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New records of some vascular plants for the flora of North Macedonia

Abstract

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This paper presents new data on the distribution of 10 vascular plant species from the territory of North Macedonia. Three species (*Erysimum cheiri*, *Iberis umbellata* and *Silene squamigera*) are listed for the first time for the flora of North Macedonia, while the other 7 rare species (*Chaenorhinum rubrifolium*, *Crepis zacintha*, *Galatella linosyris*, *Geranium versicolor*, *Glinus lotoides*, *Limosella aquatica* and *Polygonatum verticillatum*) are registered at several new localities on its territory.

Key words: biodiversity, floristics, chorology, higher plants.

Introduction

Floristic research on the territory of North Macedonia (Macedonia, The Socialist Republic of Macedonia, The Republic of Macedonia) has a long, almost 180-year tradition, starting from the middle of the 19th century (Grisebach 1843-1844), intensively carried out until today. The results of the research have been published in numerous scientific papers, which have been analytically processed in the eight books of the edition Flora of the Republic of Macedonia (Flora of North Macedonia) (Micevski 1985, 1993, 1995, 1998, 2001, 2005; Matevski 2010, 2021), within the project activity of the Macedonian Academy of Sciences and Arts. However, serious field research constantly leads to the discovery of new, hitherto unknown species for the territory of North Macedonia as well as new localities of rare plant species which, according to current knowledge, have a very limited distribution on its territory. This is the case with the latest data in the last 10 to 15 years presented in the works of Matevski (2007, 2016, 2017, 2018a, 2018b; 2019); Matevski & Kostadinovski (2009); Matevski & Teofilovski (2011); Matevski & Čarni (2019); Kostadinovski (2007); Kostadinovski & al. (2019); Stevanović, & al. (2009, 2010); Vladimirov & al. (2011, 2012, 2014, 2016a, 2016b, 2019a, 2019b); Niketić & al. (2014, 2017); Đurović & al. (2014); Melovski (2016); Melovski & Hristovski (2015);

Teofilovski (2017, 2018, 2020); Nikolov (2017, 2020); Čušterevska & al. (2020) and others. Thus, knowledge about the flora of North Macedonia is continuously enriched.

The latest field research realized by the authors of this paper in different parts of the territory of North Macedonia in the past period, led to the discovery of 3 new species (*Erysimum cheiri* (L.) Crantz., *Iberis umbellata* L. and *Silene squamigera* Boiss.), coupled with new data on 7 other rare and insufficiently known species (*Chaenorhinum rubrifolium* (DC.) Fourr., *Crepis zacintha* (L.) Babc., *Galatella linosyris* (L.) Rchb. f., *Geranium versicolor* L., *Glinus lotoides* L., *Limosella aquatica* L. and *Polygonatum verticillatum* (L.) All.).

Materials and Methods

The new data are based on the plant material collected during field research conducted by the authors, followed by study of the processed herbarium material stored in the Herbarium of the Institute of Biology, Faculty of Natural Sciences and Mathematics in Skopje (MKNH). In addition, for each of the taxa, information on geographic distribution, locality and habitat, GPS coordinates, along with collection date are provided. Appropriate floristic literature is cited in the comments section for each species. Species habitat data are provided by the authors' personal observations. The nomenclature and taxonomy of the plant are consistent with the Euro + Med (2006-) database. Voucher specimens of all taxa are preserved in the Herbarium (MKNH).

Results and discussion

***Crepis zacintha* (L.) Babc.**
(*Asteraceae*)

North Macedonia:

Localities from literature: Zelenikovo, Ostri (Bornmüller 1926); Bregalnica - v. Karaorman, Negorci (Jurišić 1923); Ohrid, Lukovo (Šmarda 1968).

New localities: Gevgelija - v. Dolno Konjsko, 41.183477° N; 22.324043° E; 516 m a.s.l., 7.6.2005, *M. Kostadinovski s.n.*; Štip: Penuš, dry grassland, 41.706382° N, 22.108975° E, 248 m a.s.l., 6.6.2015, *V. Matevski s. n.* (MKNH).

A Southern European – Euro-Mediterranean species with a very limited distribution on the territory of North Macedonia. Two new localities have been discovered (the vicinity of Štip, along the river Bregalnica, near the abandoned village Penuš, as well as in the vicinity of Gevgelija - Dolno Konjsko v.).

***Galatella linosyris* (L.) Rchb. f.** [Syn.: *Aster linosyris* (L.) Bernh.]
(*Asteraceae*)

North Macedonia:

Localities from literature: Kapina (Soška 1939); Star Dojran, Pčinja - Katlanovska Banja; Žedenska Gorge - v. Rašče (Micevski 1970); Jažince (Teofilovski 2015).

New localities: Dojran - between Star and Nov Dojran, Kaldrma, dry grassland in the belt of *Quercus coccifera*, 41.205107° N; 22.708445° E; 165 m a.s.l., 22.9.1999, *V. Matevski s. n.*; Skopje - v. Vučidol, dry grasslands, 42.042924° N; 21.336155° E; 365 m a.s.l., 13.11.2001, *V. Matevski s. n.*; Štip - v. Testemelci, dry grasslands, 41.73167191° N; 22.11229993° E; 270 m a.s.l., 24.6.2018, *V. Matevski, R. Čušterevska, S. Cvetanoska & C. Cvetkoska s. n.*; Galičica - Dva Javora, 40.98260° N; 20.85833° E; 1566 m a.s.l., 3.9.2020, *V. Matevski, M. Kostadinovski, R. Čušterevska, S. Cvetanoska & C. Cvetkoska s.n.* (MKNH).

The distribution area of *Galatela linosyris* extends to the territories of Central, Eastern and Southern Europe, Asia Minor and North Africa. With the newly discovered localities, the distribution area of this rare plant species on the territory of North Macedonia is gradually determined.

***Erysimum cheiri* (L.) Crantz.** (Basionym: *Cheiranthus cheiri* L.) (Fig. 1a, 1d)
(*Brassicaceae*)

North Macedonia:

New locality: Ohrid-Old City, on the limestone rocks, just above Ohrid Lake, 41.111020° N; 20.792737° E; 709 m a.s.l., 17.6.2010, 1.5.2016, *V. Matevski s. n.* (MKNH)

Erysimum cheiri is an old cultivated plant, the origin of which has not been determined with certainty. Mosleh & al. (2019) states that this ornamental species originates from Europe, especially from the Mediterranean region, so that today it is cultivated all over the world. According to Ball (1964), it grows naturally in southern Greece (S. Greece and the islands of the S. Aegean Sea), while in other countries of Central, Western and Southern Europe, it is an introduced or cultivated plant. Polatschek & Snoggerup (2002) note that it is a naturalized plant of disputed origin that has been cultivated in Greece since ancient times and it has become increasingly rare in recent times, with some of its oldest forms being able to trace their origins to some Greek taxa. It grows on walls, cliffs or rocks, but sometimes it grows spontaneously; hence, it happens to escape into the wild. According to the Euro + Med plant base, in natural conditions it is found only on the territory of Croatia (Marhold 2011). As maintained by Nikolić (2021), on the territory of Croatia, the plant is present only as cultivated and naturalized in the coastal parts of central and southern Dalmatia, in the Zadar-Šibenik archipelago, in the Kvarner-Velibit area, Istria, North Dalmatia, and a minor number of localities in the continental parts of Croatia. Barina & al. (2013) cite this species as naturalized in Albania, which has been confirmed by the discovery of a sustainable natural population along the sea rocks in the vicinity of Vlora.

This species has been discovered on the territory of North Macedonia, in the narrower urban area of the city of Ohrid. It develops along the vertical limestone rocks rising above Lake Ohrid, in the old part of Ohrid, on the stretch between the Church of St. Sophia and the Monastery of St. John at Kaneo. The population of *Erysimum cheiri* has sustained in the area for many years, together with *Aurinia saxatilis* subsp. *orientalis* (Ard.) T. R. Dudley, *Urtica pilulifera* L., *Parietaria judaica* L., *Sedum album* L., *Silene vulgaris* (Moench) Garcke subsp. *vulgaris*, and others. In Ohrid, it is definitely a naturalized species, which has encountered suitable ecological conditions in the area, and it flourishes in that ambient space. This area had not been accessible from the mainland for a long time,

but in the past two decades, a wooden bridge has been constructed to shorten the distance between St. Sophia Church and the Monastery of St. John at Kaneo; thus, during the flowering period, numerous passers-by enjoy the beauty of this ornamental species.

***Iberis umbellata* L.** (Fig. 1b, 1d)

(*Brassicaceae*)

North Macedonia:

New locality: Pehčevo - Trebomirska River, beech forest clearings, 41.747331° N, 22.983864° E; 1320 m a.s.l., 26.10.2014, *V. Matevski s.n.* (MKNH).

As indicated by Pinto de Silva & al. (1964), in natural conditions this Mediterranean species occurs on the territories of Albania, France, Greece, Italy and former Yugoslavia while in other parts of Europe, it develops as a cultivated plant or a plant with an unknown status. In the distribution map of *Iberis umbellata* in Euro + Med PlantBase (Marthold, 2011), the presence of this species is more accurately mapped in only three countries of former SFR Yugoslavia - Montenegro, Bosnia and Herzegovina and Croatia.

Micevski (1993) notes that *Iberis umbellata* is an ornamental plant, but no natural populations of this species are known from the territory of Macedonia. With a small number of specimens, this plant has been registered in the eastern parts of North Macedonia, in the Maleševo Mountains, at the Trebomirska River locality, near Pehčevo. It grows in clearings in beech forest; nonetheless, the locality and habitat where the species has been recorded (in the beech forest belt) is distant from urban or rural areas where this plant could be grown. This is probably a spontaneous occurrence of the species in North Macedonia.

***Silene squamigera* Boiss.** (Fig. 1c, 1d)

(*Caryophyllaceae*)

North Macedonia:

New locality: Galičica - Prespa side, 40.976222° N, 20.883362° E, 1238 m a.s.l., 24.6.2009, *R. Čušterevska s.n.*; Galičica - Prespa side, on burned places, 40.97714°N, 20.882492°E, 1296 m a.s.l., 28.6.2009, *R. Čušterevska s. n.* (MKNH).

Silene squamigera is a southern Balkan endemic species (Sect. *Lasiocalycinae*), present in Central and Southern Greece (Chater & Walters, 1964) while in Euro + Med PlantBase, its areal also covers the territory of Turkey. Greuter (1997) distinguishes two subspecies - *S. squamigera* subsp. *squamigera* (Greece) and *S. squamigera* subsp. *vesiculifera* (endemic to SE Anatolia). It is remarkable that there is available data about the incidence of the current species on the territory of Serbia - in the vicinity of Niš (Slavnić 1970), which was later revised; consequently, it refers to the species *S. echinata* (Niketić & Stevanović 2012).

Until now, there were no data whatsoever on the presence of this species in North Macedonia. It has been observed in two localities in Galičica Mountain, that extend its range to the territory of North Macedonia. According to current knowledge, it is the northernmost location of the species within the boundaries of its distribution area. In Galičica Mt, it grows on limestone background (1,200-1,300 m), in a transitional zone, between the belt of dry grasslands and subalpine pastures.

The most significant morphological characteristics of plants originating from Galičica Mt as well as ecological features completely correspond to those emphasized in the description by Greuter (1997) (“*Calyx costae, especially in the upper half, covered with swollen, white, bladder-like, shortly apical bases of the hair; teeth wide rounded, not with fringes with bars, but small papillomas on the margins ...*”).

***Geranium versicolor* L.**

(*Geraniaceae*)

North Macedonia:

Localities from literature: Bitola - Bukovo, Djavato (Vandas 1909; Micevski 2005); Galičica (Vandas 1909); Mariovo: Satoka (Soška 1939).

New locality: Struga - Crn Drim gorge, v. Modrič, 41.367752° N; 20.585151° E; 682 m a.s.l., 21.7.1997, *V. Matevski s. n.* (MKNH).

This Mediterranean species is known from the southern part of the Balkan Peninsula and C. & S. Italy (Webb & Ferguson 1968). In North Macedonia, so far it has been known only from Galičica Mt, Prespa and Mariovo. A new locality has been registered in the gorge of the Crn Drim River, near the village of Modrič. The gorge of the Crn Drim is an important refuge where relict species (*Aesculus hippocastanum* L., *Ramonda serbica* Pančić, *Dioscorea balcanica* Košanin and others) are found. Simultaneously, it is an important phytogeographical corridor where many Mediterranean and sub-Mediterranean plants occur, such as *Salvia officinalis* L., *Vincetoxicum huteri* Vis. & Asch., *Moltkia petraea* (Tratt.) Griseb., *Thymus rohlenae* Velen. and others.

***Glinus lotoides* L.**

(*Molluginaceae*)

North Macedonia:

Localities from literature: Strumica: Monospitovo marsh (Micevski 1995).

New locality: Prilep - Mariovo: Rasim Bej Most, along the Crna Reka river, 41.194107° N; 21.716121° E; 421 m a.s.l., 6.10.2006, *V. Matevski s. n.* (MKNH).

On the territory of North Macedonia, *Glinus lotoides* had only been known from the surroundings of Strumica - in the belt of the well-known swamp near the Bansko spa, at the foot of Belasica Mountain. This species has been recorded in the area of Mariovo, in the middle course of the Crna Reka river, at the locality Rasim Bej Most. It is the species second locality within North Macedonia. *Glinus lotoides* has been sighted in a sandy habitat near the Crna Reka river in spots where the river water level raises during the spring months where new loads of sand are accumulated every year.

***Chaenorhinum rubrifolium* (DC.) Fourn.**

(*Plantaginaceae*)

North Macedonia:

Localities from literature: Kavadarci - v. Dradnja, on limestone rock, 650 m a.s.l., 20.6.2001 (MKNH) (Matevski 2002).

New locality: Prilep: v. Debrešte - Debreška Krasta, limestone, 41.485527° N; 21.340256° E; 823 m a.s.l., 23.6.2004, *V. Matevski & M. Kostadinovski s. n.* (MKNH).

Chaenorhinum rubrifolium is a Mediterranean species with a predominantly central-western Mediterranean range whereas in the Eastern Mediterranean it is currently known only from Greece (Fernandes 1972). It is represented by three subspecies - *C. rubrifolium* (DC.) Fourr. subsp. *rubrifolium*, *C. rubrifolium* subsp. *formenterae* (Gand.) R. Fern. and *C. rubrifolium* subsp. *ravey* (Boiss.) R. Fern., whereof only the typical subspecies occurs in the Eastern Mediterranean.

According to the available floristic data, to date this species has been observed only at a single site in the vicinity of Kavadarci - near Dradnja village, on a carbonate substrate in the belt of hilly pastures (Matevski 2002). A new locality of the species was recorded in the central part of North Macedonia, in the vicinity of Prilep - Debreška Krasta. It develops in the belt of hilly pastures that phytocenologically belong to the ass. *Sileno-Thymetum ciliatopubescentis* (all. *Diantho haematocalycis-Festucion hirtovaginatae* Matevski & al. 2018).

***Limosella aquatica* L.**

(*Scrophulariaceae*)

North Macedonia:

Localities from literature: Bistra: Toni Voda (Micevski & Matevski 1986); Galičica: between Asan Djura and Dzafa (Matevski & Kostadinovski 2009) (MKNH).

New localities: Pelister - Golemo Ezero, temporary ponds, 40.966620° N; 21.205585° E; 2214 m a.s.l., 3.10.2018, *V. Matevski & R. Čušterevska s. n.*; Šar Mt. - Karanikola-Šeremetica, 42.068580° N, 20.792368° E; 2298 m a.s.l., 4.08.2017, *Lj. Melovski, S. Hristovski, V. Matevski & R. Čušterevska s. n.* (MKNH).

Limosella aquatica is a therophyte with a very interesting ecological adaptation in aquatic biotopes with periodic variations of the water level. During summer months, these biotopes become dry, and they are favourable habitats for development of populations of the current species. In the meantime, on the territory of North Macedonia, two new additional localities have been discovered of this remarkable and rare plant species: in Pelister Mt (Golemo ezero – the Great Lake) and Šar Mountain (Karanikola).

***Polygonatum verticillatum* (L.) All.**

(*Asparagaceae*)

North Macedonia:

Localities from literature: Bistra Planina (Leute, 1978); Belasica: Semer - Kaja, in beach forest, 1700 m (Stojanov 1921).

New localities: Bitola:Mariovo, Nidže - Lubnica, in the foothills of Dobro Pole, in a mixed fir-beech forest, 41.051444° N, 21.858928° E; 1474 m a.s.l., 19.6.1995, *V. Matevski s. n.*; Bitola:Mariovo, v. Gradešnica, Pette Češmi, in the foothills of Zmejca Mt., 41.059030° N, 21.840758° E; 1200 m a.s.l., 10.6.1996, *V. Matevski s. n.*; Galičica - up the Lipona Livada, in a mixed fir-beech forest, 40.948780° N, 20.830966° E; 1700 m a.s.l., 23.7.2020, *V. Matevski, M. Kostadinovski & R. Čušterevska s. n.* (MKNH).

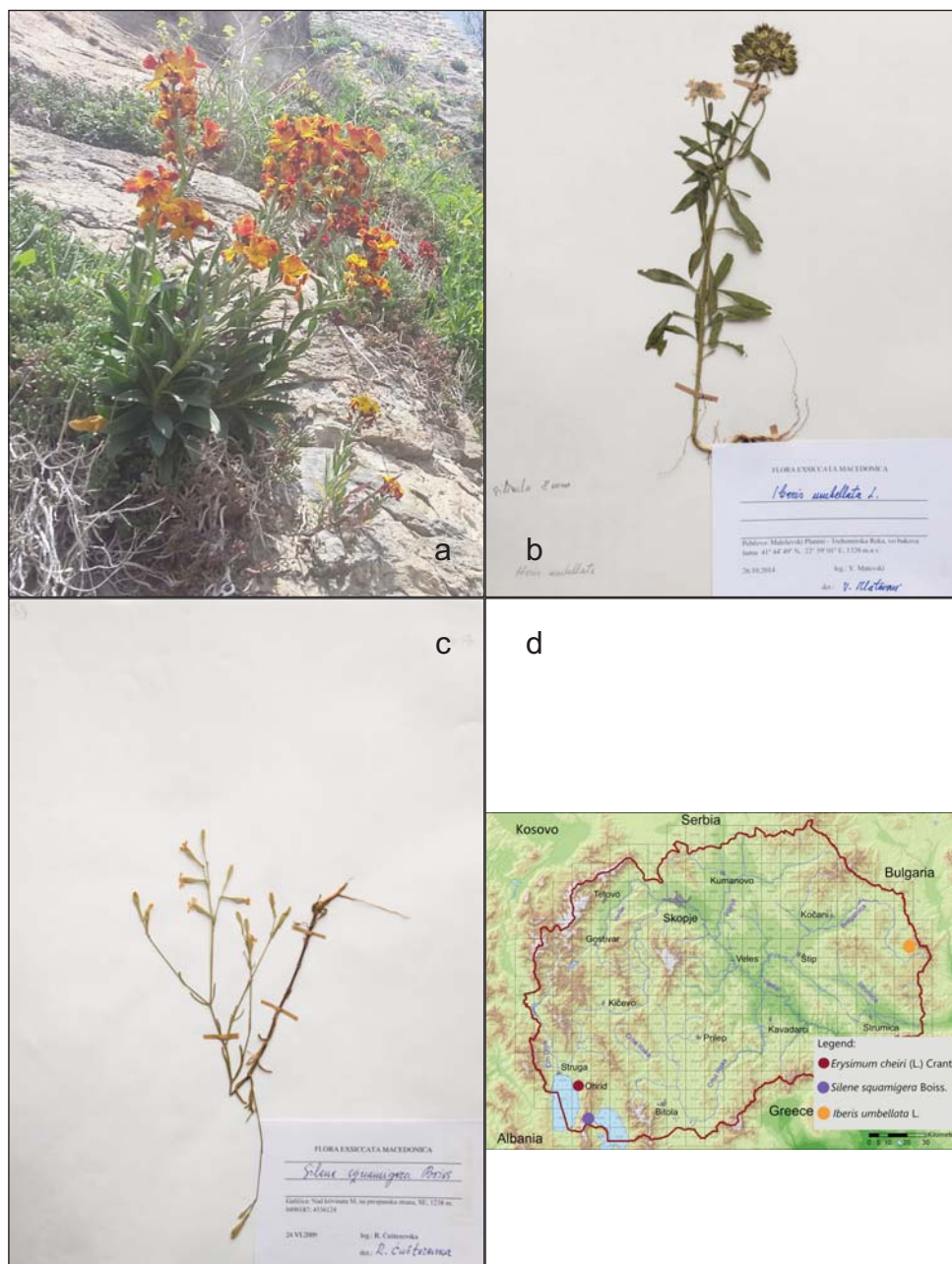


Fig.1. **a)** *Erysimum cheiri* - Ohrid: Old City, on the limestone rocks, above Ohrid Lake, 1.5.2016 (V. Matevski) (MKNH); **b)** *Iberis umbellata* - Pehčevo:Trebomirska River, beech forest clearing, 26.10.2014, V. Matevski s. n.(MKNH); **c)** *Silene squamigera* - Galičica – Prespa side, 1238 m a.s.l., 24.6.2009, R. Čušterevska s. n.)(MKNH); **d)** Distribution map of *Erysimum cheiri*, *Iberis umbellata* and *Silene squamigera* in North Macedonia.

Polygonatum verticillatum has worldwide distribution, from montane to alpine Himalaya, Kashmir, Southeast Tibet, Russia (W. Siberia, Caucasia), West Asia to Europe (except for the Mediterranean region) (Saboon & al. 2016). According to De Filips (1980), in Europe it spreads from Arctic Norway, southwards to N. Spain, C. Italy and S.W. Bulgaria, and eastwards to c. 26° E, in Latvia and Romania. Two localities have been cited for Macedonia - Belasica: Semer - Kaja (Stojanov 1921, but it is disputable whether the site is in the Greek or the Macedonian part of Belasica Mt) and Bistra Mt (Leute 1978).

This very rare and insufficiently known species has been observed at three localities in Macedonia (two in the Mariovo region - Lubnica and Zmejca, and one locality in Galičica Mt (up the Lipova Livada), always in mixed fir-beech forest.

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