

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 articles 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 phthioticum* 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; *Allium 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 spe-

cies, on the territory of the Republic of North Macedonia, we find in the works of Soška (1938-1939b), for the locality “Kраста” (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

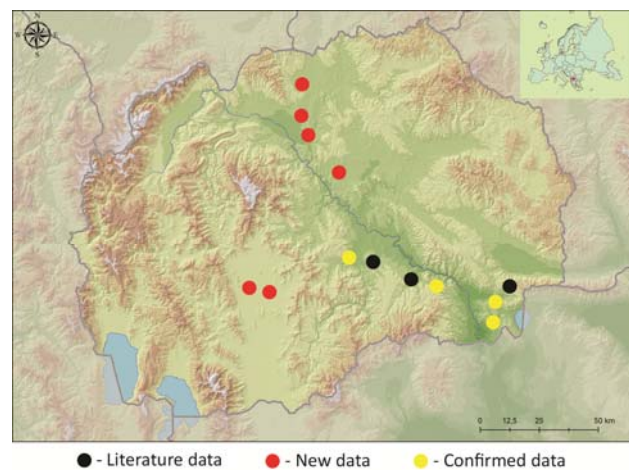


Fig. 2. Distribution of *Allium cyrilli* Ten.

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

A. cyrilli 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, steeper-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 sediments, 06.05.2013., 154 m (leg. B. Zlatković, G. Tomović)

Confirmed data

Kavadarci: Raec village, ruderal places along the road, neogenic sediments, 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: 41°41'12.8"; E: 021°48'32.9". Leg./Det.: Z. Nikolov

Veles: along the old road to Gradsko, 200 m a.s.l., 02.08.2014; nr. 10767; N: 41° 40' 54.6", E: 021° 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: 41° 41' 12.2", E: 021° 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)

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 -

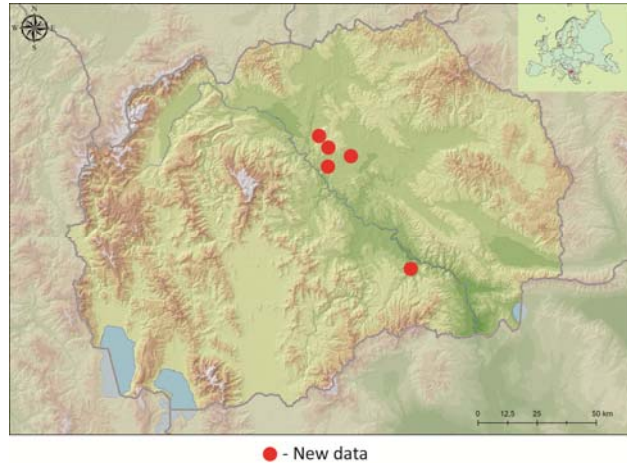


Fig. 4. Distribution of *Allium rhodopeum* Vel.

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: 41°28'54.3"; E: 020°47'07.9". Leg./Det.: Z. Nikolov

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

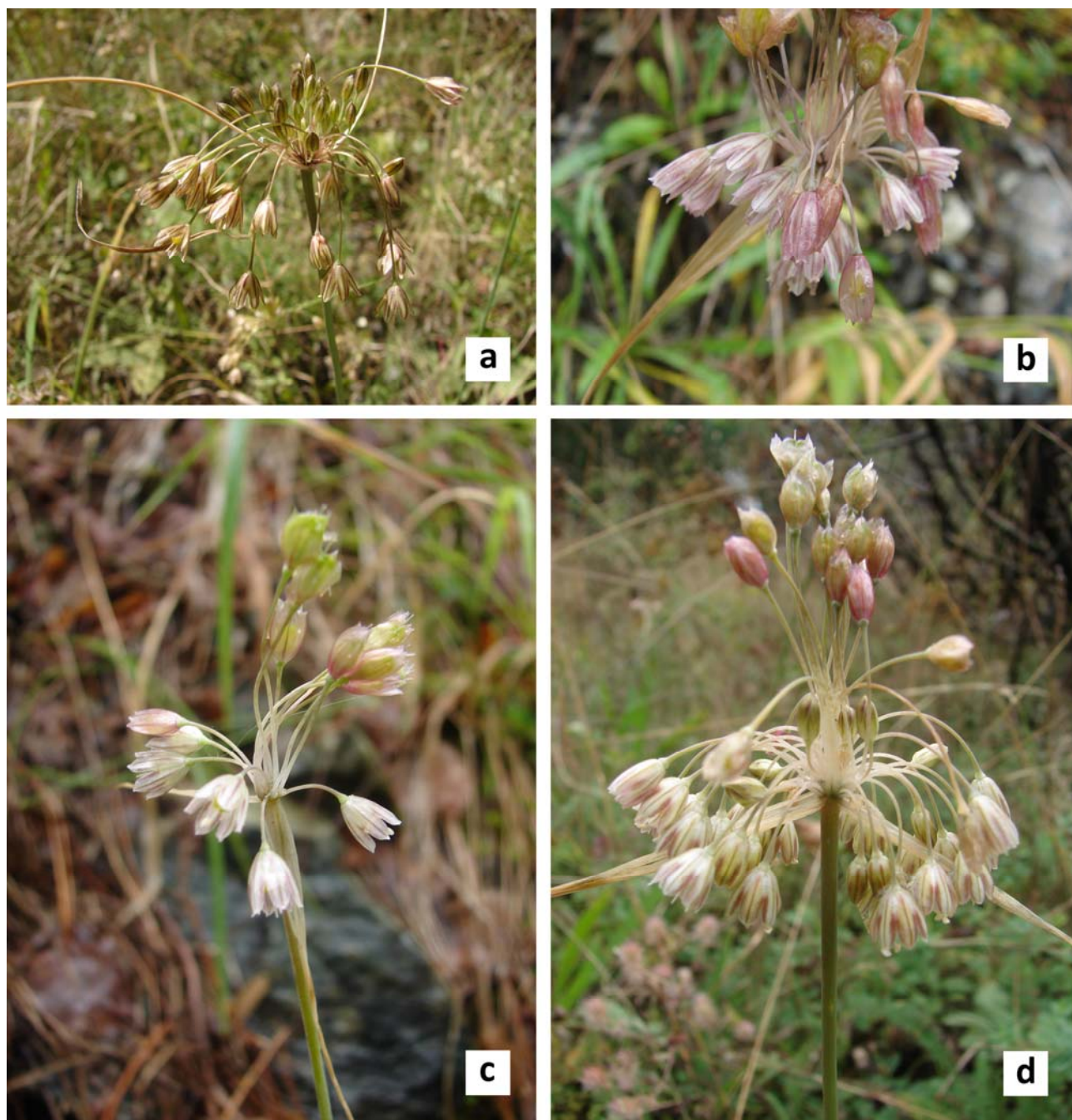


Fig. 5. *Allium fuscum* Waldst. & Kit. (Photo: Z. Nikolov)

a) Bistra b, c, d) Kozjak

pine-beech forest, 1042 m a.s.l., 05.09.2014. N: 41°09'13.1"; E: 021°55'50.5". 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

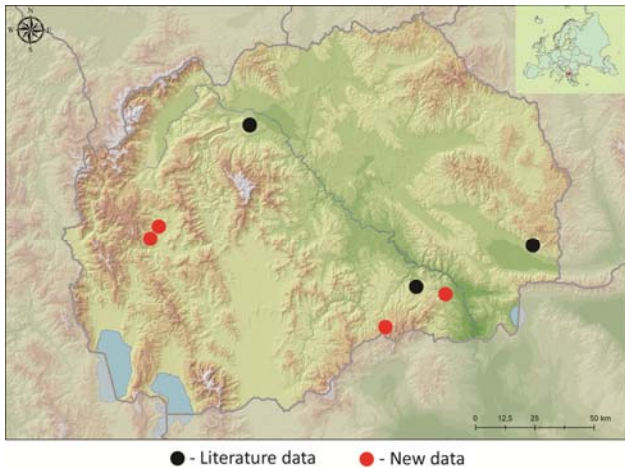


Fig. 6. Distribution of *Allium fuscum* Waldst.& Kit.

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. 50°30' 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 Reichb.) 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,

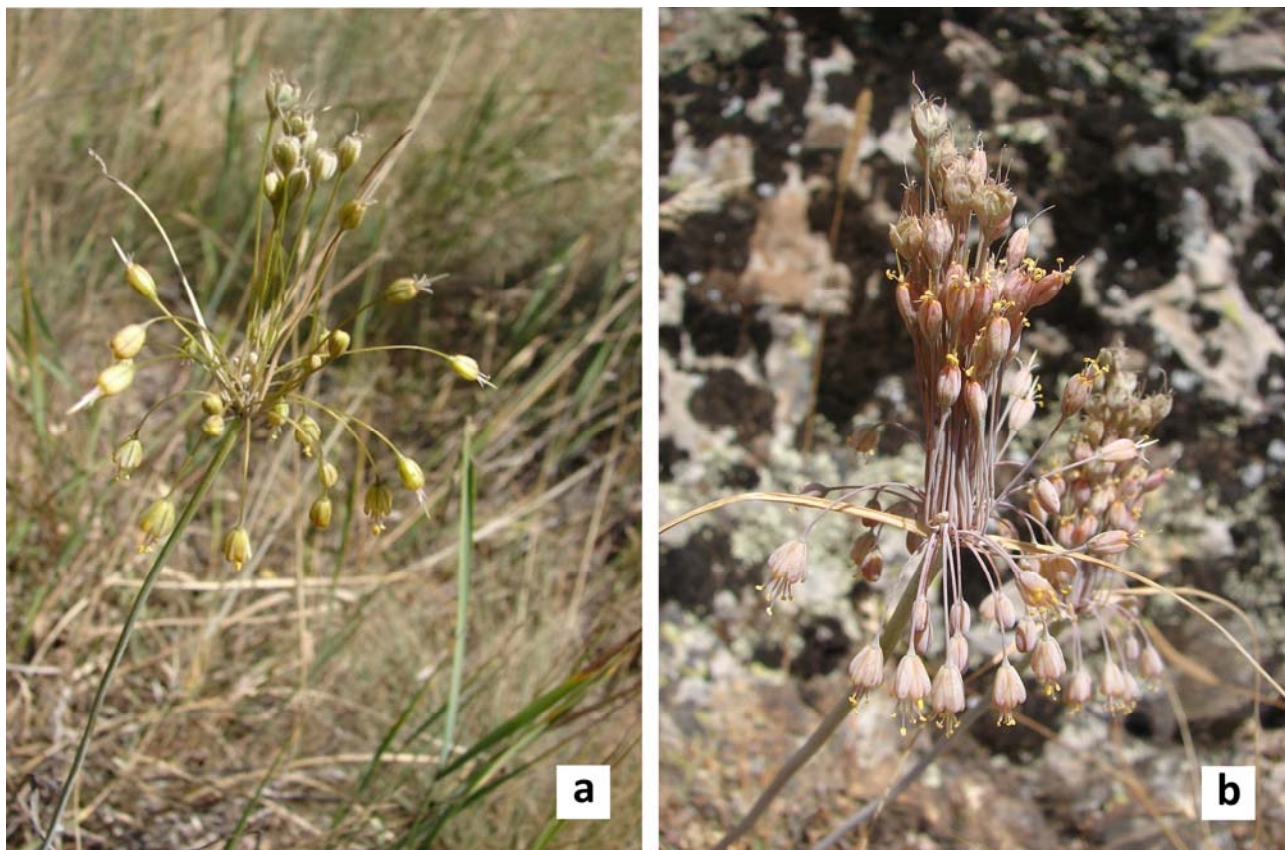


Fig. 7. *Allium flavum* subsp. *tauricum* (Besser ex Rchb.) K. Richt.
a) Tekija village b) S.C. Gora (Photo: Z. Nikolov)

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).

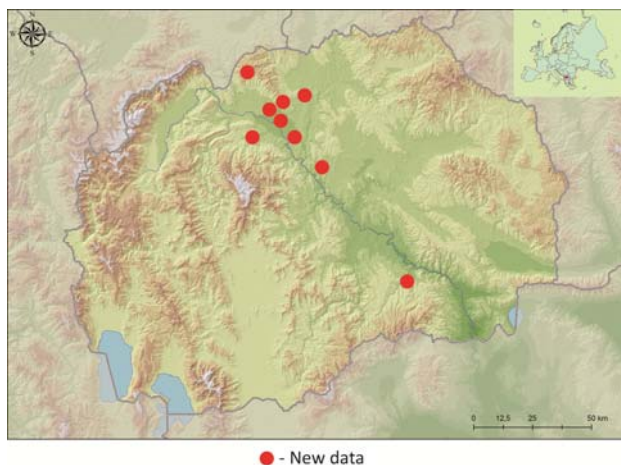


Fig. 8. Distribution of *Allium flavum* subsp. *tauricum*

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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