terricola* Bonelli, 1813	M08 (8); M09 (3); M36 (2); M42 (3)	16
Stenolophus (*Stenolophus*) *discophorus* (Fischer von Waldheim, 1823)	M15 (1); M22 (6); M32 (1); M45 (3)	11
Stenolophus (*Egadroma*) *marginatus* Dejean, 1829	M12 (2); M16 (3); M17 (1); M22 (1); M45 (1)	8
Stenolophus (*Stenolophus*) *abdominalis persicus* Mannerheim, 1844	M31 (1); M43 (1)	2
Stenolophus (*Stenolophus*) *mixtus* (Herbst, 1784)	M08 (1); M22 (1); M32 (1); M34 (3); M35 (2); M54 (5)	13
Stenolophus (*Stenolophus*) *proximus* Dejean, 1829	M24 (1); M43 (1)	2
Stenolophus (*Stenolophus*) *skrimshiranus* Stephens, 1828	M17 (1)	1
Stenolophus (*Stenolophus*) *teutonus* (Schrank, 1781)	M06 (3); M13 (2); M22 (13); M23 (3); M24 (1); M36 (1); M37 (1); M42 (1); M51 (1)	26

Species/subspecies	Localities (number of adult specimens)	Total adult specimens
Syntomus obscuroguttatus (Duftschmid, 1812)	M17 (2)	2
Tachyura (*Sphaerotachys*) *hoemorroidalis* (Ponza, 1805)	M17 (2); M18 (7); M19 (1); M20 (19); M22 (14); M23 (11); M26 (1); M34 (1); M45 (1)	57
Tachyura (*Tachyura*) *parvula* (Dejean, 1831)	M08 (5); M 11(1)	6
Trechus (*Trechus*) *austriacus* Dejean, 1831	M17 (3)	3
Trechus (*Trechus*) *quadristriatus* (Schrank, 1781)	M30 (1); M31 (1); M34 (1); M36 (1)	4
Zabrus (*Pelor*) *spinipes insignis* J. Müller, 1931	M25 (3)	3

Hristovski

M40: Selište, cattail stand (pitfall traps), 205 m a.s.l., 04.05-03.07.2007, leg.: S. Hristovski & M. Komnenov

M41: Selište, dry acres, 205 m a.s.l., 09.06.2007, leg.: S. Hristovski

M42: Selište, meadow (pitfall traps), 205 m a.s.l., 09.06-03.07.2007, leg.: S. Hristovski & M. Komnenov

M43: Selište, reed bed and cattail stand (traps), 205 m a.s.l., 09.08-11.09.2007, leg.: S. Hristovski & M. Komnenov

M44: Selište, reed bed, 205 m a.s.l., 29.03.2007, leg.: S. Hristovski

M45: Selište, wet acres, 205 m a.s.l., 09.06.2007, leg.: S. Hristovski

M46: Selište, wet meadow, 205 m a.s.l., 17.06.2007, leg.: S. Hristovski

M47: Selište, dry ruderal site, 205 m a.s.l., 22.04.2008, leg.: Gj. Ivanov

M48: Selište, cattail stand (pitfall traps), 205 m a.s.l., 23.03-24.04.2008, leg.: Gj. Ivanov

M49: Selište, cattail stand (pitfall traps), 205 m a.s.l., 24.04-12.07.2008, leg.: Gj. Ivanov

M50: Selište, reed bed and cattail stand (pitfall traps), 205 m a.s.l., 12.07-03.08.2008, leg.: Gj. Ivanov

M51: Selište, reed bed and cattail stand (pitfall traps), 205 m a.s.l., 24.04-12.07.2008, leg.: Gj. Ivanov

M52: Vodočnica, reed bed, 205 m a.s.l., 28.03.2007, leg.: S. Hristovski

M53: Vodočnica, channel, 205 m a.s.l., 29.03.2008, leg.: Gj. Ivanov

M54: Vodočnica, channel (pitfall traps), 205 m a.s.l., 24.04.2008, leg.: Gj. Ivanov

M55: Vodočnica, small channel (pitfall traps), 205 m a.s.l., 28.05.2008, leg.: Gj. Ivanov

The material is kept in the private collection of the first author.

Results and Discussion

In total 1,834 adult specimens belonging to 129 ground beetle species from 45 genera (arranged in 65 subgenera) were collected and determined (Tab. 1). The richest in species are the following genera: *Harpalus* (16 species), *Bembidion* (12), *Pterostichus* (10), *Acupalpus* and *Amara* (8 each), as well as *Stenolophus* (7). The most abundant species was *Poecilus* (*Poecilus*) *cupreus* with 768 adult specimens, followed by *Asaphidion flavipes* (100), *Agonum* (*Olisares*) *angustatum* (89) and *Pterostichus* (*Pseudomaseus*) *anthracinus* (84). These four species constitute about 57% of all specimens collected.

The most recent studies on ground beetle fauna of the wetlands on the Balkans concern the Srebarna wetland in Bulgaria (Jocque et al. 2016) and the floodplains of the Vjosa River in Albania (Paill et al. 2018). In the case of the Srebarna wetland, a total of 1,728 adult specimens of 116 ground beetle species were collected by light trapping during 11 evenings. The ground beetle fauna of the floodplains of the Vjosa River consists of 112 species. Namely, 2,327 specimens of ground beetles were collected in the mentioned floodplains by hand, intensive pitfall trapping in a short period of time and by light trapping). Monospitovo wetland is inhabited by 129 species of ground beetles, which were collected in a longer period of time compared to the respective studies in Bulgaria and Albania.

Dyschirius (*Dyschiriodes*) *chalybeus gibbifrons* and *Acupalpus* (*Acupalpus*) *planicollis* are new taxa for the fauna of the Republic of North Macedonia. Actually, Monospitovo wetland is the single known locality in the country for these two and eight more ground beetle species [*Tachyura* (*Tachyura*) *parvula*, *Anisodactylus* (*Pseudodichirus*) *intermedius*, *Acupalpus* (*Acupalpus*) *brunnipes*, *A.* (*A.*) *exiguus*, *Anthracus longicornis*, *Badister* (*Badister*) *meridionalis*, *Licinus* (*Licinus*) *depressus* and *Amara* (*Zezea*) *plebeja*] (Hristovski and Guéorguiev 2015). Additional 39 taxa may be considered as rare in the Republic of North Macedonia (known from only 2-3 localities, mostly wetlands):

Acupalpus (*Acupalpus*) *luteatus*, *A.* (*A.*) *parvulus*, *A.* (*A.*) *planicollis*, *A.* (*A.*) *suturalis*, *A.* (*O.*) *angustatum*, *Agonum* (*Agonum*) *marginatum*, *A.* (*Olisares*) *permoestum*, *Amblystomus metallescens*, *Anisodactylus* (*Pseudanisodactylus*) *signatus*, *Badister* (*Badister*) *lacertosus*, *Bembidion* (*Philochthus*) *biguttatum*, *B.* (*P.*) *inoptatum*, *B.* (*P.*) *lunulatum*, *B.* (*Emphanes*) *tenellum tenellum*, *Brachinus* (*Brachinus*) *elegans*, *B.* (*B.*) *psophia*, *Broscus cephalotes*, *Chlaenius* (*Chlaeniellus*) *nigricornis*, *C.* (*C.*) *tristis tristis*, *Clivina* (*Reichardtula*) *laevifrons*, *Demetrias* (*Aetophorus*) *imperialis*, *D.* (*Demetrias*) *monostigma*, *Dolichus halensis*, *Drypta* (*Drypta*) *dentata*, *D.* (*D.*) *chalybeus gibbifrons*, *Elaphrus* (*Neoelaphrus*) *uliginosus*, *E.* (*Elaphrus*) *weissi*, *Harpalus* (*Semiophonus*) *signaticornis*, *Harpalus* (*Harpalus*) *zabroides*, *Odacantha* (*Odacanth*) *melanura*, *Oodes helopioides helopioides*, *Ophonus* (*Ophonus*) *diffinis*, *O.* (*Metophonus*) *veluchianus*, *Poecilus* (*Poecilus*) *anatolicus*, *P.* (*P.*) *rebeli*, *Pterostichus* (*Argutor*) *vernalis*, *Stenolophus* (*Stenolophus*) *proximus*, *S.* (*S.*) *skrimshiranus* and *Tachyura* (*Sphaerotachys*) *hoemorroidalis*. However, it can be expected that many of these taxa will be found in other wetlands in the Republic of North Macedonia in the future.

Most of the recorded species are distributed in Europe or the Palaearctic. However, some of them have southern distribution and are restricted to the Balkan Peninsula, southeastern Europe or the Mediterranean, or they are distributed in southeastern Europe, Asia Minor and the Middle East. Comments on some of these interesting findings are presented in the following text.

Elaphrus (*E.*) *weissi* is distributed in the southern part of the Balkan Peninsula, Turkey and Israel (Arndt 2011). The specimens from the Monospitovo wetland were incorrectly identified as *Elaphrus* (*Elaphrus*) *riparius* (Linnaeus, 1758) and thus cited in the catalogue of ground beetles of the Republic of North Macedonia (Hristovski and Guéorguiev 2015). There is one more record of *E.* (*E.*) *riparius* known for the country – from a wetland near the town of Bitola (Hristovski and Guéorguiev 2015). Hence, this species might be absent from the Republic of North Macedonia. Furthermore, all specimens of *E.* (*E.*) *riparius* from the southern part of the Balkans should be re-examined.

Clivina (*R.*) *laevifrons* is a rare species in the Republic of North Macedonia. So far, it was known in the country only from the Badar Gorge of the Pčinja River. It is distributed in the Mediterranean (Bulirsch and Stachowiak 2017). This species is known from the neighbouring region (Sandanski-Petrich Valley) in Bulgaria (Guéorguiev and Guéorguiev 1995).

Tachyura (*T.*) *parvula* is also rare in the Republic of North Macedonia, with the Monospitovo wetland being the only known locality in the country (Hristovski and Guéorguiev 2015). It is considered a rare Euromediterranean species too (Aleksandrowicz 2012). Six specimens of this species were collected by pitfall trapping in the Monospitovo wetland in a wet meadow close to a stand of royal fern.

Bembidion (*Nepha*) *vseteckai dissimile* is generally distributed on the Balkan Peninsula and Italy (Basilicata, Calabria and Sicily) (Bonavita and Taglianti 2010). In the Republic of North Macedonia it is frequently found along rivers and streams in both lowlands and mountainous areas (Hristovski and Guéorguiev 2015).

Acupalpus (*A.*) *planicollis* is known from Bulgaria (Sandanski-Petrich Valley and southern Black Sea coast), Albania (Velipojë, Vlorë, Butrint, Vjosa) and Greece (Peloponnese, Thessaly), as well as from northeastern Italy (Guéorguiev and Guéorguiev 1995; Guéorguiev 2007; Jaeger et al. 2016; Paill et al. 2018). The record of this species from the Monospitovo wetland is the first one for the Republic of North Macedonia.

Poecilus (*P.*) *anatolicus* can be easily distinguished from other European congeners by the presence of pubescence on the terminal part of the third antennomere. It was described from Turkey (Wrase 1992) and it is with a few known localities on the Balkan Peninsula (Bousquet 2017). It is associated with humid habitats (wetlands). In the Republic of North Macedonia it was previously known from the area of the village of Mralino (Cvetkovska-Gjorgjievska et al. 2011).

Poecilus (*P.*) *rebeli* was recorded so far in the Republic of North Macedonia only from Mt. Galičica, in the vicinity of a small pond and wetlands surrounded by meadows close to Glajšo stream (Hristovski and Guéorguiev 2015). This species is known from all Balkan countries with the exception of Bulgaria (Bousquet 2017). The record from the Monospitovo wetland is the second one for the Republic of North Macedonia.

Pterostichus (*P.*) *anthracinus* includes four subspe-

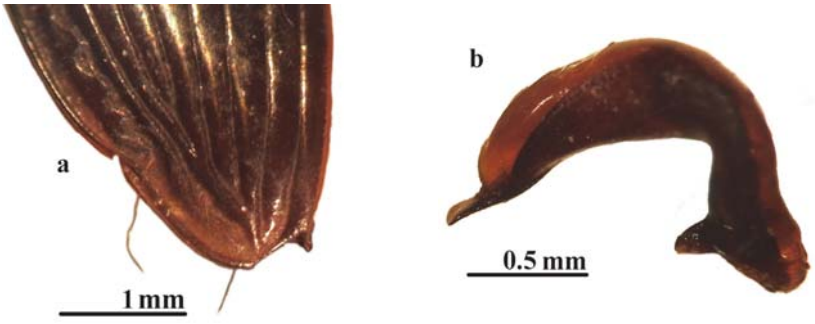

Fig. 2. *Pterostichus* (*Pseudomaseus*) *anthracinus anthracinus* from the Monospitovo wetland. a) Tip of left elytron of a female, dorsal view; b) Median lobe of aedeagus, right lateral view.

cies [*anthracinus* (Illiger, 1798), *biimpressus* (Küster, 1853), *hespericus* (Bucciarelli & Sopracordevole, 1958) and *depressiusculus* (Chaudoir, 1844)], out of which the nominotypical subspecies and ssp. *biimpressus* are reported for most Balkan countries (Bousquet 2017). The latter subspecies was described based on the specimens from Omiš, Dalmatia. It is with uncertain taxonomic status (Paill et al. 2018). The specimens from the floodplains of the Vjosa River (Albania) differ from the ones of the nominotypical subspecies by apically broadened elytra with microsculpture consisting of transverse meshes in both sexes. Specifically in males of the nominotypical subspecies, the impression on the last visible sternum is shallower and doesn't reach the apicomedial border, while the aedeagus is deeply notched in its right-angled part (Paill et al. 2018). The specimens from the Monospitovo wetland and other localities in the Republic of North Macedonia are assigned to the nominotypical subspecies and there are no records of ssp. *biimpressus* in the country (Hieke 1981; Krpač et al. 2013; Hristovski and Guéorguiev 2015). Examination of the nominotypical subspecies from the Monospitovo wetlands showed that all females have a deep excision on each elytron before the tip (Fig. 2a), which was previously considered a diagnostic feature of ssp. *biimpressus* (Schatzmayr 1942; Guéorguiev and Skoupý 2010). We compared the aedeagus of the specimens from the Monospitovo wetland with that of the specimens from the floodplains of the Vjosa River (Paill et al. 2018, p.294). The median lobe of the aedeagus of the specimens from the former area (Fig. 2b) shows great similarity to that of ssp. *anthracinus*: the general form is almost identical, it lacks the notch, but the apex of the aedeagus is somewhat longer than that of ssp. *anthracinus*. The impression on the last visible sternum in males is clearly visible and reaches the apicomedial border. The last two characteristics point out to the conclusion that the specimens from the Monospitovo wetland belong to the nominotypical subspecies of *P*. (*P*.) *anthracinus*. The form of the aedeagus is very similar to the one of *P*. (*P*.) *anthracinus*

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Novelties of *Hieracium* s. str. (Asteraceae) in the flora of North Macedonia

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Abstract

During the author's recent studies of *Hieracium* s. str. (Asteraceae) in North Macedonia, three species are recorded for the first time in the county flora: *Hieracium camkorijense* (Maleševo Mountains and Osogovo Mt.), *H. paniculatissimum* (Plačkovica Mt.) and *H. pellense* (Nidze Mt.). The first one is SE European & SW Asian species while the two others are rare Balkan endemics. The recorded populations of *H. camkorijense* belong to the Balkan endemic subsp. *boreograecum*. The species status of *H. paniculatissimum,* originally described as subspecies of *H. sparsiflorum* (= *H. sparsum*), is newly proposed. Illustrations and map of general distribution are presented for each of the reported taxa.

Key words: Balkan, endemic, first records, *Hieracium*, North Macedonia.

Introduction

Hieracium L. s. str. (Asteraceae) is one of the most polymorphic genera in the vascular flora of North Macedonia with more than 60 species so far reported in literature. The wide majority of the data regarding this genus originates from the Zahn's monographic works (1921-1923, 1922-1930, 1931-1935, 1936-1938) and the contributions of Behr & all. (1937, 1939, 1939a). Among the recently published data regarding the *Hieracium* flora of North Macedonia worth to be mentioned are the description of *H. renatae* Szeląg from Jakupica Mt. (Szeląg 2010) and the first records of the following five species: *H. jurassicum* Griseb., *H. jankae* R. Uechtr., *H. maculatum* Schrank (Teofilovski 2011, 2019), *H. olympicum* Boiss. (Vladimirov & al. 2014) and *H. crocatum* Fr. (Duraki & Niketić 2018). Nevertheless, the current knowledge of *Hieracium* s. str. flora in North Macedonia regarding its taxonomy and chorology is still far of sufficient. This paper deals with some collections from the author's herbarium which appeared to be interesting finding regarding the *Hieracium* flora of the country and the Balkan Peninsula.

Material and methods

Specimens appropriate for identification were photographed and collected in the field and stored in the author's private herbarium. Identification was performed according to: Boissier (1875), Zahn (1911, 1921-1923, 1936-1938), Hayek (1928-1931) and Gottschlich & Dunkel (2018, 2019).

Results and discussions

1. *Hieracium camkorijense* subsp. ***boreograecum*** Gottsch. & Dunkel (Figs. 1, 2)

Maleševo Mountains: W of Vladimirovo village, roadside excavation in the zone of *Fagus sylvestris* forest, silicate, 1000 m, 41°42'18.63"N, 22°42'53.47"E, 20.6.2017, leg. & det. A. Teofilovski; Maleševo Mountains: 0.8 km S of the Berovo Lake dam, roadside excavation in the zone of *Fagus sylvestris* forest, silicate, 1030 m, 41°39'48"N, 22°53'37"E, 1.8.2020, leg. A. Teofilovski & D. Mandzukovski, det. A. Teofilovski; Berovo: Bezgaštevo village, *Quercus frainetto* and *Carpinus betulus* forest, silicate, 960 m, 41°34'45,6"N, 22°47'9,6"E, 3.8.2020, leg. A. Teofilovski & D. Mandzukovski, det. A. Teofilovski; Osogovo Mt.: SE of Drenok village, roadside excavation and eroded places in the zone of *Fagus sylvestris* forest, silicate, 1350 m, 42° 5'55.39"N, 22°22'33.18"E, 30.6.2021, leg. & det. A. Teofilovski; Osogovo Mt.: SE of Jamište village, roadside excavation in the zone of *Fagus sylvestris* forest, silicate, 1070 m, 42°3'24.86"N, 22°17'25.49"E, 24.6.2021,

1.7.2021, leg. & det. A. Teofilovski.

The species and subspecies respectively, are new in the flora of North Macedonia.

H. camkorijense Zahn is a SE European & SW Asian species occurring in: Romania, Bulgaria, Greece, Asiatic Turkey, Azerbaijan and Georgia (Zahn 1921-1923, 1936-1938; Greuter 2006+, Gottschlich & Dunkel 2018) with the new locality near Jamište village on Osogovo Mt. representing the westernmost point of its range. It is described from the locality Čamkorija (Rila Mt.) in W Bulgaria, as a species with a hybridogenous origin interpreted with the formula *sparsiflorum* < *vulgatum* (Zahn 1911). Later in two occasions, the proposed formula was corrected by the same author as *sparsum* ≥ *vulgatum* (Zahn 1921-1923) and *sparsum* < *lachenalii* (Zahn 1936-1938) of which the latter is considered a current one.

H. camkorijense is a polymorphic species with 11 recognized subspecies (Greuter 2006+) four of which occur in the European part of its range: subsp. *camkorijense* (Bulgaria), subsp. *rilae* Rech. f. & Zahn (Bulgaria), subsp. *perlongiramum* Zahn (Romania) (Zahn 1936-1938) and subsp. *boreograecum* (Greece) (Gottschlich & Dunkel 2018).

The recorded populations in North Macedonia belong to *H. camkorijense* subsp. *boreograecum*, a recently described subspecies from NE Greece which was distinguished from the closest related subsp. *camkorijense* and subsp. *perlongiramum* by its only denticulate leaves and from subsp. *rilae* by the less numerous stem leaves (4-6 vs. 10-12). Beside the type locality Thermia (Drama) it was quoted also from the nearby Xanthi (NE Greece) (Gottschlich & Dunkel 2018).

Fig. 1. *Hieracium camkorijense* subsp. *boreograecum,* Maleševo Mountains, Berovo Lake dam, herbarium specimen with a detail of a fruiting and a flowering capitula (photo A. Teofilovski)

2. *Hieracium paniculatissimum* (Zahn) Teofilovski **comb. et stat. nov.** (Figs. 3, 4)

≡ *H. sparsiflorum* subsp. *paniculatissimum* Zahn in Magyar Bot. Lapok 10: 169. (1911) [basionym]

≡ *H. sparsum* subsp. *paniculatissimum* (Zahn) Zahn in Engl., Pflanzenr. 79: 1022. (1922)

Plačkovica Mt.: in the vicinity of the touristic complex NE of Kozbunar village, shallow soils and stony places in beech forest zone, silicate, 1400 m,

Fig. 2. General distribution of *Hieracium camkorijense* subsp. *boreograecum,* solid circle – new record, rings – data from literature

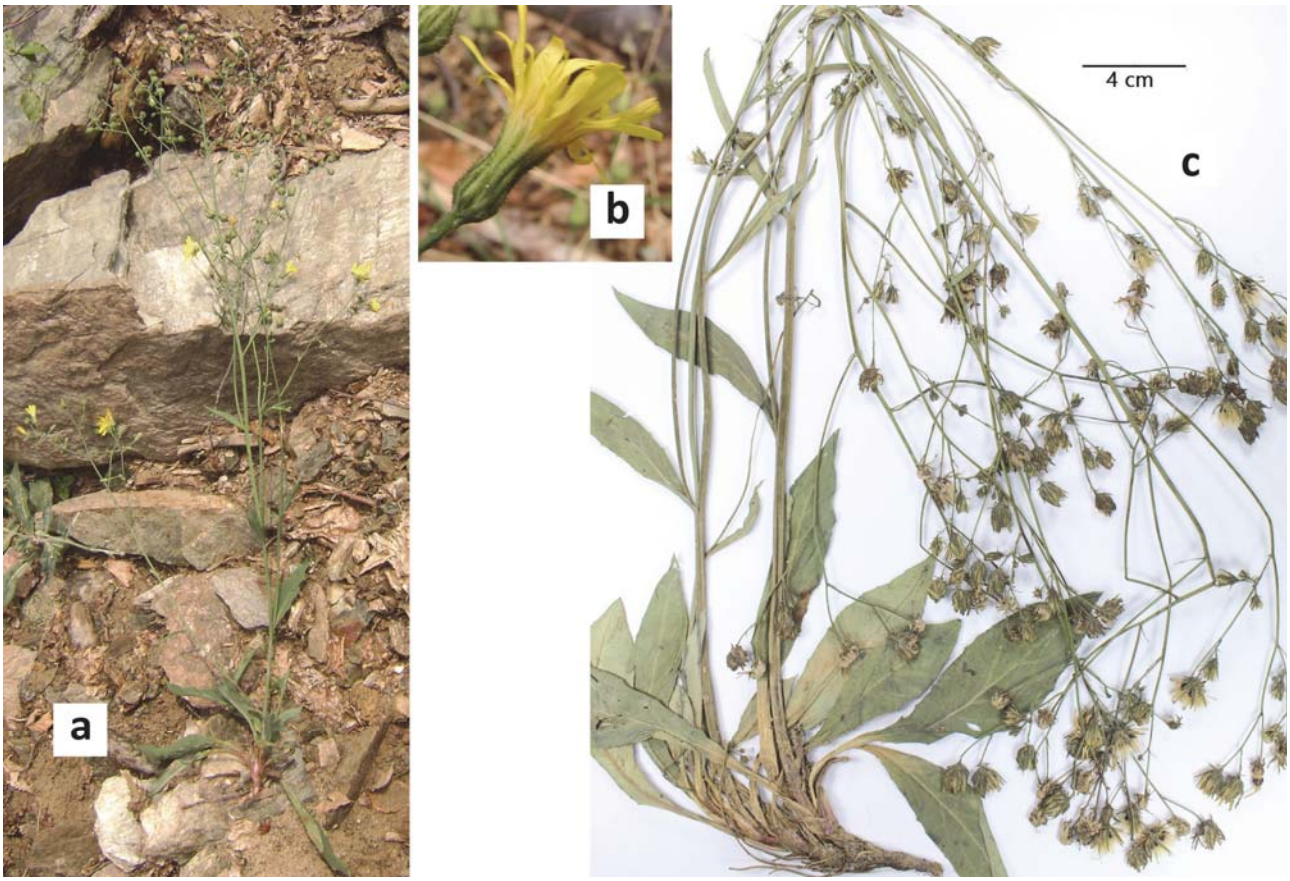

Fig. 3. *Hieracium paniculatissimum*, Plačkovica Mt., NE of Kozbunar village, a – whole plant, b – flowering capitula, c - herbarium specimen (photo. A. Teofilovski)

41°44'30"N, 22°30'12"E, 11.8.2009, leg. A. Teofilovski & D. Mandzukovski, det. A. Teofilovski.

A new species to the flora of North Macedonia.

It is a S Balkan endemic species previously known only from the type locality Čamkorija (Rila Mt.) in E Bulgaria and Leila Mt. (Serres) in NE Greece (Zahn 1911, sub *H. sparsiflorum* subsp. *paniculatissimum*; Zahn 1921-1923, 1936-1938, sub *H. sparsum* subsp. *paniculatissimum*). Dimopoulos & al. (2013, sub *H. sparsum* subsp. *paniculatissimum*) quoted it for the North East floristic region of Greece most probably on a base of the literature report for Leila Mt. The new locality on Plačkovica Mt. is situated 110 km SW of the locality Čamkorija and NW of Leila Mt, significantly extending the species range toward west.

H. paniculatissimum belongs to *H. sparsum* group which include di-, three- and tetraploid taxa distributed in parts of SW Asia, Balkan Peninsula, W & E Carpathians, E Sudetes and E Alps (see Szeląg 2003). Zahn (1921-23) considered this group a collective species with 41 recognized subspecies which concept is followed also by Greuter (2006+) who recognizes 74 subspecies. This concept is obviously not sustainable and a species rank of a number of the representatives of this group is already reaffirmed or newly proposed (Buttler 1991, Szeląg 2006, Niketić 2020). Among the subspecies of *H. sparsum* quoted in literature for North Macedonia the original taxonomic status so far is not disputed for: subsp. *korabense* O. Behr & al. (Korab Mt.) (Behr & al. 1937) and subsp. *peristeriense* O. Behr & al. (Baba Mt. -

Fig. 4. General distribution of *Hieracium paniculatissimum,* solid circles – new records, rings – data from literature

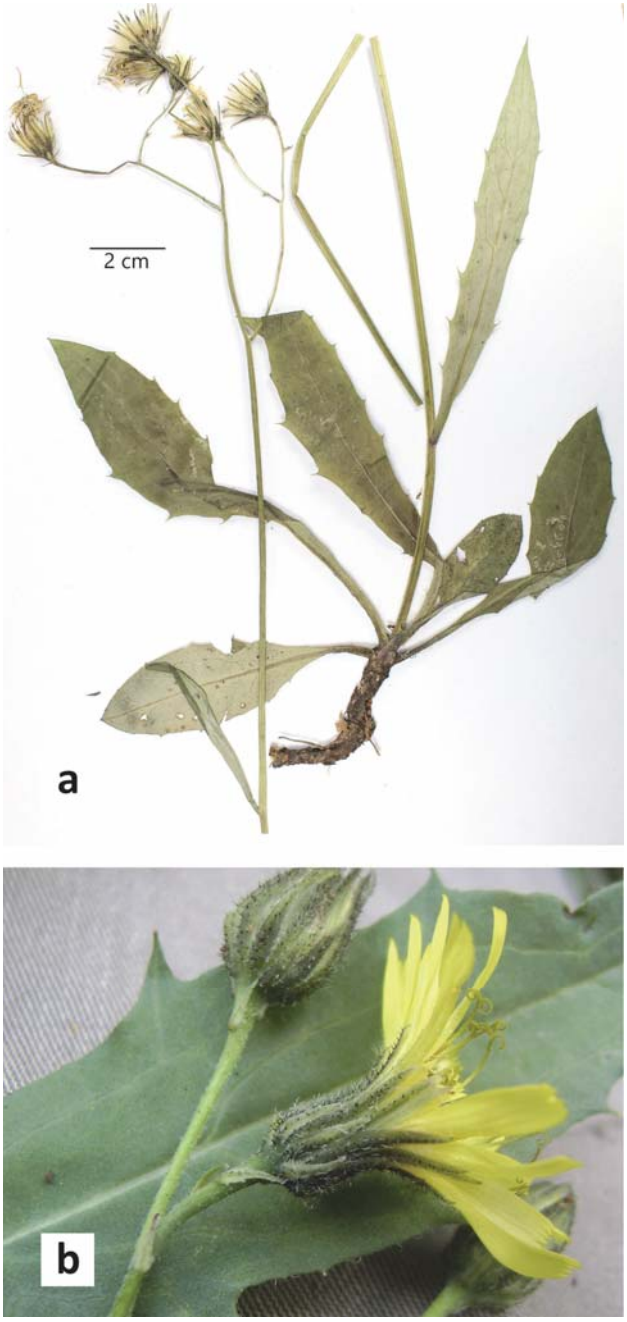

Fig. 5. *Hieracium pellense*, Nidze Mt., Suvi Dol, a - herbarium specimen, b - part of a basal leaf and inflorescence
(photo. A. Teofilovski)

Pelister, Nidze Mt.) (Behr & al. 1937, 1939). A new status of separate species is proposed for *H. sparsum* subsp. *naegelianiforme* O. Behr & al. (Buttler 1991) and *H. sparsum* subsp. *squarrosobracchiatum* O. Behr & al. (Niketić 2020), both described from Korab Mt. (Behr & al. 1937, 1939), while *H. sparsum* subsp. *livadicanum* O. Behr & al., described from Šar Mountains (Behr & al. 1939a), was synonymized with *H. oroglaucum* Behr & al. (Niketić 2020). Another two taxa within this group also occur in North Macedonia: *H. sparsum* subsp. *schultzianum* var. *kajmakčalanicum* Rech. fil. et Zahn (Behr & al. 1939a) and *H. macedonicum* Boiss. & Orph. (Boissier 1875).

Originally described as a subspecies of *H. sparifloru*m Friv. (= *H. sparsum* Friv.) (Zahn 1911), *H. paniculatissimum* is closely related to the following two members of *H. sparsum* group: S Balkan endemic *H. macedonicum* and the Romanian one *H. borbasii* R. Uechtr. It can be distinguished from the first one at least in its: usually more robust habitus, branches which often reach the base of the stem (vs. confined in the upper 1/2-1/3 of the stem), inflorescence with 10-80 capitula (vs. 7-30), and thicker leaves with less dense and shorter indumentum. Regarding the second one at least the following characteristics could be considered as differential: more robust habitus, inflorescence with 10-80 capitula (vs. 8-25), akladium 2-4 cm (vs. 0.5-2 cm), branches 5-15 (vs. 4-6), peduncles only with stellate hairs or glabrous (vs. hairy with stellate, simple and glandular hairs) and stem leaves 4-5 (8) (vs. 2-4). Further studies are needed to make clearer the origin, ploidy level and reproductive mechanism of these three species.

3. *Hieracium pellense* Gottsch. & Dunkel (Figs. 5, 6)

Nidze Mt.: Suvi Dol, sparse *Pinus sylvestris* forest, limestone, 1800 m, 40°59'47"N, 21°48'33"E, 24.7.2010, leg. A. Teofilovski & D. Mandzukovski, det. A. Teofilovski.

A new species to the flora of North Macedonia.

According to the present knowledge this species is a local endemic to the subalpine belt of Nidze Mt., occurring exclusively on calcareous geological substrate. It

Fig. 6. General distribution of *Hieracium pellense*, solid circle – new record, ring – data from literature

was described just recently and was known only from the type locality, situated on the Greek part of this mountain (NW of Edesa, calcareous macadam, 1800 m) (Gottschlich & Dunkel 2019).

The origin of *H. pellense* is considered hybridogenous, with supposed parental species being quoted *H. murorum* L. and the Balkan endemic *H. oroglaucum* O. Behr & al. (Gottschlich & Dunkel 2019). The cited authors proposed a morphological formula *oroglaucum* - *murorum*.

Conclusions

Three new species of *Hieracium* s. str. are reported for the first time to the flora of North Macedonia, with the species status of one of them (*Hieracium paniculatissimum*) being newly proposed.

The SE European & SW Asian species *Hieracium camkorijense* was recorded on Maleševo Mountains and Osgovo Mt. (E North Macedonia). The locality near Jamište village on Osogovo Mt. represents the new westernmost point of the species range. The recorded populations belong to subsp. *boreograecum*, previously considered endemic to NE Greece (Thermia, Xanthi). The new localities on Osogovo Mt. extend the subspecies range of distribution 190 km toward northeast.

Hieracium paniculatissimum, previously known only from two localities – Čamkorija (E Bulgaria) and Leila Mt. (NE Greece), was recorded on Plačkovica Mt. (E North Macedonia). It is situated 110 km SW of the locality Čamkorija and at the same distance NW of Leila Mt., thereby representing the new westernmost point of the species range.

The recently described *Hieracium pellense*, previously known only from the type locality on the Greek part of Nidze Mt., was recorded 12 km northwards, on the Macedonian part of this mountain.

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Bupleurum aequiradiatum (Apiaceae) in the flora of the Republic of North Macedonia

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Abstract
New data of *Bupleurum aequiradiatum*, a rare and little-known species in the Republic of North Macedonia, are presented. So far, it has been recorded only in the vicinity of Prilep village based on an old herbarium specimen dates back to 1937. Recently, a new locality was found in the area of "Tekijski Rid", nearby the village Tekija (Skopje valley). The key morphological characters of the closely-related species *B. aequiradiatum* and *B. commutatum* are illustrated and commented on.

Key words: *Bupleurum*, chorology, new data, rare species, *Umbelliferae*

Introduction

The difficulties in identifying of *Bupleurum* species, especially in the annuals of sect. *Juncea*, can be explained by the fact that the most important diagnostic characters are flower and fruit details which often are less than 1 mm large. Such is the case with *B. aequiradiatum* (H. Wolff) Snogerup & B. Snogerup, initially described as *B. commutatum* var*. aequiradiatum* H. Wolff *by* Wolff (1910). It became more recognizable nowadays after the monography of European annuals of Bupleurum (Snogerup & Snogerup 2001), in which it was raised in the rank of species.

Bupleurum aequiradiatum is absent in the most recent flora of the Republic of Macedonia (Micevski 2005), although a little earlier it was mentioned for Macedonia (Snogerup & Snogerup 2001) with a single locality based on a herbarium record in PR*.* Probably due to the lack of specimens of this species in the national herbarium of Macedonia (MKNH), the species has been neglected.

In this paper, we reported the finding of second locality of *B. aequiradiatum* and confirm the species for the flora of the Republic of North Macedonia.

Material and Methods

The plants were collected from the locality "Tekijski Rid" , in the vicinity of the village Tekija, eastern part of Skopje valley, c. 20 km from the capital. Voucher specimens have been deposited in the herbarium of the Natural History Museum of the Republic of North Macedonia (HMMNH). Relevant literature sources were used for the determination of the plant material (Wolff 1910, Snogerup & Snogerup 2001, Stoyanov 2019*).*

Macro-photographs of some details of *Bupleurum* were done using the Trinocular Stereo Microscope Zeiss Stemi 2000-C (zoom 0.65x–5.0x) equipped with a Canon EOS 350D camera. Blue matt glass covered with a transparent plastic plate with a millimeter mesh was used as a background for the shooting.

Results and discusion

Bupleurum aequiradiatum (H. Wolff) Snogerup & B. Snogerup in Willdenowia 31: 302 (2001) ≡ *Bupleurum commutatum* var. *aequiradiatum* H. Wolff in Engler, Pflanzenr. 43: 84 (1910).

— Skopje: village Tekija, locality "Tekijski Rid", 400 m, 14.06.2009, leg. Z. Nikolov (HMMNH 7824–7825, sub *B. praealtum*);

— Skopje: village Tekija, locality "Tekijski Rid", 330–360 m, 23.06.2011, leg. Z. Nikolov (HMMNH 7780, sub *B. affine*);

— Skopje: village Tekija, locality "Tekijski Rid", 300–350 m, 26.06.2015, leg. Z. Nikolov (HMMNH 14220–

14221).

In the protologue, Wolf (1910) noted with uncertainty the occurrence of *B. commutatum* var. *aequiradiatum* for the geographical area of Macedonia, without a specific locality. Much later Snogerup & Snogerup (2001) for the first time reported *B. aequiradiatum* for the current territory of the Republic of North Macedonia based on revised specimen of *B. commutatum* Boiss. & Balansa (Prilep, montis supra vicum Pletvar, 25 July 1937, F. Weber, PR 872982).

In 2021, during the review of *Bupleurum* specimens stored in the Herbarium HMMNH we came across of several specimens of *B. aequiradiatum* (non-determined or misidentified as *B. affine* and *B. praealtum*), all collected recently in the vicinity of Tekija village, in Skopje valley (Fig. 1, 2). Their traits, such as almost equal, divergent umbel rays, up to 2 cm long, clearly corresponded with the diagnostic characters of *B. aequiradiatum* mentioned by Wolff (1910).

Fig. 1. *Bupleurum aequiradiatum* in the locality "Tekijski rid"
(N: 42º00.013' E: 021º40.802'; 391 m a.s.l.)
(Photo: Z. Nikolov)

The locality "Tekijski Rid" (Tekija village), where dominates dry grasslands (with *Paliurus spina-christi* Mill. and *Quercus pubescens* Willd.) and former arable lands, is also habitat of the recently discovered steppe-element *Dianthus pallidiflorus* Ser., in the flora of the Republic of North Macedonia (Nikolov 2020).

Bupleurum aequiradiatum and *B. commutatum* are similar to some extent, in the habit and having 5–8 rays in the top umbels, but are quite different in a number of other characteristics (Table 1), especially in their petals and mericarps (Fig. 3, 4).

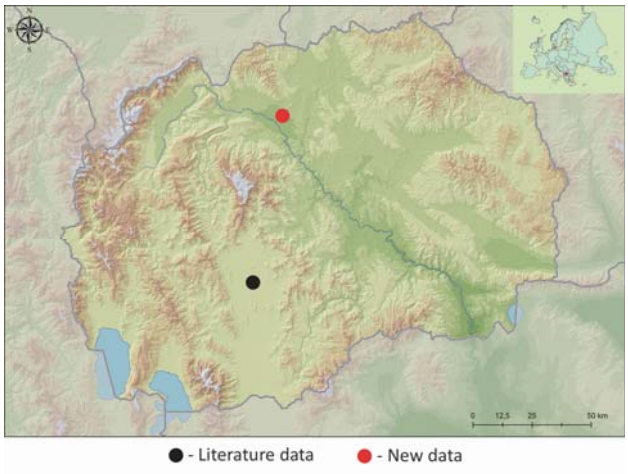

Fig. 2. Distribution of *Bupleurum aequiradiatum* in the R. of North Macedonia

Conclusion

Bupleurum aequiradiatum was confirmed for the flora of the Republic of North Macedonia with the finding of second locality of that species in the vicinity of Tekija village. The Macedonian, Serbian and Greek localities (according to Snogerup & Snogerup 2001) form the western limit of the species range that extends eastwards to south and east Bulgaria and Romanian Dobrogea (Stoyanov 2019).

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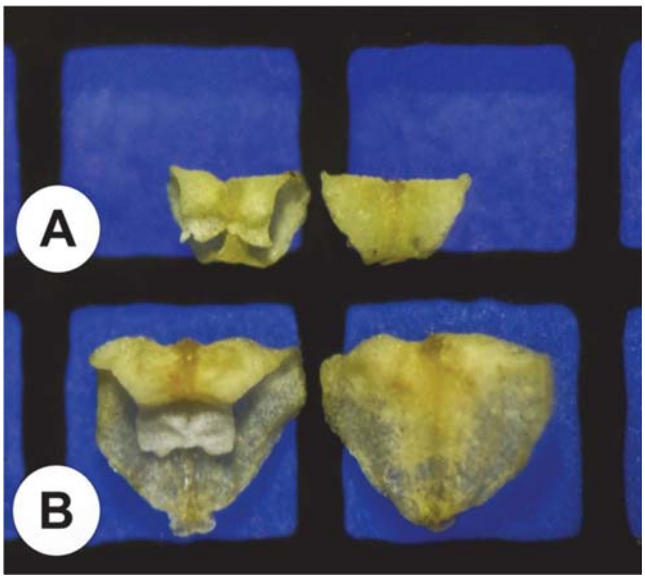

Fig. 3. Comparison of petals (inside and outside view) of *Bupleurum aequiradiatum* and *B. commutatum*. – A: *Bupleurum aequiradiatum*. – B: *Bupleurum commutatum*.

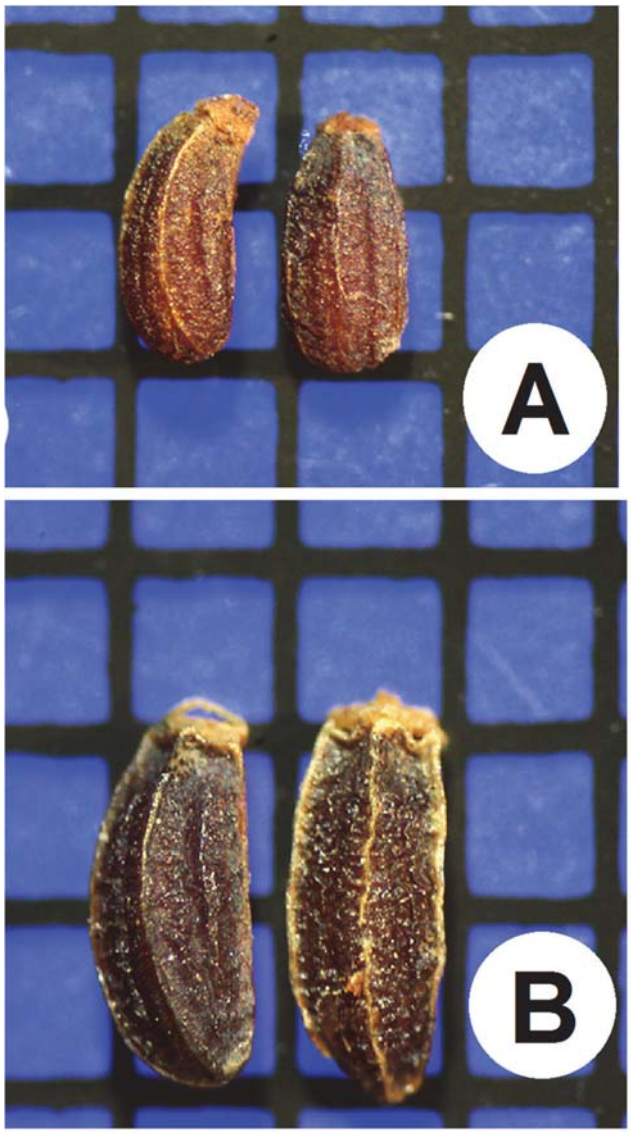

Fig. 4. Comparison of mericarps of *Bupleurum aequiradiatum* and *B. commutatum*. – A: *Bupleurum aequiradiatum*. – B: *Bupleurum commutatum*.

Table 1. Comparison of the key morphological characters of *Bupleurum aequiradiatum* and *B. commutatum*.

Characters	***B. aequiradiatum***	***B. commutatum***
Umbel rays	almost equal, the longest up to 2 cm, diver-	very unequal, the longest 4–5 cm, non-
Bracts and bracteoles	with finely serrulate margins	with entire margins or serrulate near apex
Petals	limb 0.4–0.5 mm wide, inflexed lobe at apex almost as wide as limb	limb 0.8–0.9 mm wide, inflexed lobe at apex two times narrower than limb
Fruits	1–1.5 mm long, styles 0.3–0.4 mm	2–2.5 mm long, styles 0.4–0.5 mm

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Contribution to the knowledge of the genus *Allium* (Alliaceae) in the flora of the Republic of North Macedonia

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Abstract

In this paper, one new species - *Allium rhodopeum*, and one new subspecies - *Allium flavum* subsp. *tauricum*, in the flora of the Republic of North Macedonia, are presented. There are also new chorological data for two rare species - *Allium cyrilli* and *Allium fuscum*. The presence of *A. rhodopeum* increased the number of *Allium*-species, in our country, on 26. Photos as well as distribution maps of all taxa are also presented.

Key words: *Allium*, chorology, Republic of North Macedonia, new finding.

Introduction

Allium (Alliaceae) is one of the largest genera of the monocotyledons with a current number of c. 920 species (Seregin & al., 2015; Xie & al., 2019). The genus comprises perennial herbs with bulbs enclosed in membranous (in some cases fibrous) tunics, narrow basal leaves, umbellate or head-like inflorescence, flowers with six free or almost free tepals, and often a subgynobasic style (Friesen, 2006; Li & al., 2010). The specific odor and taste, as a result of the production of a large amount of cysteine-sulphoxides, is characteristic for the most of the species (Friesen, 2006).

The distribution of the genus *Allium* is confined to the Northern hemisphere, with one main center of diversity in southwest and central Asia and another smaller one in North America (Friesen, 2006; Li, 2010).

So far, there is no comprehensive study for the genus *Allium* on the territory of the Republic of North Macedonia. The data from the articals of many authors: Wettstein (1892), Grecescu (1899), Halascy (1906), Dimitrov (1908), Vandas (1909), Stojanov (1921, 1928), Jurišić (1923), Urumov (1923), Bornmüller (1928, 1932, 1937), Soška (1938, 1938/39 a, b, 1941, 1953), Rudski (1943), Černjavski (1943), Weber (1951), Micevski (1952, 1974), Horvat (1953), Ade (1954), Todorovski (1954), Cirimotić (=Matvejeva) (1958, 1965, 1968), Grupče (1958), Drenkovski (1969, 1969a), Šopova (1972), Matevski (1995), Teofilovski (2007, 2011; 2021), Niketić & al. (2014), Nikolov (2018) are only fragmented records, for different species, registered in different parts of the country.

The total of *Allium*-species, in our country, is 25. The Mediterranean *Allium subhirsutum* L., registered so far only on Flora mountain (Vandas, 1909), is included in this number. But, the data of Bornmüller (1928), for *Allium orientale* Boiss. and Soška (1938), for *Allium zebdanense* Boiss. & Noë, are not because it is concluded that the Bornmüller's data (1928) referred to *Allium cyrilli* Ten. (Greuter in Greuter & Raus, 2009) and the data of Soška (1938), to *Allium phthiothicum* Boiss. & Heldr. [Niketić, M. & al., 2014 – Mt Dautica, EM31, coll./det. T. Soška, 27-Jul-1926 sub *A*. ex aff. *zebdanense*/*A. phthioticum*, rev. G. Anačkov 28-Nov-2008 (BEO)].

Materials and methods

Collected material, dried and labeled according to the standard procedures, is deposited in the Herbarium of Natural History Museum of the Republic of North Macedonia. The most of the material was collected during the work on the project "Taxonomy and chorology of the genus *Allium* in the flora of the Republic of

Fig. 1. *Allium cyrilli* Ten. (Photo: Z. Nikolov)
a) var. *cyrilli* b) var. *flavescens*

Macedonia", carried out from 2011-2013 year. Relevant literature sources, for the determination of the material, were consulted: Hayek (1933), Velev & Asenov (1964), Zahariadi (1966), Tatić (1975), Stearn (1978, 1980, 1981), Kollman (1984), Anačkov (2009). Photos of the plants, in their native habitat, were also taken.

Results and discussion

Subgen. Melanocrommyum (Webb et Berth.) Rouy

Sect. Melanocrommyum Webb. & Berth.

Allium cyrilli Ten. Fl. Napol. 3: 364. 1827.

(Syn. *A. nigrum* var. *cyrilli* (Ten.) Fiori in A.Fiori & al. 1896, Fl. Italia 1: 202; *A. fragrans* Cirillo ex Ten. 1827, Fl. Napol. 3: 364, nom. illeg.; *A. elmaliense* Deniz & Sümbül 2004, Ann. Bot. Fenn. 41: 147; *Allim cyrilli* Ten. var. *flavescens* (Acht.) Cheshm. 1977, Proceed. 3rd Nat. Conf. Scient. of Bulg., 290).

Allium cyrilli (Fig. 1) is an East-Mediterranean species distributed in Italy (South-Eastern Italy – Pulja and Northern Italy – Piedmont, Emilia-Romagna and Veneto), S. and E. Balkans (SE Serbia, Makedonija, E Albania, Greece, Bulgaria, Turkey), east Aegean islands (Samotraki, Ksios), Krit, Asia Minor, Krim (Niketic, 1999; Peruzzi & al., 2012). Data for the presence of this species, on the territory of the Republic of North Macedonia, we find in the works of Soška (1938-1939b), for the locality "Krasta" (Gorge of Demir Kapija and Petrovo village), and Greuter (in Greuter and Raus, 2009), for the surrounding of Dojran and Drenovo village. The new findings are registered in Skopje valley (Katlanovo; Tekija village), Kumanovo (G. Konjare village), Mariovo, and Negotino (Fig. 2). The data from Raec village (Drenovo village, Kavadarci) and surroundings of Dojran and Demir Kapija are confirmation of the data of Soška

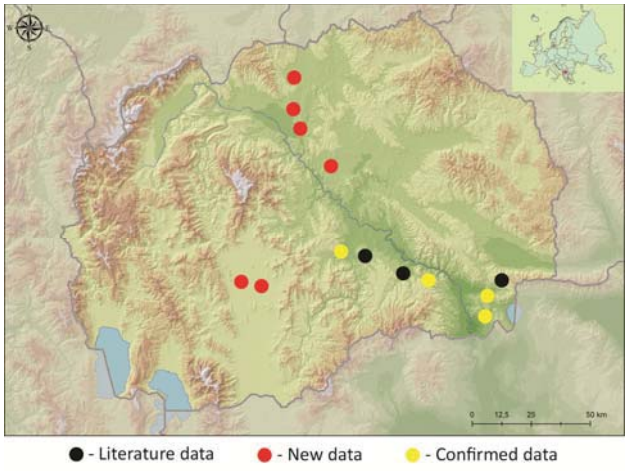

Fig. 2. Distribution of *Allium cyrilli* Ten.

(1938-1939b) and Greuter (in Greuter and Raus, 2009 (Fig. 2).

A. cyrili belongs to the Subgen. Melanocrommyum (Webb et Berth.) Rouy, sect. Melanocrommium Webb & Berth. (Stearn, 1981; Anačkov, 2009; Peruzzi & al., 2012). Taxonomically, its species-rank is stable. But, misidentifications with the closest *Allium nigrum* L., which also occurs in our country (Jurišić, 1923; Stojanov, 1928; Rudski, 1943; Drenkovski, 1969, Šopova, 1972), are often. The differential characteristics between these two species are detailed and illustrated in the work of Peruzzi & al. (2012).

The sub-specific variability of *A. cyrilli* (Fig. 1, a, b) results with typical form (var. *cyrilli*) and var. *flavescens* (Acht.) Cheshm. Dominance of the var. *flavescens* (Acht.) Cheshm. is noticed in our so-far encountered populations. Only the population, from the surrounding of Katlanovo (Kožle village), includes the both varieties.

Literature data

Soška, Th., 1938-1939b: Beitrag zur Kenntnis der Schluchten-floren von Südserbien, III Teil. BSS Sk., 20 (7):167-191

Greuter, M., 2009: *Allium cyrilli* in Greuter & Raus. Med-Checklist Notulae, 28. Willdenowia, 39(2):335-345. Botanic Garden and Botanical Museum Berlin (BGBM)

New data

Kumanovo: G. Konjare village, locality "Rusa Voda"; 23.05.2012; nr. 9135; Leg./Det.: Z. Nikolov

Katlanovo (Skopje): Kožle village, along the river Pčinja, grassland, 377 m.a.s.l., 05.05.2013.; nr. 9371; Leg./Det.: Z. Nikolov

Skopje: Tekija village, 300 m a.s.l., 19.05.2013; nr. 9370; Leg./Det.: Z. Nikolov

Mariovo: along the road to Čebren, 500-650 m a.s.l., 17.06.2013; nr. 9151; Leg./Det.: Z. Nikolov

Mariovo: Manastir village, steepe-like localities, along the roads (Thero-Brachypodietalia), carboniferous, 27.05.2013., 675 m a.s.l. (leg. B. Zlatković, G. Tomović, S. Hristovski)

Negotino: between Pepelište and Vojšanci villages, segetal places, formal arable places, neogenic sedimets, 06.05.2013., 154 m (leg. B. Zlatković, G. Tomović)

Confirmed data

Kavadarci: Raec village, ruderal places along the road, neogenic sedimets, 15.04.2011., 836 m a.s.l., (Leg. B. Zlatković)

Demir Kapija: on the rocks, along the river, carboniferous, 10.06.2013., 168 m a.s.l., 41°24'20.11"N, 22° 15'35.90"E; (leg. B. Zlatković, G. Tomović)

Dojran: along the road to Nikolić village, in the vicinity of the camp "Ačikot", 164 m a.s.l, 06.05.2013; nr. 9373; Leg./Det.: Z. Nikolov

Dojran: along the road from Dojran to Nikolić village, 130-170 m a.s.l., 25.05.2013; nr. 9137; Leg./Det.: Z. Nikolov

*B. Zlatkovic & Z. Nikolov

Subgenus Allium

Sect. Codonoprasum Rchb.

Allium rhodopeum Velen. Sitzungsber. Königl. Böhm. Ges. Wiss., Math.-Naturwiss. Cl. 1889(2): 58. 1890.

(Syn.: *Allium paniculatum* var. *rhodopeum* (Velen.) Stoj. & Stef. Fl. Bulgar. 1: 233. 1924; *Allium paniculatum* var. *villosulum* Halácsy. Consp. Fl. Graec. 3: 256. 1904); *Allium paniculatum* subsp. *villosulum* (Halácsy) Stearn. Ann. Mus. Goulandris 4: 161. 1978).

Literature data

So far, no data for the territory of N. Macedonia.

New data

Kavadarci (Drenovo village, river Raec): Drenovska gorge, 300 m a.s.l., 10.08.2012; nr. 7433; Leg./Det.: Z. Nikolov

Veles: in the vicinity of the slaughterhouse, along the old road to Gradsko, dry grasslands, 178 m a.s.l., 22.08.2013; nr. 9257; N 41° 41' 12.4"; E: 021° 48' 33.2". Leg./Det.: Z. Nikolov

Veles: along the river Babuna, in the vicinity of the slaughterhouse; dry grasslands, 183 m a.s.l., 02.08.2014; nr. 10652; N: 41º41'12.8": E: 021º48'32.9". Leg./Det.: Z. Nikolov

Veles: along the old road to Gradsko, 200 m a.s.l., 02.08.2014; nr. 10767; N: 41º 40' 54.6", E: 021º 49' 31.2"; Leg./Det.: Z. Nikolov

Veles: along the river Babuna, in the vicinity of the slaughterhouse, 182 m a.s.l., 19.08.2014; nr. 10781; N: 41º 41' 12.2", E: 021º 48' 35.3"; Leg./Det.: Z. Nikolov

Allium rhodopeum (Fig. 3) is a Mediterranean-submediterranean species whose typical form (subsp. *rhodopeum*) is confined to S Bulgaria, N and C Greece, and Evvoia while the other, subsp. *turcicum* Brullo, Guglielmo & Terrasi, grows in NE Greece, European Turkey and NW Anatolia (Brullo, Guglielmo & Terrasi, 1998; Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity). Meanwhile, its distribution was extended to Serbia with the data by Tomović & al. (2006), for the presence of this species in

Fig. 3. *Allium rhodopeum* Velen. (Photo: Z. Nikolov)

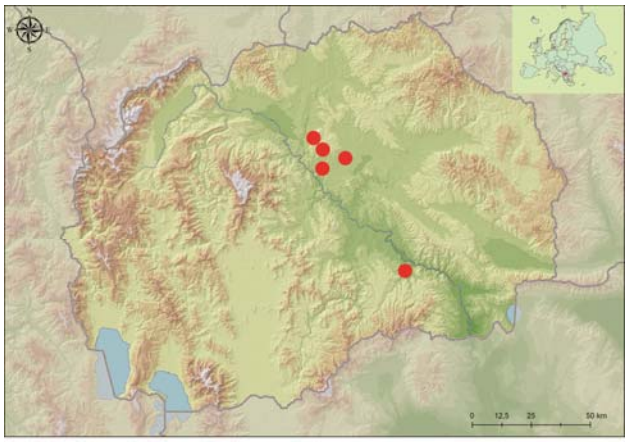

Fig. 4. Distribution of *Allium rhodopeum* Vel.

Eastern Serbia [sub. *A. rhodopeum* Vel. subsp. *villosulum* (Halácsy) Stearn].

Hitherto, data for the presence of this species, on the territory of the Republic of North Macedonia, are not recorded. Hayek (1933) included Macedonia, together with Bulgaria and Greece, in the distribution area of *A. rhodopeum* but geographically "Hayek's Macedonia" doesn't coincidence (overlap) with the nowadays Republic of North Macedonia. The new findings of *A. rhodopeum* concern Drenovska gorge (Kavadarci, Drenovo village) and localities along the road from Veles to Gradsko, in the vicinity of the slaughterhouse (Fig. 4).

A. rhodopeum belongs to the subgenus Allium, sect. Codonoprasum Rchb. (Stearn, 1981; Anačkov, 2009). It is, in taxonomical view, stable taxon, only the rank is different, by different authors. Described by Velenovsky (1890) as a species, *A. rhodopeum* was later treated as a variety of *Allium paniculatum* (Stojanov & Stefanov, 1924; Velev & Asenov, 1964). In the meantime, the described variety - *Allium paniculatum* var. *villosulum* from Attica (Greece) by Halácsy (1904), was considered to be a synonym of *A. rhodopeum* (Hayek, 1933). In spite of Hayek (1933), Stearn (1978) accepted the Halácsy's solution but made a change in the rank - from variety level (*Allium paniculatum* var. *villosulum*) to subspecies level (*A. paniculatum* subsp. *villosulum*). This was later accepted by Kollman (1984) and Tomović & al. (2006). Brullo, Guglielmo & Terrasi (1998), in their detailed study, concluded that *A. rhodopeum* and *A. paniculatum* var. *villosulum* are actually synonyms and used the name, given by Velenovsky (1890) – *A. rhodopeum*. This name, which was later accepted in the works of Anačkov (2009) and Strid & al. (2017), is used in this paper.

The plants, from the alleged localities, match the typical form of the species (Velenovsky, 1890; Stern, 1978; Brullo et al., 1998).

Subgenus Allium

Sect. Codonoprasum Rchb.

Allium fuscum Waldst. & Kit. Descr. Icon. Pl. Hung. 3: 267. 1807.

[Syn. *Allium paniculatum* var. *fuscum* (Waldst. & Kit.) Boiss. Fl. Orient. 5: 260. 1884; *Allium paniculatum* subsp. *fuscum* (Waldst. & Kit.) Arcang. Comp. Fl. Ital. 2: 136. 1894]

Literature data

Lepenec: Vučidol, Eleshan (Soška, 1938/1939a, sub. *A. fuscum*)

Strumica: Poroj (Rudski, 1943, sub. *A. fuscum*)

Valandovo: Kula (Soška, 1953, sub. A. *fuscum*).

New data

Bistra (Kičevo): along the black road to "Jama", oak forest, 1090 m a.s.l., 11.08.2013; Leg./Det.: Z. Nikolov

Bistra (Kičevo): along the black road to "Jama", oak forest, 1109 m a.s.l., 16.08.2014; N: 41º28'54.3"; E: 020º47'07.9". Leg./Det.: Z. Nikolov

Kozjak (Majdan village, Alšar): along the forest road,

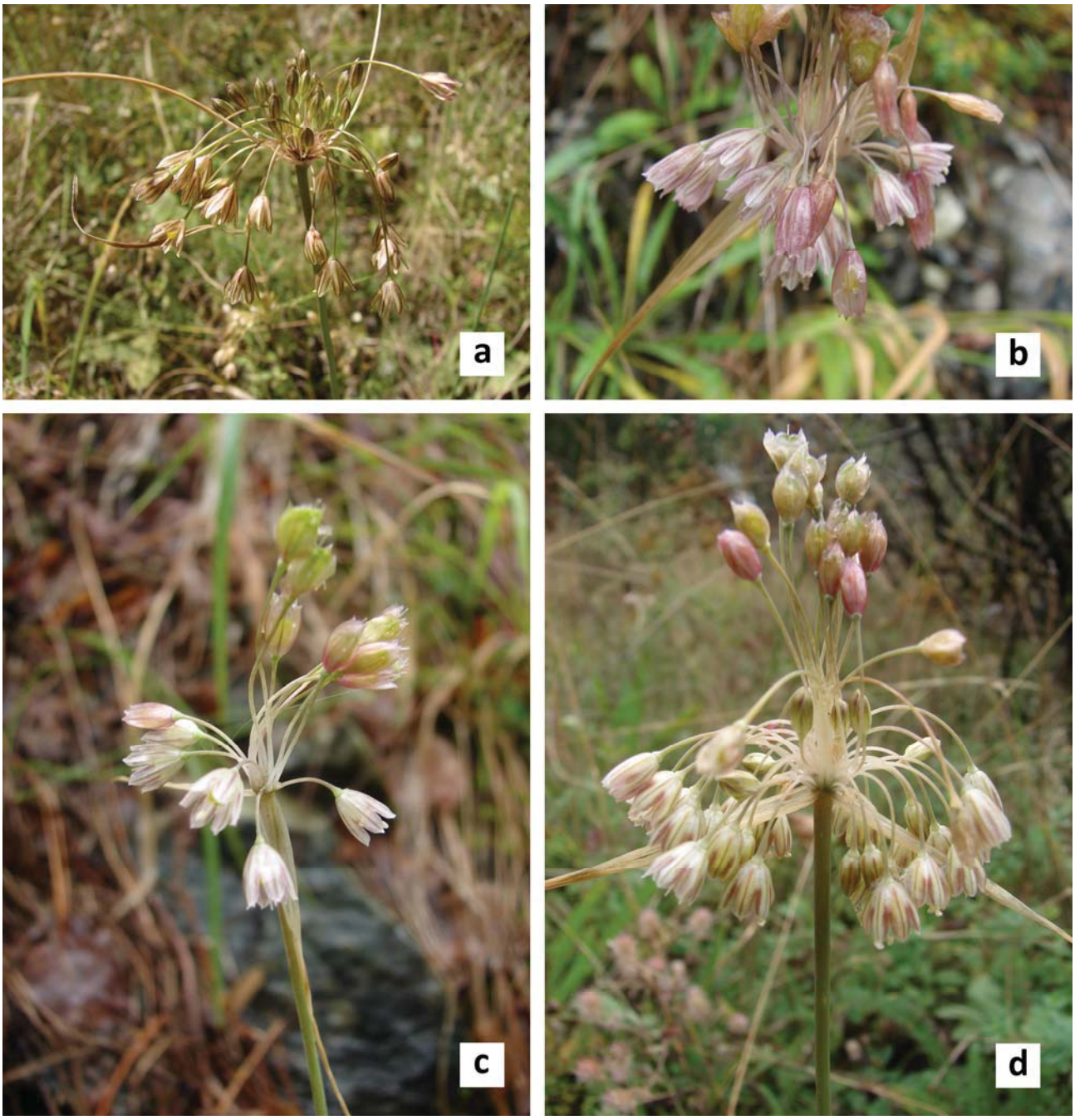

Fig. 5. *Allium fuscum* Waldst. & Kit. (Photo: Z. Nikolov)
a) Bistra b, c, d) Kozjak

pine-beech forest, 1042 m a.s.l., 05.09.2014. N: 41º09'13.1"; E: 021º55'50.5". Leg.: Z. Nikolov, A. Teofilovski; Det. Z. Nikolov

Bogdanci: in the vicinity of the windmills, 320 m a.s.l., 04.07.2020; Leg./Det.: Z. Nikolov

Allium fuscum (Fig. 5) is a Mediterranean-submediterranean species spread from south-eastern Europe to Turkey and NW Africa (Goeverts, 2006; Anačkov, 2009). Old data, for the presence of *A. fuscum,* on the territory of the Republic of North Macedonia, come from Soška (1938/1939a, 1953) and Rudski (1943). New findings are registered on the mountains Bistra (Kičevo) and Kozjak (Majdan village) and in the surrounding of Bogdanci, in the vicinity of the windmills (Fig. 6).

A. fuscum belongs to the subgenus Allium, sect. Codonoprasum Rchb. (Stearn, 1981; Anačkov, 2009). Although described as a species (Waldst. & Kit., 1807), its taxonomic status was treated differently (Boissier, 1884; Arcangeli, 1894; Hayek, 1933; Tatić, 1975; Stearn, 1978, Kollman, 1984). But, the comparative morphological, karyological, ecological and other researches on

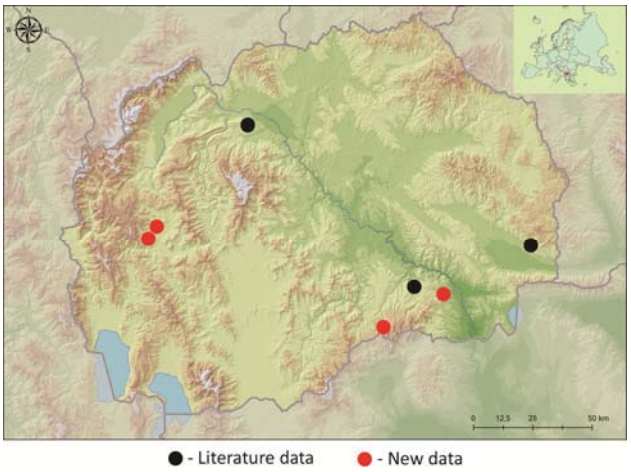

Fig. 6. Distribution of *Allium fuscum* Waldst.& Kit.

the plants, from different parts of the distribution area, confirmed the justification of the species rank of *A. fuscum* (Brullo & al., 1998).

The plants from the newly-discovered localities match the description of *A. fuscum* (Brullo & al., 1998). Considering the color of the perigon segments, the inflorescence in the populations from Bistra and Bogdanci is quite uniform – greenish-white, tinged with brown-green (Fig. 5, a) while the segments in the inflorescence in the population from Kozjak are dominant purplish-brown with brown-green mid vein (Fig. 5, b, c, d). Also, the inflorescence in the first-mentioned populations (Bistra and Bogdanci) is many-flowered (Fig. 5, a) while the inflorescence in the population of Kozjak is few to many-flowered (Fig. 5, c, d).

Subgenus Allium

Sect. Codonoprasum Rchb.

Allium flavum subsp. ***tauricum*** (Besser ex Rchb.) K. Richt. Nomencl. ref.: Pl. Eur. 1: 206. 1890.

[Homotypic names: *Allium flavum* var. *tauricum* Besser ex Rchb. Nomencl. ref.: Iconogr. Bot. Pl. Crit. 6: 9. 1828; *A. tauricum* (Besser ex Reichb.) Grossh. Flora Kavkaza, 1:213. (1928)]. (A*. tauricum* (Besser) Pall. ex G. Don in Mem. Werner, Soc. VI (1827); Zahariadi, C., 1966. Flora na Romanija, IX]

Literature data

There are no literature data for the presence of this subspecies on the territory of the R. of North Macedonia.

New data

Katlanovo: Katlanovo spa, stony carboniferous terrain, 300 m a.s.l., 21.06.2009; Leg./Det.: Z. Nikolov

Katlanovo: in the vicinity of former youth settlement, 294 m a.s.l., 25.06.2011; Leg./Det.: Z. Nikolov

Katlanovo: in the surrounding of Gradmanci village, 200-350 m a.s.l., 01.07.2016; Leg./Det.: Z. Nikolov

Veles: along the river Topolka, 200 m a.s.l., 06.07.2012; nr. 9082; N: 41° 41' 57.5" E: 021° 47' 10.6"; Leg./Det.: Z. Nikolov

Vodno (Skopje): along the road from Sredno to Gorno Vodno, 630-1060 m a.s.l., 13.07.2012; Leg./Det.: Z. Nikolov

Vodno (Skopje): Gorno Vodno, 1000 m a.s.l., 04.08.2020; Leg./Det.: Z. Nikolov

S.C. Gora (Pobožje village): over village Brodec, "Zelenkovec" locality, 1300 m a.s.l., 06.08.2013; Leg./Det.: Z. Nikolov

Skopje: Tekija village, Tekijski Rid, 400 m a.s.l., 08.07.2020; Leg./Det.: Z. Nikolov

Bogdanci: over the hills southeast of the town, in the vicinity of the new church, 13.07.2019; Leg./Det.: Z. Nikolov

Allium flavum is spread in S & SC Europe, extending northwards to c. 50º30’ N. in S. Russia, but absent from the Iberian Peninsula: Al Au Bu Cz Ga Gr Hu It Ju Rm Rs (C, W, K, E) Si Tu (Stearn, 1980). *A. flavum* subsp. *tauricum* (Besser ex Reich.) K. Richt. (Fig. 7, a, b) occurs in S.E. Europe, from Greece to S.E. Russia (Stearn, 1980). According to Kollman (1984), *A. flavum* subsp. *tauricum* belongs to the Mediterranean elements.

All data, that we find in the works of many authors (considering the territory of North Macedonia) like Grecescu (1899), Dimitrov (1908), Vandas (1909), Stojanov (1921), Bornmüller (1928, 1937), Soška (1938, 1938/39a,b, 1941), Černjavski (1943), Micevski (1952, 1994), Grupče (1958), Matvejeva (1965), Drenkovski (1969), Šopova (1972), Matevski (1995), Teofilovski (2007), refer to *A. flavum*. But, data for the presence of the subsp. *tauricum* are, so far, not registered. The findings of this subspecies are confined to Skopje valley (Katlanovo, Tekija village, Vodno, S.C. Gora), Veles (along the river Topolka) and the surrounding of Bogdanci (Fig. 8).

A. flavum belongs to the subgenus Allium, sect. Codonoprasum Rchb. (Stearn, 1981; Anačkov, 2009).

The status of the subsp. *tauricum*, differently evaluated in the past, is now dominantly accepted at a subspecies level (Stearn 1978, 1980; Kollman, 1984; Anderson, 1991; Anačkov, 2009; Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity. World Checklist of Selected Plant Families (2010); Plant list - A working list of all plant species that is result of the collaboration of Royal Botanic Gardens,

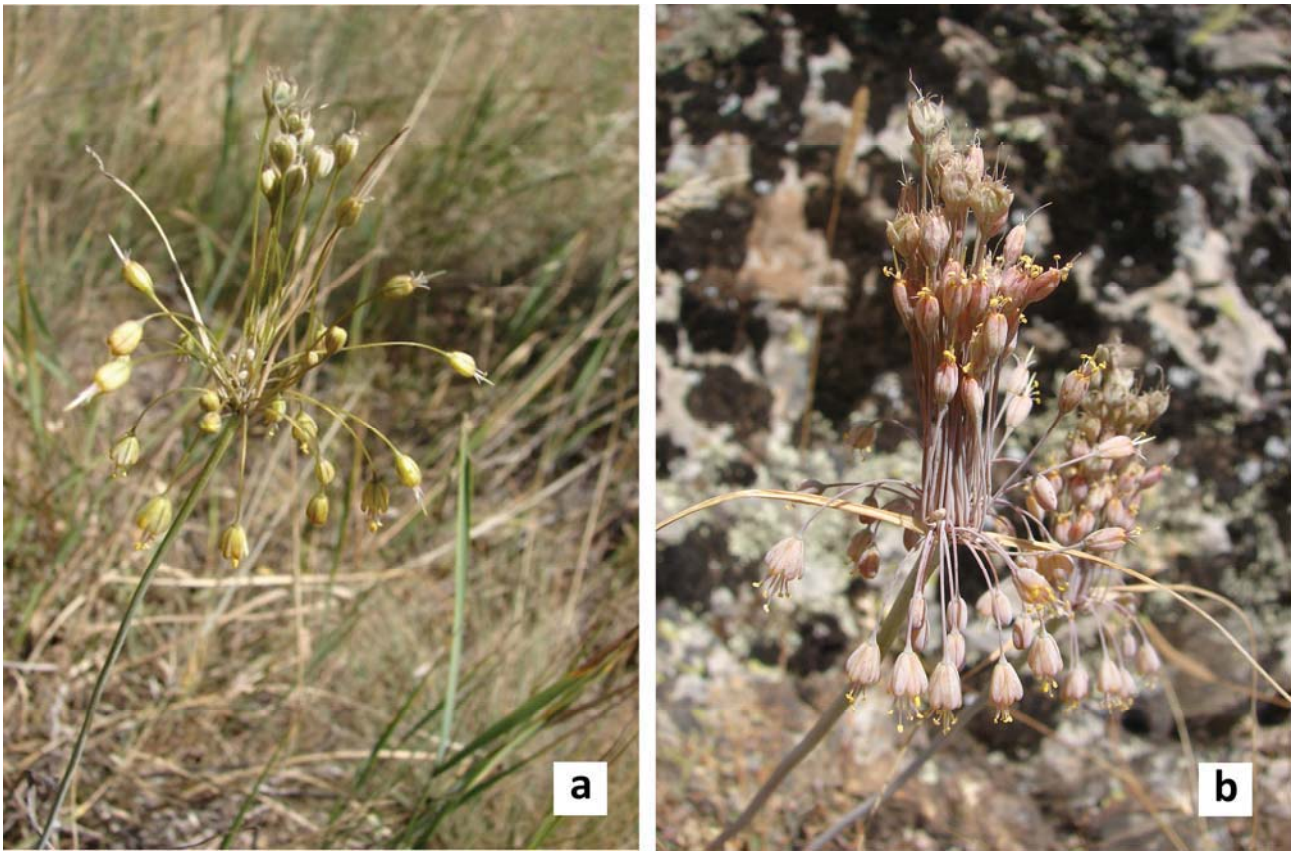

Fig. 7. *Allium flavum* subsp. *tauricum* (Besser ex Rchb.) K. Richt.
a) Tekija village b) S.C. Gora (Photo: Z. Nikolov)

Kew and Missouri Botanical Garden (http://www.theplantlist.org).

The plants from the above-mentioned localities, completely match the characteristics of the subspecies *tauricum,* given in the descriptions in the works of Stearn (1978, 1980), Kollman (1984), Anderson (1991).

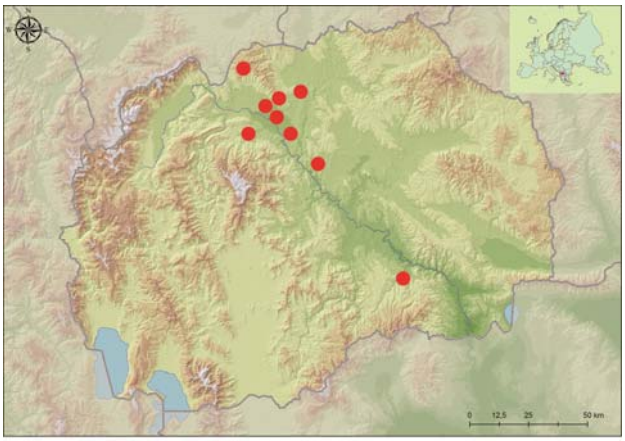

Fig. 8. Distribution of *Allium flavum* subsp. *tauricum*

Conclusion

The work on the genus *Allium*, in the past years, revealed the presence of *A. rhodopeaum* (new species) and *A. flavum* subsp. *tauricum* (new subspecies), in the flora of North Macedonia. In addition, the new data for *A. cyrilli* and *A. fuscum*, obtained during the researches, made the distribution picture of these species, in our country, more clear.

This paper is the second contribution to the knowledge of the genus *Allium*, which arose mainly from the work on the project "Taxonomy and chorology of the genus *Allium* in the flora of the Republic of Macedonia" (2011-2013). The first one was the paper for *Allium amethystinum* Tausch (Nikolov, 2018).

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