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## ***Fumana bonapartei* and *F. aciphylla* (Cistaceae), new additions to the Bulgarian flora**

### **Abstract**

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The occurrence of *Fumana bonapartei* and *F. aciphylla* in Bulgaria is reported here for the first time. Both species were found together at a single site on serpentine slopes near the village of Zagorichane, East Rhodope Mts. The diagnostic features of each species have been compared with those of other members of the genus already known for the country. An identification key to all four Bulgarian species of *Fumana* has been provided. Population structure and size, and floristic composition at the new sites as well as a preliminary assessment of the conservation status of both species are also presented.

*Key words:* Balkans, new records, identification key, native species, serpentinophytes.

### **Introduction**

In Bulgaria, *Fumana* (Dunal) Spach has been presented up to date by two taxa (Markova 1979; Assyov & Petrova 2012; Petrova & Vladimirov 2018), namely the widespread *F. procumbens* (Dunal) Gren. & Godr., and *F. arabica* (L.) Spach known from one region only (Velčev & al. 1966). The presence in the country of *F. ericoides* (Cav.) Gand., listed for Bulgarian flora by Raab-Straube (2018), needs confirmation, since it has been neither reported in floristic references (Markova 1979; Kožuharov 1992; Delipavlov & Chesmedzhiev 2011; Assyov & Petrova 2012), nor deposited at any national indexed herbaria (SO, SOM and SOA).

### **Materials and Methods**

On 13.05.2019, a botanical trip was held to a region in East Rhodope Mts., known for its rich and interesting flora (Pavlova & al. 2003; Stoyanov & Marinov 2020). A subsequent careful examination of photos taken during the trip and a review of the relevant literature suggested that an unknown for the Bulgarian flora species of *Fumana* might have been photographed. This encouraged the two consecutive botanical trips in the following

year. As a result, two previously unencountered species of the genus have been found and collected in a single site near the village of Zagorichane, Kardzhali district. During the first trip on 17.05.2020, individuals of both taxa were at the beginning of flowering period; during the second trip on 14.06.2020, individuals of both taxa were at fruiting stage. The diagnostic characters were noted from both living plants and collected specimens after examination under stereomicroscope. Collected materials were deposited at the herbarium of Sofia University “St. Kliment Ohridski” (SO) and that of the Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences (SOM). For identification purpose, the key to the genus *Fumana* (Heywood 1968) was used as a main source, and cross-checked with data from Boissier (1867), Maire & Petitmengin (1908), Coode (1965), Markova (1979) and Bogdanović & al. (2012). To verify the identification, the collected specimens were compared with a number of exsiccata, including type materials kept at SO, VAL, K, E, P, MA, WU, MPU and MW. Most of the exsiccata were obtained as scanned or photographic images at GBIF.org (2020) or provided from the collectors after personal communication. The habitat’s physical characteristics and floristic composition were noted by the author at the field, and combined with data from previous studies (Pavlova & al. 2003; Stoyanov & Marinov 2020). Climatic conditions are presented according climate model (Climate-Data.org 2020). The numbers of individuals of the reported species were counted in limited parts of the area and after that, their total number for entire site was estimated by assumption.

## Results

The detailed morphological analyses confirmed that the studied specimens represent undoubtedly *Fumana bonapartei* Maire & Petitm. and *F. aciphylla* Boiss. This is the first report of the presence of both taxa for the Bulgarian native flora.

*F. bonapartei* can be distinguished from other species of the genus in Bulgaria by its glandular-viscid inflorescence axis, glabrous, linear to narrowly lanceolate, shortly mucronate leaves, as well as by the fruit capsule, which usually bears six seeds (Fig. 1). *F. bonapartei* is a Balkan endemic and an obligate serpentinophyte, documented until now from Albania, Bosnia-Herzegovina, Montenegro, Serbia (incl. Kosovo), North Macedonia and Greece (Stevanović & al. 2003; Raab-Straube 2018; Carrió & al. 2020). *F. aciphylla* is distinctive by its erect to ascending habitus and glaucous green appearance. Plants are usually glabrous (except scattered cilia on leaf margins), fruit capsule is three seeded and seed surface is shallow broadly pitted (Fig. 2). The species has been known thus far from Asiatic Turkey and Greece (Coode 1965; Greuter & Raus 1984; Babalonas 1989; Tan & Strid 2008; Raab-Straube 2018; Carrió & al. 2020). All of its European localities are confined to areas with serpentine substrates.

## Key to the Bulgarian species of *Fumana*

1. Leaves oblong-elliptic to broadly lanceolate, stipulate ..... *F. arabica*
- 1\*. Leaves linear to narrowly lanceolate, exstipulate ..... 2
2. Plants glaucous. Stems erect or ascending, glabrous. Capsule with 3 seeds ..... *F. aciphylla*
- 2\*. Plants green. Stems procumbent or ascending, pubescent. Capsule with 6–12 seeds ..... 3



Fig. 1. Habitus (a), terminal inflorescence (b) and seed capsule (c) of *Fumana bonapartei* from the Eastern Rhodopes, Bulgaria. Photos by Georgi Kunev.

- 3. Indumentum glandular. Flowers few 2–4(–7). Pedicels distinctly longer than adjoining leaves ..... *F. bonapartei*
- 3\*. Indumentum eglandular. Flowers solitary. Pedicels equal or shorter than adjoining leaves ..... *F. procumbens*

**Ecological conditions at the locality.** - In Bulgaria, *Fumana bonapartei* and *F. aciphyl-la* are found on open rocky slopes with low to moderate inclination (up to 15 °) surrounded by pine forest plantations. The serpentine outcrops cover up to 70% of the studied area. Soil layer is nearly absent or it is very shallow. The climate is hot-summer Mediterranean (Csa), with mean annual temperature 12.5 °C and precipitation maximum in December. The vegetation is composed by chamaephytes mostly, among which dominate obligate serpentinophytes such as *Convolvulus boissieri* subsp. *compactus* (Boiss.) Stace, and the recently described as new to science *Thymus jalsianus* Stoyanov & Marinov (Stoyanov



Fig. 2. Habitus (a), terminal inflorescence (b) and seed capsule (c) of *Fumana aciphylla* from the Eastern Rhodopes, Bulgaria. Photos by Georgi Kunev.

& Marinov 2020). Frequent are also *Genista anatolica* Boiss., *Fumana procumbens* (Dunal) Gren. & Godr., *Sedum ochroleucum* Chaix, *Teucrium montanum* L., *Euphorbia myrsinites* L., *Paronychia kapela* (Hacq.) A.Kern., *Cheilanthes marantae* (L.) Domin, *Plantago subulata* L., *Agropyron cristatum* subsp. *pectinatum* (M. Bieb.) Tzvelev, *Chrysopogon gryllus* (L.) Trin., *Asperula purpurea* (L.) Ehrend., *Danthonia alpina* Vest, *Linum tauricum* subsp. *bulgaricum* (Podp.) Petrova. The locality is inhabited by some local or Balkan endemics and species with restricted distribution in the country, such as *Silene fetleri* D. Pavlova, *Aethionema rhodopeum* D. Pavlova, *Saponaria stranjensis* Jordanov, *Onosma kittanae* Strid, *Verbascum humile* Janka, *Silene cretica* L., and *Trifolium globosum* L.

**Population size and structure.** - The study site is located at 41°22'47.06"N, 25°19'33.74"E, 1.5 km northwest of Zagorichane village, Kardzhali district (Fig. 3). A

total area of 37.5 ha was studied in order to evaluate the distribution, population structure and its size for each of the species. The population of *F. bonapartei* covers the whole study site (i.e. 37.5 ha), consists of about 300 individuals and has mosaic structure: individuals are sparsely distributed across the study site in groups of up to five plants, or solitary. The population of *F. aciphylla*, found at the same site, is more dense and uniform in appearance. It is composed of approximately 350 individuals within an area of 1.5 ha (Fig. 3). Given the small population size and the single known so far locality on the territory of

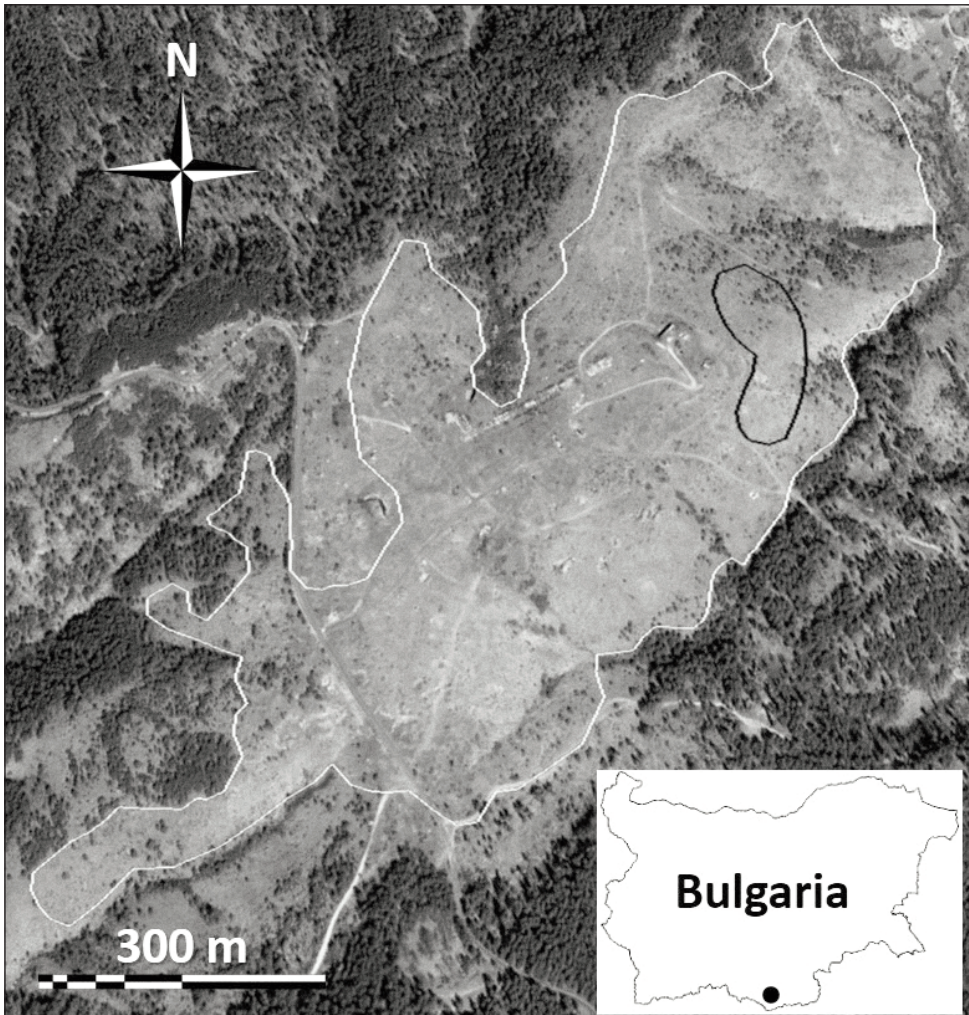


Fig. 3. Area and location of *F. bonapartei* and *F. aciphylla* in Bulgaria. The black dot in the smaller panel is the position of their first known population site in the country. In larger, ortho-photo map, the white contour delineates the population area of *F. bonapartei* (37.5 ha), whereas the area outlined in black presents the population area of *F. aciphylla* (1.5 ha).

Bulgaria, both taxa meet provisionally the national status of ‘Critically Endangered’ according to the IUCN Red List Criteria (IUCN 2012). However, serpentine sites with suitable habitat conditions for both taxa cover much larger area in Eastern Rhodopes (Kozhoukharova 1984, 1985; Pavlova & al. 2003), thus more locations of *F. bonapartei* and *F. aciphylla* could be expected in a course of future investigations.

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