

Novelties and new records in the flora of North Macedonia

Original Article

Abstract:

Epipactis purpurata Sm. and *Leontodon saxatile* Lam. are reported as new species in the flora of North Macedonia. The first one is found in the forest area near Bezgaštevo village, southwest of Berovo, and the latter in the central part of Kičevo, on the quay of the Sušica River. The collected specimens of *L. saxatile* are perennial plants with shortly beaked inner achenes, clearly belonging to subsp. *saxatile*. New localities are reported for the following eight rare plants: *Aconitum lycoctonum* subsp. *neapolitanum* (Ten.) Nyman, *Bidens frondosus* L., *Carex tomentosa* L., *Dittrichia viscosa* (L.) Greuter, *Erysimum korabense* Kümmerle & Jáv., *Lactuca aurea* (Vis. & Pančić) Stebbins, *Phegopteris connectilis* (Michx.) Watt, and *Thymus oehmianus* Ronniger & Soska. Data from the literature on their distribution in the country are also presented.

Key words:

Epipactis purpurata, *Leontodon saxatile*, rare species, flora, North Macedonia

Apstrakt:

Novine i novi zapisi u flori Severne Makedonije

U radu su navedeni prvi nalazi vrsta *Epipactis purpurata* Sm. i *Leontodon saxatile* Lam. za floru Severne Makedonije. Prva vrsta je pronađena u šumama u blizini sela Bezgaštevo, jugozapadno od Berova, a druga u centralnom delu Kičeva, na keju reke Sušice. Prikupljeni egzemplari *L. saxatile* su višegodišnje biljke sa unutrašnjim kratkokljunim ahenijama, koji očigledno pripadaju subsp. *saxatile*. Navedeni su i novi nalazi za sledećih osam retkih vrsta: *Aconitum lycoctonum* subsp. *neapolitanum* (Ten.) Nyman, *Bidens frondosus* L., *Carex tomentosa* L., *Dittrichia viscosa* (L.) Greuter, *Erysimum korabense* Kümmerle & Jáv., *Lactuca aurea* (Vis. & Pančić) Stebbins, *Phegopteris connectilis* (Michx.) Watt, i *Thymus oehmianus* Ronniger & Soska. Podaci iz literature o distribuciji istih su takođe prezentovani.

Ključne reči:

Epipactis purpurata, *Leontodon saxatile*, retke vrste, flora, Severna Makedonija

Introduction

The territory of North Macedonia has been continuously studied by many florists for about 180 years, and a large amount of floristic data has been published in the past (Grisebach, 1843-44; Bornmüller, 1925; Černjavski, 1943; Grupče, 1958; Micevski, 1985, 1993-2005; Matevski, 2010, 2021; Teofilovski, 2011; etc.). According to the present knowledge, the country's vascular flora consists of more than 3,200 species and several hundreds of lower taxa, of which a large proportion are Balkan and national endemic. Considering the relatively small country area, the flora of North Macedonia could be regarded as one of the richest in the region.

In this paper, the author presents some results of his recent floristic studies carried out in several parts

of the country in the frame of some enthusiastic and founded projects. Special attention was paid to some unknown, rare, and overlooked species. All the taxa, treated in this work, are perennial herbs belonging to the following families: Asteraceae, Brassicaceae, Cyperaceae, Lamiaceae, Orchidaceae, Ranunculaceae, and Thelypteridaceae.

Materials and Methods

The field studies were conducted during the period 2012-2022. Representative plant specimens, accompanied by data regarding the population's habitat, size, and condition, were collected and herbarized. Herbarium material is stored in the author's private herbarium. Identification was performed according to Tutin et al. (1964-1980), Micevski (1985, 1995), Matevski (2021), and some



other regional and national floras and monographic works. The floristic literature regarding the flora of North Macedonia was checked for previously published chorological data of each treated taxa (if present).

Results and discussion

Aconitum lycoctonum subsp. *neapolitanum* (Ten.) Nyman (*Ranunculaceae*) (syn. *A. lamarckii* Rchb.)

Baba Mt.: Sapundžica, moist place with *Cirsium appendiculatum*, silicate, 1,734 m, 23.7.2022, 40.959954°N, 21.241955°E, leg. & det. A. Teofilovski; **Jablanica Mt.:** Čumin Vrv, shady place near rocks, limestone, 1,950 m, 41.225345°N, 20.530201°E, 19.7.2017, leg. & det. A. Teofilovski; **Šar Mountains:** Plat, shady shrubby place, limestone, 1,900 m, 42.034528°N, 20.825139°E, 13.7.2012., leg. & det. A. Teofilovski (**Fig. 1**).

Aconitum lycoctonum is a rare species in North Macedonia, represented only by southern European and northwestern African subsp. *neapolitanum*. It was known only from two localities - Šar Mountains (Micevski, 1985) and Jablanica Mt. (above Podgorečko Lake) (Niketić et al., 2007).

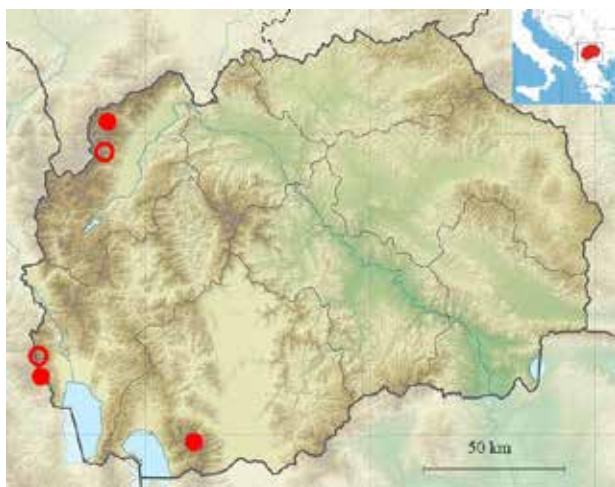


Fig. 1. Distribution of *Aconitum lycoctonum* subsp. *neapolitanum* in North Macedonia (solid circles - own herbarium data, rings - data from literature)

Bidens frondosus L. (*Asteraceae*)

Kičevo: near Sušica River, wet places, 617 m, 41.513404°N, 20.959337°E, 24.9.2020., leg. & det. A. Teofilovski; **Veles:** Ubogo, near Bregalnica River, 153 m, 41.639898° N, 21.961945°E, 29.6.2021., leg. A. Teofilovski & D. Mandzukovski, det. A. Teofilovski (juvenile specimens which cannot be identified with certainty) (**Fig. 2, Fig. 3**)

The recorded population in the central part of Kičevo is well-established along the one-kilometre-long section of the Sušica River. It grows in wet

and occasionally flooded places just near the river stream. According to a collection of juvenile specimens, it probably also occurs near Bregalnica River (Ubogo).



Fig. 2. *Bidens frondosus* (Kičevo, near Sušica River, 24.9.2020., photo. A. Teofilovski)



Fig. 3. Distribution of *Bidens frondosus* in North Macedonia (solid circle - own herbarium data, ring - data from literature)

This *Bidens* is native to North America but introduced (mostly naturalized) in many countries in Europe, E Asia, and New Zealand (Vladimirov & Kuzmanov, 2012). In the Balkan Peninsula, it is recorded in all countries except Montenegro (Greuter, 2006; Dimopoulos et al., 2013). In North Macedonia, it was previously known only from the shoreline of Lake Prespa (near Stenje village), where it has been recently recorded and considered naturalized (Vladimirov et al., 2019). The presented data for a new, already naturalized population, indicate a wider but probably overlooked distribution of this species in the country.

***Carex tomentosa* L. (Cyperaceae) (syn. *C. filiformis* L.)**

Delčevo: Zvegor village, in the vicinity of the monastery St. Ilija, thermophilous oak and black pine forests, 800–1,000 m, 41.975018°N, 22.817063°E, 14.7.2021., leg. & det. A. Teofilovski (**Fig. 4**).

Until recently, this rare species was obscurely known only from an old report referring to „Petrina - St. Petka” (Malý, 1931-1932), a locality probably situated above Velgošti village, on Galičica Mt. Its presence, however, has been confirmed a few years ago, with a record on the same mountain (Ljubaništa village) (Teofilovski, 2014).



Fig. 4. Distribution of *Carex tomentosa* in North Macedonia (solid circles - own herbarium data, ring - data from literature)

***Dittrichia viscosa* (L.) Greuter (Asteraceae)**

Ohrid: Gorenci village, near the road Ohrid - Kičevo, 714 m, 41.188831°N, 20.749826°E, 20.10.2021., leg. & det. A. Teofilovski; **Ohrid:** Pesočani village, near the road Ohrid - Kičevo, roadside excavation, 790 m, 41.314886°N, 20.793627°E, 26.10.2021, leg. & det. A. Teofilovski; **Skopje:** Gazi Baba, roadside, 254 m, 42.001158°N, 21.451099°E, 3.10.2022., leg. & det. A. Teofilovski (**Fig. 5, Fig. 6**).

The only previous report of this Mediterranean plant refers to the vicinity of Krivolak village, in the central part of the country (Matevski, 2007). The mentioned author classified the recorded population as native. However, the populations recorded near Ohrid and in Skopje are apparently just recently settled and of unknown origin. Further secondary spread of the species can be expected in the warmer parts of the country.

***Epipactis purpurata* Sm. (Orchidaceae)**

Berovo: above Bezgaštevo village, beech and mixed *Carpinus betulus* and *Quercus frainetto* forests,



Fig. 5. *Dittrichia viscosa* (Ohrid, Gorenci village, 20.10.2021., photo A. Teofilovski)

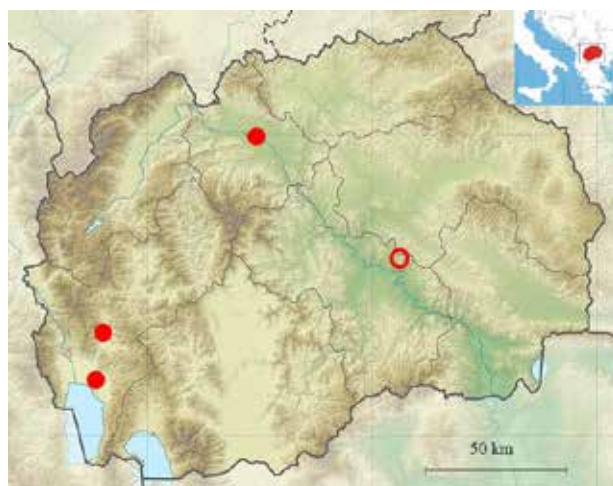


Fig. 6. Distribution of *Dittrichia viscosa* in North Macedonia (solid circles - own herbarium data, ring - data from literature)

silicate, 860-890 m, 41.607396°N, 22.773798°E, 3.8.2020., leg. A. Teofilovski & D. Mandzukovski, det. A. Teofilovski (**Fig. 7, Fig. 8**).

This is a new species in the flora of North Macedonia.

The recorded population near Bezgaštevo village is quite small, consisting of c. 15 specimens. It grows on deep soil, in shady beech and mixed *Carpinus betulus* and *Quercus frainetto* forests. In the locality are evident the damages of forest fires that occurred a decade or two ago.

Description. Rhizome short, vertical. Stem 20-70 cm, pubescent above, purplish below, with sheathing scales. Leaves spirally arranged, 5-10, 6-10×2-5 cm, ovate-lanceolate to lanceolate, acute to shortly acuminate, greyish or purplish. Raceme 15-25 cm, many-flowered; bracts linear, acuminate, the lower usually exceeding flowers. Flowers obliquely pendent when mature; outer perianth-segments 10-



Fig. 7. Distribution of *Epipactis purpurata* in North Macedonia



Fig. 8. *Epipactis purpurata* (details: a flower and the middle part of the stem with leaves) (Berovo, Bezgaštevo village, 3.8.2020., photo. A. Teofilovski)

12 mm, lanceolate, subobtuse, green outside, whitish inside, the inner whitish, sometimes with pinkish tinge. Labellum 8-10 mm; hypochile cupuliform, greenish outside, usually mottled with violet inside; epichile triangular-cordate, acute, with recurved apex, as long as or longer than wide, whitish, with 2-3 smooth, confluent basal protuberances. Rostellum persistent. Ovary scabridulous. $2n=40$. Woods; somewhat calcicole. (Moore, 1980).

Epipactis Zinn is a relatively large and taxonomically difficult genus, distributed in temperate Eurasia, North Africa, and North America (Vakhrameeva et al., 2008). In the Euro+Mediterranean zone, it is represented by more than 50 species (World Checklist of Selected Plant Families, 2010). *Epipactis purpurata* occurs in most countries of central, western, and southern Europe and Georgia (World Checklist of Selected Plant Families, 2010). In the Balkan Peninsula, it is known in Croatia, Bosnia and Herzegovina, Serbia (excl. Kosovo), Greece, and Bulgaria (Andreev, 1992; Djordjević et al., 2010; Antonopoulos & Tsiftsis, 2012; Nikolić, 2015; Šabanović et al., 2021). The closest relative to *E. purpurata* is *E. rechingeri* Renz, distributed in Iran and Azerbaijan (Efimov, 2008).

In North Macedonia, the genus *Epipactis* has not been comprehensively studied so far. Four species are mentioned in the floristic literature: *E. atrorubens* (Hoffm.) Besser, *E. helleborine* (L.) Crantz, *E. microphylla* (Ehrh.) Sw., and *E. palustris* (L.) Crantz. Of these, the first two are common forest species, the third occurs very sporadically in various, mostly forest habitats, and the fourth is a rare species of wet habitats. The most similar to *E. purpurata* is *E. helleborine*, differing to which at least by the vertical rhizome (vs. oblique or horizontal), smaller and relatively narrower (6-10x2-5 cm vs. 5-17x2.5-10 cm), grayish or purplish leaves (vs. green), and as long as or longer than wide epichile (vs. not longer than wide) (Moore, 1980).

The locality near Bezgaštevo village is in the zone of strong impact of forest management activities. The tree-cutting and wood transportation, taking place in the locality even during the fieldwork, are a serious threat to the recorded population.

***Erysimum korabense* Kümmerle & Jáv. (Brassicaceae)**

Jablanica Mt.: Strižak, subalpine pastures, limestone, 1,850-1,950 m, 41.279217°N, 20.536592°E, 23.5.2021., leg. & det. A. Teofilovski & Z. Nikolov, det. A. Teofilovski (Fig. 9, Fig. 10).

This west Balkan endemic besides North Macedonia occurs also in Albania (Korab Mt.) and Kosovo (Metohija) (Tomović et al., 2014; Barina et al., 2017). In North Macedonia, it was known only from the highest parts of Šar Mountains (1,800-2,700 m) (Rudoka, Bagardan, Ceripašina, Turčin), and Korab Mt. (2,500-2,764 m) (Micevski, 1995; Polatschek, 2013). The discovery of *E. korabense* on Jablanica Mt. has extended the species' range 55 km southward, with the closest known populations occurring in Korab Mt.



Fig. 9. Distribution of *Erysimum korabense* in North Macedonia (solid circle - own herbarium data, rings - data from literature)



Fig. 10. *Erysimum korabense* (Jablanica Mt., Strižak, 23.5.2021., photo A. Teofilovski)

***Lactuca aurea* (Vis. & Pančić) Stebbins (Asteraceae) (syn. *Mulgedium sonchifolium* Vis. & Pančić)**

Baba Mt.: Sapundžica, mountain meadow, with *Juniperus* sp., silicate, 1,650 m, 40.961845°N, 21.235575°E, 23.7.2022., leg. & det. A. Teofilovski; **Koža Mt.:** beech forest margin, 1,538 m, 20.7.2022., 41.739659°N, 20.766582°E, leg. & det. A. Teofilovski; **Stogovo Mt.:** above Ehloec village, beech forest, 1,688 m, 41.440384°N, 20.718777°E, 5.8.2020., leg. & det. A. Teofilovski; **Jablanica Mt.:** Tri Šilka, beech forest, 1,660 m, 16.8.2017., 41.181556°N, 20.572072°E, leg. & det. A. Teofilovski; **Jablanica Mt.:** above Lakvaica village, 1,752 m, 41.336603°N, 20.524403°E, 10.8.2016., leg. & det. A. Teofilovski; **Šar Mountains:** Ljuboten River basin, beech forest, 1,386 m, 42.178801°N, 21.117017°E, 25.6.2015., leg. & det. A. Teofilovski (**Fig. 11, Fig. 12**).

Until recently this conspicuous plant was known only from Jablanica Mt. (Gorna Belica) (Velenovský, 1922, as *Mulgedium sonchifolium*),

while several years ago was reported also from Šar Mountains (Čaušička River, Plat) and Kičevo (Prostranje) (Teofilovski, 2014). The long-time overlooking in many localities can be attributed to its sporadic occurrence and the small size of the populations, which are often hidden in distant forests.

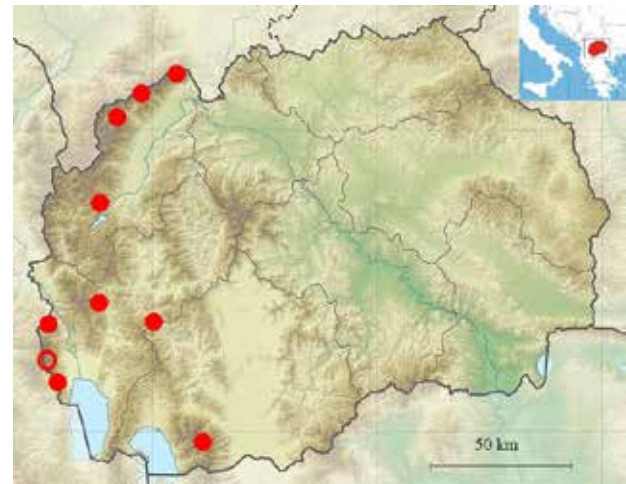


Fig. 11. Distribution of *Lactuca aurea* in North Macedonia (solid circles - own herbarium data, ring - data from literature)



Fig. 12. *Lactuca aurea* (Baba Mt., Sapundžica, 23.7.2022., photo A. Teofilovski)

***Leontodon saxatilis* Lam. subsp. *saxatilis* (Asteraceae)**

Kičevo: quay of Sušica River, 41.515258°N, 20.959629°E, 618 m, 21.10.2020., leg. & det. A. Teofilovski (**Fig. 13, Fig. 14**).

The species and subspecies are new to North Macedonia.



Fig. 13. Distribution of *Leontodon saxatilis* subsp. *saxatilis* in North Macedonia



Fig. 14. *Leontodon saxatilis* subsp. *saxatilis*, unripe and ripe fruiting capitula (detail: pappuses of inner and outer achenes) (Kičevo, near Sušica River, 21.10.2020., photo. A. Teofilovski)

The recorded population in the central part of the town of Kičevo consists of numerous plants, occupying an area of c. 500 m². They grow in the lawn and waste, moist places on the quay of the Sušica River.

Description of *Leontodon saxatilis* Lam. Stems 1-numerous, 2.5-35 cm, simple, with few to numerous simple eglandular or long-stalked 2- to 3-fid hairs; bracts 0-2. Leaves 20-150 (250)×3-10 mm, narrowly oblanceolate to oblong-oblanceolate, obtuse to acute, entire, dentate to pinnatifid, attenuate into a short or long petiole, with numerous rigid, simple eglandular or long-stalked 2- to 3-fid hairs. Capitulum solitary. Involucre 7-11×4-9 mm; bracts narrowly lanceolate, obtuse to acute, with few to numerous, rigid simple eglandular or long-stalked 2-fid hairs. Ligules deep yellow, the outer greyish-violet on the outer face. Stigmas yellow. Achenes 4.5-5 mm, brown, transversely muricate, of 2 kinds:

outer curved and with a pappus of small scarious scales; inner more or less beaked, with the pappus-hairs in 2 rows, the outer rigid and simple, the inner plumose. (Finch & Sell, 1976, sub *L. taraxacoides* (Vill.) Mérat)

Leontodon saxatilis has a distribution range that includes southwest Asia, central, west, and south Europe, Macaronesia, and northwest Africa. In Europe and the Balkan Peninsula, two of the four recognized subspecies occur, namely subsp. *saxatilis* and subs. *rothii* Maire (Syn. *L. longirostris* (Finch & P.D. Sell) Talavera) (Greuter, 2006). The former differs from the latter in its perennial, rarely biennial life form, with short vertical stock (vs. usually annual), and shorter back of the inner achenes (c. 1 mm vs. 2-3 mm). All of the collected specimens from Kičevo clearly match the description of subsp. *saxatilis*. This subspecies has a general distribution range that includes most of the Eurasian part of the species range. On the other hand, subsp. *rothii* is distributed in Macaronesia and some parts of the Mediterranean (Portugal, Spain, France, Croatia, Greece, Albania, Morocco, Algeria, Tunisia) (Greuter, 2006).

Among the neighboring countries of North Macedonia, *L. saxatilis* subsp. *saxatilis* has been reported in Albania and Greece. Reports of *L. saxatile* s.l. in Serbia (Vojvodina) and Bulgaria (Balkan Foothills floristic region) (Sarić & Diklić, 1986; Dimitrova et al., 2005; Greuter, 2006; Dimopoulos et al., 2013) most likely refer to this subspecies as well. In these listed countries, *L. saxatile* is considered a native species, while the available data for North Macedonia are insufficient to determine its status.

In the flora of North Macedonia, there are currently four known species of *Leontodon* s.s.: *L. crispus* Vill., *L. biscutellifolius* DC., *L. tuberosus* L., and *L. hispidus* L. (for references see Greuter, 2006). In the cited web platform, based on a report for the locality Dobro Pole (Velenovský, 1922), the status of *L. saxatilis* in North Macedonia is considered „native: presence questionable”. However, this locality is located in the Greek part of Nidže Mt. and is therefore not relevant to the flora of North Macedonia. Additionally, *L. saxatilis* is typically found in lowlands and hilly areas (Hegi, 1929; Assyov et al., 2012; Barina et al., 2017), whereas the mentioned locality is in the subalpine zone.

Leontodon saxatilis can be distinguished from all other *Leontodon* species occurring in North Macedonia by the combination of the following two characteristics: the absence of tubers and the pappus of outer achenes reduced to a short cartilaginous crown.

***Phegopteris connectilis* (Michx.) Watt (*Thelypteridaceae*) (syn. *Thelypteris phegopteris* (L.) Sloss.)**

Jablanica: above Labuniško Lake, near siliceous rocks, 1,995 m, 41.265174°N, 20.518069°E, 16.7.2021., leg. & det. A. Teofilovski (Fig. 15, Fig. 16).

The occurrence of this fern in North Macedonia is extremely restricted, with only one known locality, recorded on Jakupica Mt. near Kadina River (Micevski, 1985, sub *Thelypteris phegopteris*). The several patches observed on Jablanica Mt., just above the Labuniško Lake, grow in shady places, near siliceous rocks.



Fig. 15. Distribution of *Phegopteris connectilis* in North Macedonia (solid circle - own herbarium data, ring - data from literature)



Fig. 16. *Phegopteris connectilis* (Jablanica Mt., above Labuniško lake, 16.7.2021., photo A. Teofilovski)

***Thymus oehmianus* Ronniger & Soska (*Lamiaceae*)**

Makedonski Brod: between Zdunje and Blizansko villages, wet place, limestone, 490 m, 12.5.2016., leg. & det. A. Teofilovski; **Makedonski Brod:** near the road between Zdunje and Dolna Belica villages, wet roadside excavation, limestone, 480 m, 16.8.2020., observ. & photo. A. Teofilovski (Fig. 17).

Thymus oehmianus is a local endemic to the Treska River basin, with only a few previously



Fig. 17. *Thymus oehmianus* (Makedonski Brod, between Zdunje and Dolna Belica villages, 16.8.2020., photo. A. Teofilovski)

recorded populations: Kapina (Ronniger, 1938), Samokov (Mala Reka), Oča River gorge, and Vrba (Matevski, 2021). Its occurrence is confined to wet habitats on carbonate geological substrates, which are quite rare in the area. On the locality near the road between Zdunje and Dolna Belica villages, the species exhibits pioneer behavior, quickly colonizing a freshly deposited mass of crushed carbonate stones adjacent to the road (Fig. 17).

Conclusion

Epipactis purpurata is recorded for the first time in the country, near Bezgaštevo village (Berovo). The recorded c. 15 specimens are highly endangered due to ongoing forestry activities in the area.

Leontodon saxatile is also recorded for the first time in the country, found in the central part of Kičevo (quay of Sušica River). The population belongs to subsp. *saxatile*. The present data are insufficient to determine whether this plant is native or adventive in the country.

The second locality of *Phegopteris connectilis* is recorded in the subalpine zone of Jablanica Mt. (above Labuniško Lake). It was previously known only from Jakupica Mt. (near Kadina River).

The second locality in the country is reported also for the adventive *Bidens frondosus*, recorded as naturalized species in the central part of Kičevo (near Sušica River). Some juvenile specimens collected near Bregalnica River (Ubogo) probably also belong to this species. Previously, it was known only from the shoreline of Lake Prespa (Stenje village), but its distribution in the country is possibly wider.

The Mediterranean species *Dittrichia viscosa*, reported in literature only from the vicinity of Krivolak village (as native species), has now been recorded near Ohrid (Gorenci and Pesočani villages) and in Skopje (Gazi Baba). The recorded populations are only recently settled in the localities. A further secondary spread of this species in the country can

be expected in the future.

The west Balkan endemic *Erysimum korabense*, known only from Šar Mountains and Korab Mt., is recorded on Jablanica Mt. (Strižak). The new locality extends its general range of distribution 55 km southward.

Carex tomentosa, which was known only from two localities on Galičica Mt., is recorded near Zvegor village (Delčevo).

Aconitum lycoctonum subsp. *neapolitanum*, reported in the literature from Šar Mountains and Jablanica Mt. (above Podgorečko Lake), is recorded on Baba Mt. (Sapundžica), Jablanica Mt. (Čumin Vrv), and Šar Mountains (Plat).

New localities are also added for *Lactuca aurea* and the Macedonian endemic *Thymus oehmianus*.

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