

## ***Orobanche elatior* Sutton and *Orobanche centaurina* Bertol. (Orobanchaceae) in the locality “Kozjak” (Skopje) in North Macedonia**

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### **Abstract**

The field researches, carried out in the locality “Kozjak” (v. Nova Breznica, Skopje), revealed the existence of two species: *Orobanche elatior* and *Orobanche centaurina*. The presence of *Orobanche elatior*, in the flora of North Macedonia is already known, while *Orobanche centaurina* is a new species. This finding, despite the latest distribution data, definitely incorporates the territory of North Macedonia, in the distribution areas of the both species. *Centaurea grbavacensis*, *Centaurea atropurpurea* and *Centaurea salonitana*, for *Orobanche elatior* and *Jurinea polycephala*, for *Orobanche centaurina*, are, so far, unknown to be host plants neither for these or any other *Orobanche* species. The deviation, concerning the dorsal line of the corolla, by the both species, from the locality “Kozjak” (v. Nova Breznica, Skopje), is discussed. Photographs of the species habitats, the whole plants and their different parts, crucial for the determination, are also taken.

**Key words:** *Centaurea*, host plant, *Jurinea*, *Orobanchaceae*

### **Introduction**

In general, all *Orobanche* in Central Europe, that parasitize on *Centaurea*, primarily on *Centaurea scabiosa* L., had been for more than 100 years considered as *Orobanche elatior* Sutton. But, the studies of Zázvorka (2010) revealed the existence of two, rather distinct species, *Orobanche elatior* Sutton and *Orobanche centaurina* Bertol. (sub *O. kochii* F.W. Schultz), parasitic mostly on the same host – *C. scabiosa* L. This work of Zázvorka (2010), that actually became an incentive for further investigations and revisions of the existing data for *Orobanche elatior* group (Frajman et al., 2011; Piwowarczyk & Krajewski, 2015), was also a base and motive, for the present work.

Meanwhile, the same author, with others (Zázvorka, J., Sanchez Pedraja, Ó, Moreno Moral, G., Carlon, L., Domina, G., Lainz, G. & Piwowarczyk, R. (2019) revealed that the correct name for *O. kochii* F.W. Schultz (1847) is *Orobanche centaurina* Bertol. (1846).

In the course of various studying of the flora of North Macedonia, the locality “Kozjak” (v. Nova Brezni-

ca, Skopje) was visited many times. During the visit in year 2008, on the ridge on the left side of the road that leads to the dam “Kozjak”, a population of *O. elatior*, that parasitizes on here-dominated *Centaurea grbavacensis* (Rohlena) Acht. & Stoj., was encountered. In the following years (2011-2013), within the project “Taxonomy and chorology of the genus *Orobanche* in the Republic of Macedonia”, another population of *O. elatior*, parasitic on here-present *Centaurea atropurpurea* W. & K. and *Centaurea salonitana* Vis. as well as on *C. grbavacensis*, was also registered, but this time on the opposite, right side of the road, on the so-called “Rudine” plateau (Fig. 1). On the same locality, from the middle of June, develops another, easy-differentiated population of other *Orobanche* species – *Orobanche centaurina* Bertol. that parasitizes on *Jurinea polycephala* Formanek. Despite the allegation of Zázvorka (2010), but in accordance with the records of Krajewski & Piwowarczyk (2015), here, both populations grow on the same location, with short, overlapping period, in the flowering stage.

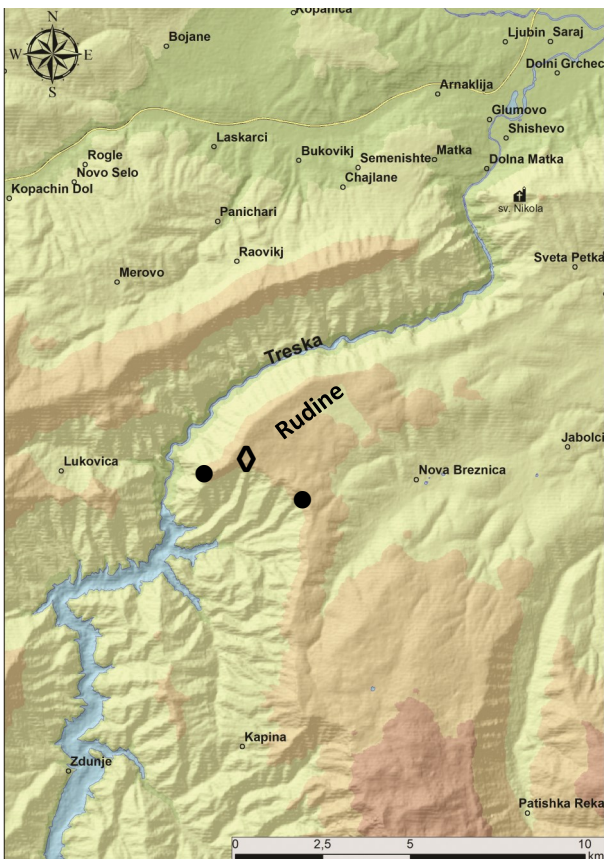


Figure 1. Locality "Kozjak (v. Nova Breznica)  
 (●) *Orobanche elatior* Sutton  
 (◊) *Orobanche centaurina* Bertol.

## Material and methods

Collected material of the both species (39 herbarium specimens of *O. elatior*, 37 of *O. centaurina*), deposited in the herbarium of the Natural History Museum of North Macedonia, descends from the field work, carried out in the locality "Kozjak", at first in year 2008, than intensified in the period from 2011-2013. In order to successful determination of *Orobanche* species, some of the following requirements, detailed by Foley (2000), were fulfilled. First, appropriate photographs of live plants and their parts were provided. Second, the most important characteristics were analyzed on living plants. In addition, the established haustorial connections between the parasitic *Orobanche* and the host plants, in the most of the cases, were preserved and documented. The host and the characteristics of some parts of the plants like color of stem, corolla and stigma, are among the most crucial for certain, as much as possible, determination of *Orobanche* species. Distribution map in North Macedonia and a map of the locality "Kozjak" (v. Nova Breznica, Skopje) are also given.

The identification of the species has been done according to Beck (1890, 1930), Chater & Webb (1972), Gilli (1982), Delipavlov (1995), Kreutz (1995), Uhlich, Pusch & Barthel (1995), Pusch & Günther (2009), Zazvorka (2010).

## Locality

The locality "Kozjak" (Fig. 1, 8) is settled in the south-western part of Skopje valley, in the vicinity of the village Nova Breznica (7 km), circa 50 km from the capital Skopje. It includes parts on the left and the right side of the road that leads from the village Nova Breznica to the dam "Kozjak" (r. Treska). Here dominate rocky, dry grasslands on the carbonate bedrocks, rarely dry meadows and clearings in the oak belt or the rests of *Pinus nigra* forests (Fig. 2, 6). On the ridge, on the left side, at altitude of 1000-1240 m a.s.l. grows only population of *O. elatior* Sutton, while on the opposite, right side, on the so-called "Rudenie plateau", with altitude's spanning from 1000-1280 m a.s.l., develop the both populations of *O. elatior* and *O. centaurina*.

## Results and discussion

### I. *Orobanche elatior* Sutton, 1798.

(Syn. *Orobanche major* L., 1753 – pro parte; *Orobanche fragrans* W.D.J. Koch, 1833; *Orobanche stigmatodes* Wimmer, 1840).

Mk. – "Kozjak" (v. Nova Breznica), Skopje valley, 1240 m a.s.l., 18.05.2008 (Leg./Det. Z. Nikolov).

1. Description of the species (based on the samples from the locality "Kozjak")

Plant robust, rarely slender. Flowering stem (15)20-45(50) cm, simple, yellowish or pale brown (ochre),



Figure 2. *Orobanche elatior* Sutton – Habitat

Figure 3. *Orobanche elatior* Sutton

a) Habitus; b) *O. elatior*, with the host plant *Centaurea atropurpurea*; c) *Centaurea atropurpurea*, the host plant; d) *O. elatior*, with the host plant *Centaurea salonitana*



Figure 4. *Orobanche elatior* Sutton. a) Habitus; b) *O. elatior*, with the host plant *Centaurea grbavacensis*; c) scale leaves

rarely  $\pm$  purple, glandular-pubescent. Scale leaves 3-5 (6) mm broad, (15)20-25(27) mm long, numerous, linear-lanceolate, lower broader at base, the upper noticeably longer and narrower, glandular-pubescent. Inflorescence (5)8-20(22) cm, flowers numerous, arranged in a  $\pm$  long, dense, cylindrical spike, rarely the lowest 1-2 flowers somewhat separated. Bracts as long as or slightly longer than the corolla, deflexed from the middle. Calyx segments up to 15 mm, free or connate at base, bidentate, covered with dense, glandular hairs. Corolla (18)22-28(30) mm, yellowish, brawn-yellowish (ochre), rarely light to dark-purple, with conspicuous brown-purple veins, glandular-pubescent. Dorsal line of the corolla vary from strong, regularly curved to somewhat straight (even) in the middle. The stamens are

inserted (3)4-6 mm from the base of the corolla. The two-lobed stigma is yellow.

## 2. Distribution

According to Zazvorka (2010), the distribution area of *O. elatior* s.str. is confined to western and central Europe: England, Sweden, Norway, Denmark, Holland, Switzerland, France, Germany and Italy, eastwards to Baltic States, Poland and the Czech Republic. Its presence on the territory of the R. of Slovenia is confirmed by Frajman, Strgulc-Krajšek & Dakskobler (2011).

## 3. Distribution in North Macedonia

Data about the presence of *O. elatior*, on the territory of North Macedonia, we find in the works of Vandas (1909) and Beck (1930), for the mountain Luben and, in the work of Petrović (1941), for the gorge of the



Figure 5. *Orobanche elatior* Sutton – flowers

a, b) *O. elatior* (parasitic on *Centaurea atropurpurea*; c) *O. elatior* (parasitic on *Centaurea grbavacensis*)

r. Treska (tributary of the river Vardar), in the area from the v. Šiševo to the hill, above the monastery "St. Nikola" (Fig. 1). Our finding, along the r. Treska (in the vicinity of the dam "Kozjak"), on the right side downstream (not far from the mentioned gorge „Matka"), confirms the data of Petrović (1941), for the presence of this species, in this part of Skopje valley (Fig. 1, 8). In "Euro+MedPlantbase - the information resource for Euro-Mediterranean plant diversity" (Domina & Raab-Straube, 2010+), the territory of North Macedonia is not included in the distribution area of *O. elatior*.

#### 4. Habitat

*O. elatior* grows on arid or semi-arid grasslands in sunny places, on carbonate, rarely on silicate bedrocks (Kreutz, 1994; Pusch, 2009). In the locality "Kozjak", dominates rocky dry grasslands, on the carbonate bedrocks (Fig. 2).

#### 5. Host plants

Hitherto, *O. elatior* is known to be parasitic only on *Centaurea* species, mainly on *C. scabiosa*, rarely on *C. jacea* L. and *C. triumfettii* All. (Pusch, 2009; Zazvorka, 2010; Frajman, Strgulc-Krajšek & Dakskobler, 2011; Piwowarczyk & Krajewski, 2015). In our case, three other species of *Centaurea*: *C. atropurpurea* (Fig. 3a, 3b, 3c), *C. salonitana* (Fig. 3d) and *C. grbavacensis* (Fig. 4a, 4b) appear to be host plants, for *O. elatior*.

#### 6. Flowering period

*O. elatior*, in the locality "Kozjak", blooms from the middle of May to the middle of June.

7. Morphological variation in the populations from the locality "Kozjak" (v. Nova Breznica)

The description of the plants, from the populations of the both side of the road, mostly matches those for *O. elatior*, given by Beck (1890; 1930), Chater & Webb (1972), Gilli (1982), Delipavlov (1995), Uhlich, Pusch & Barthel (1995), Pusch (2009), Zazvorka (2010). The main characteristics that distinguish this species from

*O. centaurina* are evident. Plants of *O. elatior* are robust and taller, the color of the flowering stem is yellowish or pale brown (ochre), rarely ± purple, the stem scales are longer and narrower (Fig. 4c) and, the spike is dense and cylindrical. The only, more or less, deviation, from the descriptions given by the above-mentioned authors, is noticed on the dorsal line of the corolla, by some plants, no matter of the host plant species. Namely, the dorsal line of the corolla is not that "uniformly curved throughout" (Fig. 5a) but is somewhat straight (even), in the middle (Fig. 5b, 5c).

#### II. *Orobanche centaurina* Bertol. (1846)

(Syn. *Orobanche kochii* F.W. Schultz, 1847)

Mk. – "Kozjak" (v. Nova Breznica), Skopje valley, 1145 m a.s.l., 15.06.2012 (Leg./Det. Z. Nikolov).

1. Description of the species (based on the samples from the locality "Kozjak")

Plants slender, medium-sized. Flowering stem (12) 17-27(30) cm, simple, rarely fork-like branched from the base, rosaceous to carrot-red, covered with dense, whitish to pale yellow, glandular hairs. Scale leaves (4)5-6 mm wide (at the base), (8)10-15 mm long, triangular to lanceolate-ovate, the upper longer and narrower in compare to those from the lower part of the stem, glandular-pubescent. Inflorescence (4)8-11(13) cm, the flowers arranged in a ± lax sub cylindrical spike. Corolla (16)19-23(25) cm, color matches that of the flowering stem – rosaceous to carrot-red, rarely yellowish or whitish, with conspicuously rosaceous veins; the dorsal line vary from almost regularly curved to even (straight), in the middle part. Stamens inserted 4-5(6) mm from the base of the corolla. Stigma, consisted of two lobes, yellow.

#### 2. Distribution

*O. centaurina* is Eurasian species, spreading from Central Europe to Central Asia, Central China and India



Figure 6. *Orobanche centaurina* Bertol. – Habitat

(Zazvorka (2010). Its distribution area includes the following countries, from central and south-eastern Europe: France (distr. Hautes Alpes), Italy, Austria, Hungary, Czech Republic, Slovakia, Poland, Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Greece, Bulgaria, Romania, Ukraine and European Russia. Reliable data, for the presence of this species in Asia, are also available (Zazvorka, 2010).

### 3. Distribution in North Macedonia

*O. centaurina* (Fig. 7a) is a new species for the flora of North Macedonia. The locality “Kozjak” is the only, so far known place where this species develops.

### 4. Habitat

*O. centaurina* grows on the same locality as *O. elatior*, on dry grasslands on carbonate bedrocks as well as on dry meadows and clearings in degraded oak and *Pinus nigra* forests (Fig. 6).

### 5. Host plants

*O. centaurina* in Central Europe parasitizes mainly on *C. scabiosa*, rarely on other species of the genus

*Centaurea* (Zazvorka, 2010). In the latest work, Zázvorka, J., Sanchez Pedraja, Ó, Moreno Moral, G., Carlon, L., Domina, G., Lainz, G. & Piwowarczyk, R. (2019), alleged also the genus *Echinops* as well as *Rhaponticoides ruthenica* (Lam.) M.V. Agab. & Greuter (PLANTARIUM, 2007+, Russian republic of Tatarstan) and *Ptilostemon echinocephalus* (Willd.) Greuter (PLANTARIUM, 2007+, Crimean Peninsula), as host plants, for this species. But, in the locality “Kozjak”, the host plant is *Jurinea polycephala* (Fig. 7a, 7b), so far unknown for this or any other *Orobanche* species.

### 6. Flowering period

In the locality “Kozjak”, the flowering period of *O. centaurina* occurs from the middle of June to the middle of July.

### 7. Morphological variation in the population from the locality “Kozjak” (v. Nova Breznica)

The description of the plants, from the locality “Kozjak” (v. Nova Breznica), corresponds, for the most of the features, to the description, given by Zazvorka (2010). In compare to *O. elatior*, the plants of *O. centaurina* are medium-sized, the color of the flowering stem is rosaceous to carrot-red, the scale leaves are triangular to lanceolate-ovate (Fig. 7c), and the inflorescence is lax, sub cylindrical. The only variation, noticed by the flowers of some plants, concerns the dorsal line of the corolla. Despite of the “unevenly curved corolla” (dorsal line curved at base, than almost straight, Zazvorka, 2010), the dorsal line, by some plants from the locality “Kozjak” (v. Nova Breznica), is almost regularly (uniformly) curved.



Figure 7. *Orobanche centaurina* Bertol.

a) Habitus; b) *O. centaurina*, with the host plant *Jurinea polycephala*; c) scale leaves; d) flowers

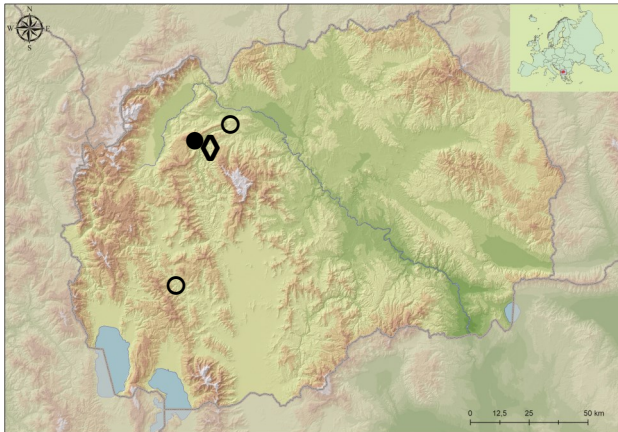


Figure 8. Distribution in North Macedonia.  
*Orobanche elatior* – literature data (○)  
*Orobanche elatior* – new data (●)  
*Orobanche centaurina* (◊)

## Conclusions

The finding of *O. elatior* and *O. centaurina*, in the locality "Kozjak" (v. Nova Breznica, Skopje), definitely confirms the presence of these species in our flora, and includes the territory of North Macedonia as a part of their distribution areas. The records of *C. grbavacensis*, *C. atropurpurea* and *C. salonitana*, for *O. elatior* and *J. polycephala*, for *O. centaurina*, elongate the list of certain host plants, for the both species. The variation, that concerns the dorsal line of the corolla, by some plants of *O. elatior* and *O. centaurina*, might be result of different host plants species and local conditions of the habitats. The flowering period, of the both species, in the locality "Kozjak", is successive: first blooms *O. elatior*, then *O. centaurina*. There is only a short, overlapping period, when bloomed plants, of the booth species, can be encountered.

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## References

- Beck, G., 1890: Monographie der Gattung *Orobanche*. *Bibl. Bot.*, 19: 1-275. Theodor Fischer, Cassel.
- Beck, G., 1930: *Orobanchaceae*. In: Engler, A. (Eds.). *Das Pflanzenreich*, 96 (IV/ 261): 1–348. Verlag von Wilhelm Engelmann, Leipzig.
- Chater, A.O. & Webb, D.A., 1972: *Orobanche*. In: Tutin, T.G., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S.M. & Webb, D.A. *Flora Europaea*, 3:286-293. Cambridge.
- Delipavlov, D., 1995: *Orobanche*. In: Kožuharov, S.I. & Kuzmanov, B.A. (Eds.). *Flora Republicae Bulgaricae*, 10:291-325. Sofia.
- Domina, G. & Raab-Straube, E. von (2010+): *Orobanche*. – In: Euro+MedPlantbase - the information resource for Euro-Mediterranean plant diversity. This work is licensed under a Creative Commons Attribution-ShareAlike 3.0 Unported license (CC-BY-SA-3.0 Unported).
- Foley, M., 2000: A morphological comparison between some British *Orobanche* species (Orobanchaceae) and their closely-related non-British counterparts from continental Europe: *Orobanche reticulata* Wallr. s.l. *Watsonia*, 23:257-267. Botanical Society of Britain & Ireland.
- Frajman, B., Strgulc-Krajšek, S. & Dakskobler, I., 2011: *Orobanche kochii* F.W. Schultz in *Orobanche elatior* Sutton (Orobanchaceae) – novi vrsti za floro Slovenije. *Hladnikia*, 27:57-65. Botanical Society of Slovenia, Ljubljana.
- Gilli, A., 1982: *Orobanche*. In: Devis, P. (Eds.). *Flora of Turkey and the East Aegean Islands*, vol. 7:1-23. Edinburgh University Press.
- Kreutz, C.A.J., 1995: *Orobanche*. Die Sommerwurzarten Europas. Band 1. Mittel- und Nordeuropa. Maastricht: Stichting Natuurpublicaties Limburg, 1-159.
- Petrović, J., 1941: Contribution to the flora of Skopje valley. *Bulletin de la societe scientifique de Skoplje*, 22(8):79-89. Section des sciences naturelles.
- Piowarczyk, R. & Krajewski, L., 2015: *Orobanche elatior* and *O. kochii* (Orobanchaceae) in Poland: distribution, taxonomy, plant communities and seed micromorphology. *Acta Societatis Botanicorum Poloniae*, 84 (1): 103–123.
- Pusch, J. & Günther, K.F., 2009: Gattung *Orobanche*. In: Wagenitz, G. (Herausg.). *Gustav Hegi Illustrierte Flora von Mitteleuropa*, vol. VI/1A. Lieferung 1: 14–99, Weissdorn-Verlag, Jena.

- Uhlich, H., Pusch, J. & Barthel K.-J., 1995: Die Sommerwurzarten Europa. Gattung *Orobanche*. Magdeburg: Westarp-Wiss.
- Vandas, C., 1909: Reliquiae Formanekianae. Enumeratio critica plantarum vascularum, quas itineribus in Haemo peninsula et Asia Minore (Bithynia) factis collegit Dr. E. Formanek, Professor gymnasii Brunensis Bohemici. Brunae.
- Zázvorka J., 2010: *Orobanche kochii* and *O. elatior* (Orobanchaceae) in central Europe. *Acta Musei Moraviae, Scientiae biologicae*, 95(2):77–119. Brno.
- Zázvorka, J., Sanchez Pedraja, Ó, Moreno Moral, G., Carlon, L., Domina, G., Lainz, G.. & Piwowarczyk, R. (2019): *Orobanche centaurina* Bertol., the correct name for *O. kochii* F. W. Schultz (Orobanchaceae). *Flora Montiberica*, 75: 52-56. annotated checklist, *Englera*. 31: 1-372.

## ***Orobanche elatior* Sutton и *Orobanche centaurina* Bertol. (Orobanchaceae) од локалитетот „Козјак“ (с. Нова Брезница), Скопје, Северна Македонија**

Зоран Николов

Теренските истражувања на локалитетот „Козјак“ (с. Нова Брезница), остварени во повеќе наврати, започнувајќи од 2008, а интензивирани во периодот од 2011-2013 г., за време на реализацијата на проектот „Таксономија и хорологија на родот *Orobanche* во Република Македонија“, го потврдија присуство на два, за нашата флора, интересни вида: *Orobanche elatior* и *Orobanche centaurina*. На брдото, од левата страна од патот кој води до браната „Козјак“, се развива популација од *O. elatior*, која паразитира на *Centaurea grbavacensis*. На спротивната, десна страна од патот, на платото Рудине се развива, исто така, популација од *O. elatior*, која паразитира на *Centaurea atropurpurea*, *Centaurea salonitana* и *C. grbavacensis*, но и популација од *O. centaurina*, која паразитира на *Jurinea polycephala*. Литературни податоци за присуството на *O. elatior* за територијата на Северна Македонија, наоѓаме кај Vandas (1909) и Beck (1930) за планината Лубен, како и кај Petrović (1941) за клисурата на р. Треска, на потегот од с. Шишево до брдото на манастирот „Св. Никола“, додека *O. centaurina* е нов вид за нашата флора. Бидејќи новиот локалитет („Козјак“), на кој го регистриравме присуството на *O. elatior*, е по течението на р. Треска и на незначително растојание од споменатата клисура (Матка), сметаме дека овој наод е всушност потврда на податокот на Petrović (1941), за присуството на овој вид во овој дел од Скопската Котлина.

Трите видови од родот *Centaurea* (*C. grbavacensis*, *C. atropurpurea* и *C. salonitana*), на кои паразитира *O. elatior*, како и *J. polycephala*, на која паразитира *O. centaurina*, досега не се познати како домаќини, било за овие или за некои други видови, од родот *Orobanche*.

Описите на видовите, направени на примероците од популациите, кои се развиваат на овој локалитет, одговараат на дијагнозите дадени од Beck (1890; 1930), Chater & Webb (1972), Gilli (1982), Delipavlov (1995), Uhlich, Pusch & Barthel (1995), Pusch (2009), Zazvorka (2010). Исклучок се јавува само во однос на формата на дорзалната линија на венчето, и тоа само кај некои примероци, од двата вида, каде се забележуваат сите преодни форми, од правилно, полукружно свиткано (карактеристично за *O. elatior*) до венче со изразито права линија во средината (карактеристично за *O. centaurina*).

Податоците од овие истражувања, со кои се потврди присуството на *O. elatior* и *O. centaurina* во нашата флора, дефинитивно ќе ја вклучат територијата на Северна Македонија, во ареалот на распространување на двата вида, што до сега, со актуалната Euro+Med Plantbase - the information resource for Euro-Mediterranean plant diversity (Domina & Raab-Straube, 2010+), не беше случај.