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FRITILLARIA MACEDONICA BORNM., A NEW SPECIES FOR THE FLORA OF GREECE

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Abstract

In this study, we present the first confirmed record of *Fritillaria macedonica* in Greece, found c. 200 km SE from its nearest known locality in the Balkans. Data concerning the distribution, the habitat preferences, as well as its population size were recorded, whereas this information have been used to determine its threat category. According to the IUCN criteria and based on the restricted distribution area and the small number of individuals, *F. macedonica* has been classified as Vulnerable (VU) at a national level.

Keywords: Balkans, chorology, *Fritillaria*, Liliaceae, southernmost location, threat status.

Introduction

The genus *Fritillaria* is composed of bulbous, perennial species, which can be found in the temperate areas of Northern Hemisphere (Kamari & al. 2017 and references herein). A considerable number, out of the c. 165 taxa of the genus, are found in Greece and Western Anatolia (Kamari & Phitos 2006, Tekşen & Aytaç 2011, Özhatay & al. 2015, Samaropoulou & al. 2016, Kamari & al. 2017), an area which is considered a secondary evolutionary center for the subgenus *Fritillaria*.

According to Dimopoulos & al. (2013, 2020), 26 species and subspecies are distributed in Greece, whereas this number is criticized by Kamari & al. (2017), confirming what was stated by Broussalis (1978) concerning the taxonomic problems within the genus. Recently, one more species - *Fritillaria phitosia* - was added by Kamari & al. (2017) to the genus *Fritillaria* in Greece, who stated that 30 taxa (25 species and 5 subspecies) are distributed in the country. In general, most of these taxa are found in the southern part of the country as well as on the islands of the eastern Aegean, and just a rather small number is found in the central and northern Greece (Dimopoulos & al. 2013). Moreover, according to Kamari & al. (2017), most of the 17 endemic taxa in Greece, are distributed in the Aegean archipelagos and the neighboring continental regions. Contrary to the high number of taxa occurring in Greece and its high endemism, the other Balkan countries have only 2 up to 6 species and subspecies, and this number is decreased towards the northern countries of the Peninsula (Tomović & al. 2007).

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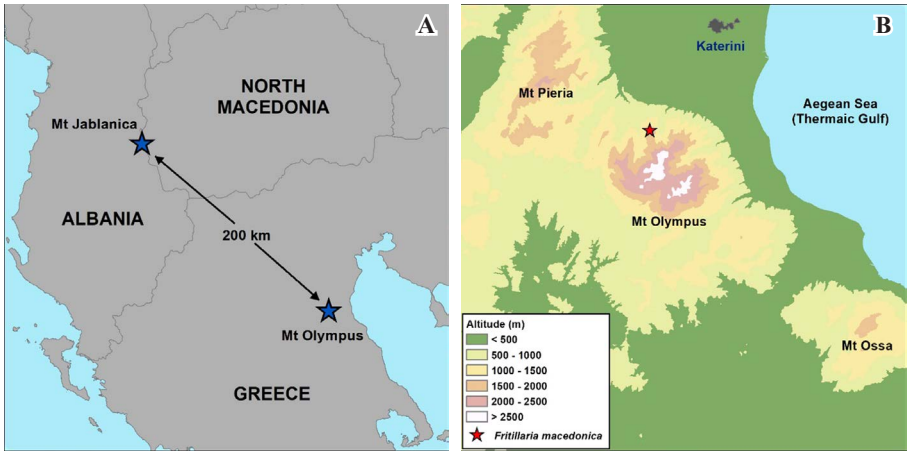

Fig. 1. *Fritillaria macedonica*. **A**. The approximate distance of the Greek locality and the nearest known locality (Mt Jablanica, North Macedonia). **B.** the here reported Greek population

Fritillaria macedonica is an endemic Balkan species, which was never recorded in Greece so far (Shuka & Matevski 2018). It was firstly recorded and described by Bornmüller (1923), who found it on Mt Jablanica, in the southwestern part of North Macedonia, and now this species is only known from the Republic of North Macedonia, E & C Albania and SW Serbia. Based on its up to now known distribution, the records of *F. macedonica* on Mt. Šara (Gine Vode-Mekuš Bor-Careve Livade) in Serbia, as well as those on Mt. Jablanica in North Macedonia represent its northernmost and southernmost distribution limits, respectively (Tomović & al. 2007).

Results and discussion

On April 25th 2008, one of us (Th. G.) recorded a previously unknown population of *Fritillaria* on Mt Olympus. On May 6th 2017, and after a series of unsuccessful excursions due to unsuitable weather conditions, Th. G. again together with the naturalists Zissis Antonopoulos and Leftheris Kipopoulos, revisited the specific site. On May 19th 2018 and on May 18th 2019, the authors of the present study visited the specific population and based on sampled material they identified it as *Fritillaria macedonica*. The locality of *Fritillaria macedonica* on Mt Olympus is c. 200 km SE from its nearest known locality (Fig. 1). The population was found in an opening in *Pinus nigra* forest, as well as under sparse *Pinus nigra* trees at an altitudinal range of c. 1500-1600 m a.s.l., on humus-rich calcareous soil on limestone bedrock. It is one of the first flowering species at the specific altitudinal zone, flowering after *Crocus veluchensis* but together with *Anemone blanda, Fritillaria messanensis, Consolida solida* subsp. *incisa, Primula veris* and *Dactylorhiza sambucina*.

Morphologically, *F. macedonica* belongs to the aggregate of *F. montana,* and its closest relative may be *F. epirotica* Turrill ex Rix considered as its closest relative (Tomović & al. 2007). It is a perennial herbaceous plant with stems up to 14 cm high and leaves which are subopposite below, whereas the upper ones are grouped in a whorl of three. The perianth is very broadly campanulate, composed of lilac, heavily tessellated with dark purple tepals. The tepals are ovate-lanceolate, toothed at their margins (Rix 1980).

Fritillaria macedonica in Greece

Fritillaria macedonica Bornm. - Greece, Central Macedonia, Prefecture of Pieria, c. 5,2 km S of Petra, Mt Olympus, 1580 m a.s.l., 19 May 2018 & 18 May 2019, 40° 08′ N, 22° 20′ E (Figs 1, 2).

Herbarium specimens are deposited to the herbariums of the Department of Forest and Natural

Environment Sciences of the International Hellenic University (IHUF) and to the School of Forestry and Natural Environment of the Aristotle University of Thessaloniki (TAUF).

This is the third species of the genus *Fritillaria* present on Mt Olympus (including Kato Olympus), after *F. messanensis* Rafin. subsp. *messanensis* (Strid 1980) and *F. montana* Hoppe ex W.D.J. Koch (Samaropoulou 2021).

In Serbia, *F. macedonica* grows in flat or gently sloped terrains on humus-rich soil within high-mountain brushwood (*Juniperus sibirica-Bruckenthalia spiculifolia*), at an altitudinal range of 1900-2250 m (Stevanović 1999). In the Republic of North Macedonia (Mt Jablanica - *locus classicus*) it inhabits high mountain pastures and rocky places, at altitudes from 1600 m to 1800 m (Tomović & al. 2007), whereas in Albania seems to be much more common compared to the other two countries and can be found at an altitudinal range of c. 1400-1900 m (Shuka L. pers. comm.), preferring mountainous grasslands and pastures (Barina & al. 2017, probably the altitudinal range in Albania was erroneously given as 400-1900 m).

Fig. 2. *Fritillaria macedonica*, Mt. Olympus, Greece. **A-D**. habitat. **E**. Bulb. **F**. interior of flower and **G**. reproductive organs.

Despite the large distance between the finding location of *F. macedonica* on Mt. Olympus and its location in the SW part of North Macedonia, the habitat where it was found is similar in all sites. The geological substrate consists the only factor that is being differentiated. Specifically, both in Serbia and North Macedonia, the species is found on siliceous substrates (granodiorite, granite and serpentine) (Stevanović 1999, Tomović & al. 2007), whereas on Mt Olympus it is found on limestone. On the contrary, *F. macedonica* was found in Albania growing both on limestone and on serpentine substrates (Barina *et al.* 2017), which partly is congruent with our findings. Moreover, the geological substrates in which *F. macedonica* has been recorded so far, are also provided by Shuka & Matevski (2018), who stated that it is found on calcareous, serpentine and siliceous substrates.

In Serbia, the species is included in the Red Data Book of the country as Critically Endangered (CR) (Stevanović 1999, Tomović & al. 2007), whereas according to Vangjeli & al. (1994), it is characterized as Rare in Albania. Recently, Shuka & Matevski (2018) evaluated its threat status according to the new IUCN criteria (IUCN 2012), and they concluded that *F. macedonica* is an Endangered (EN) taxon that fulfills the criteria B1ab(i,ii,iii,v)+2ab(i,ii,iii,v) for inclusion in the IUCN threat categories. The characterization of *F. macedonica* as an Endangered (EN) species was based on the small extent of occurrence (criterion B1) and the restricted area of occupancy (criterion B2), in combination with a declining trend that has been observed in both countries. Specifically, Shuka & Matevski (2018) estimated the total (in the three countries in which the species is distributed) area of occupancy (AOO) to be 52 km² and the extent of occurrence (EOO) to be c. 5503 km². Although according to the IUCN threat criteria (IUCN 2012) the upper limit of the EOO for inclusion in the category of the Endangered (EN) species is set to 5000 km², Shuka & Matevski (2018) estimated that to be above that limit (5503 km²). Now, after the finding of *F. macedonica* on Mt Olympus, which is located far away from its southern distribution limit, the EOO of the species is estimated to be significantly above the specific limit, and thus it should not be considered as Endangered following B1 criterion. On the contrary, and because of the restricted area in which *F. macedonica* occur on Mt. Olympus (c. 1-2 Ha), the AOO is not significantly changed, and thus the threat category (EN) according to the B2 criterion should be retained. Regarding its total population size, Shuka & Matevski (2018) estimated that it is not exceeding the 15000 (13000 - 16000) mature individuals.

On Mt Olympus, in total we found c. 400-500 mature individuals, which does not differentiate the general pattern of its total population. At a national level, after applying the IUCN criteria, *F. macedonica* should be classified as Vulnerable (VU), as the species meets the criteria D1 and D2. The difference in the evaluations at a regional and global level is attributed to the fact that in Greece we do not have estimations or data showing a continuous decline in its population size or extreme fluctuations in its EOO, AOO, sites and mature individuals. However, more studies and monitoring actions are needed to assess the patterns and trends of the specific subpopulations, as well as to evaluate potential threats that could affect the species directly (e.g. forest road construction) or indirectly (e.g. effects of climate change).

Climate change is mentioned by Shuka & Matevski (2018) as a potential threat for *F. macedonica*. Specifically, they refer that the loss of the snow cover is expected to cause damages to its individuals by causing desiccation of their bulbs. Although we did not observe any sign of desiccation on Mt Olympus, we also believe that the species could be affected by an increase in the temperature and a decrease in the precipitation, as this population is in the southernmost limit of its distribution range, and it might be affected before any other population. However, although the site of *F. macedonica* on Mt Olympus was not affected by any external factor, we believe that the vegetation succession could cause the disappearance of the specific forest opening, which in turn could negatively affect the specific subpopulation.

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