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# *Current Status, Distribution and Habitat of the Threatened Species Myricaria germanica (Tamaricaceae) in Bulgaria*

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**Abstract**. The present research aims to clarify the current status and the distribution of the population and the habitat of the threatened species *Myricaria germanica* in Bulgaria. The species occurs with one location in Bulgaria in Bulgarka Natural Park in the Central Balkan range. The location is positioned at a former inert quarry along the Syvyak River. The population of *M. germanica* consists of about 30 shrubs forming riverine community with *Salix purpurea* and affiliated to artificial habitat J3.3 of the EUNIS habitat classification. The research confirms that *M. germanica* should be considered as "Crytically endangered". There is a necessity of profound and long-term future observations and researches on the reproduction and biology of the species and the dynamics of its population and habitat.

**Key words:** *Myricaria germanica*, Central Balkan range, IUCN criteria, habitat, Bulgaria.

## Introduction

The genera *Myricaria* Desv. belongs to the family *Tamaricaceae* consisting of four genera and 78 species (CHRISTENHUSZ & BYNG, 2016) distributed in Europe, Africa and Asia. In Europe this genus is represented by the species *Myricaria germanica* (L.) Desv. The area of its distribution covers the Scandinavian Peninsula, the mountains of Central and Southern Europe - from the Northern Rein and the Alps to the Eastern Carpathians and Southern Ukraine and also the Pyrenees and Southern Spain, Central Italy and the mountain regions in the western part of the Balkan Peninsula (WEBB, 1968). In the Balkan Peninsula the species has been reported for Croatia (SCHLOSSER & VUCOTINOVIC, 1869; PICHLER, 1891), Serbia (KOŠANIN, 1926; REICHINGER, 1935, JOVANOVIČ, 1972), Albania (REICHINGER, 1935; BARINA *et al.,* 2015), Macedonia (KOŠANIN, 1926; DŽEKOV, 1957; EM, 1967), Montenegro (CERNJAVSKI *et al.,* 1949, LACUŠIĆ 1961) and Slovenia (WRABER & SKOBERNE, 1989).

In Bulgaria the species was first found in Milevska Mountain (Western Bulgiaria) in 1993 at 900 m a.s.l. and later reported by GUSSEV & DIMITROV (1997). It was represented by one well-developed seed-forming individual. In May 2007 the authors of the present study established a new locality of *M. germanica* in floristic region Central Balkan range.

The present research aims to clarify the current status and distribution of the population



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and the habitat of the threatened species *M. germanica* in Bulgaria.

## Materials and Methods

The information for the distribution, chorology and habitat of the species is based on samples collected from the field, the available literature data and specimens deposited in the Herbarium of vascular plants of the Institute of Biodiversity and Ecosystem Research (IBER) at the Bulgarian Academy of Sciences (SOM) and the Herbarium of Agricultural University, Plovdiv (SOA). The voucher specimens of the new collections are deposited in both herbaria (Table 1).

The area diagnosis follows Meusel et al. (1965, 1978). The localities in Bulgaria are shown on a UTM-Grid map (scale 1: 1500000, square side 10 km). The GPS-coordinates of the locations in the Central Balkan range are visualized on an orthophoto map of the region (Fig. 1). The phytocoenological characteristic of *M. germanica* locality was made on the basis of Braun-Blanquet's relevé method (MULLER-DOMBOIS & ELLENBERG, 1974). The two neighboring locations of the species are considered different vegetation stands in which species abundances were estimated by Braun-Blanquet old 7-degree cover-abundance scale (Table 2). Geoelements for the accompanying species are determined according to ASSYOV *et al.* (2012) for revealing the origin and phytogeographycal connections of *Myricaria germanica* community. The habitat affiliation is pointed according to EUNIS habitat classification scheme (EUNIS, 2017).

## Results and Discussion

*Morphology and biology*

*Myricaria germanica* (L.) Desv. is a representative of the family *Tamaricaceae*. It is a deciduous shrub, 1 – 2.5 m high. The young twigs are green, the old ones – brown or reddish. The leaves are entire, glabrous, greyish green, 4-6 mm long, linear-lanceolate, almost scale, recumbent on the twigs, alternate, without stipules. The bracts are longer than flowers. The flowers are pink to white, sinoecious, five-lobbed with free petals, actinomorphic, and grouped in terminal spikes (Fig. 2). The anthers are 10, turned inside, with handles fused in a short tubule which is broadened in the basis and grasping the ovary; the last with sessile stigmas. The fruit is a pyramidal capsule, up to 10 mm long, opening into three lobs. The seeds are obovoid, glabrous with an awn on top and a foot-shaped pappus of hairs. The species flowers from June to August.

*Distribution and habitat*

*Myricaria germanica* is a European-West Asian mountain species (ASSYOV *et al.,* 2012) belonging to the Euro-Asian floristic element. It is distributed in the Scandinavian Peninsula, the mountains of Central and Southern Europe, and some mountain regions of the Balkan Peninsula, Crimea, Caucasus, Eastern Asia Minor and North-Western Iran (BOBROV, 1967; GUSSEV & DIMITROV, 1997; GUSSEV, 2015).

**Table 1.** Herbarium specimens of *Myricaria germanica* in the Bulgarian herbaria.

| Specimen | Collection data |
|---|---|
| SOM 152719 | Bulgaria, Znepole Region: Milevska Mts., N 42º33'19.8", E 22º32'32.0", 900 m a.s.l., gravel terrain along the road between the villages Sredorek and Dolno Kobile, on the right-side river bank terrace of a tributary of the River Treklyanska, 11 July 1993, *Leg. Ch. Gussev/Det. Ch. Gussev* |
| SOM 164409 | Bulgaria, Central Balkan range: *Shipchenska planina Ridge*, Gabrovo district near the village Potoka, N 42º46'12.9", E 25º22'00.0", 860 m, in the valley of the River Syvyak at riverside stony eroded terrains with north-west exposition; at a steep slope in an abandoned inert quarry, with flowers and fruits, 03 May 2007, *Leg. Y. Marinov/Det. Y. Marinov* |
| SOA 059278 | Bulgaria: Central Balkan range: *Shipchenska planina Ridge*, Gabrovo district, N 42º46'12.9", E 25º22'00.0" , 860 m, in the valley of the River Syvyak at riverside stony eroded terrains with north-west exposition, at a steep slope in an abandoned inert quarry, 17 July 2006, *Leg. Y. Marinov/Det. Y. Marinov* |

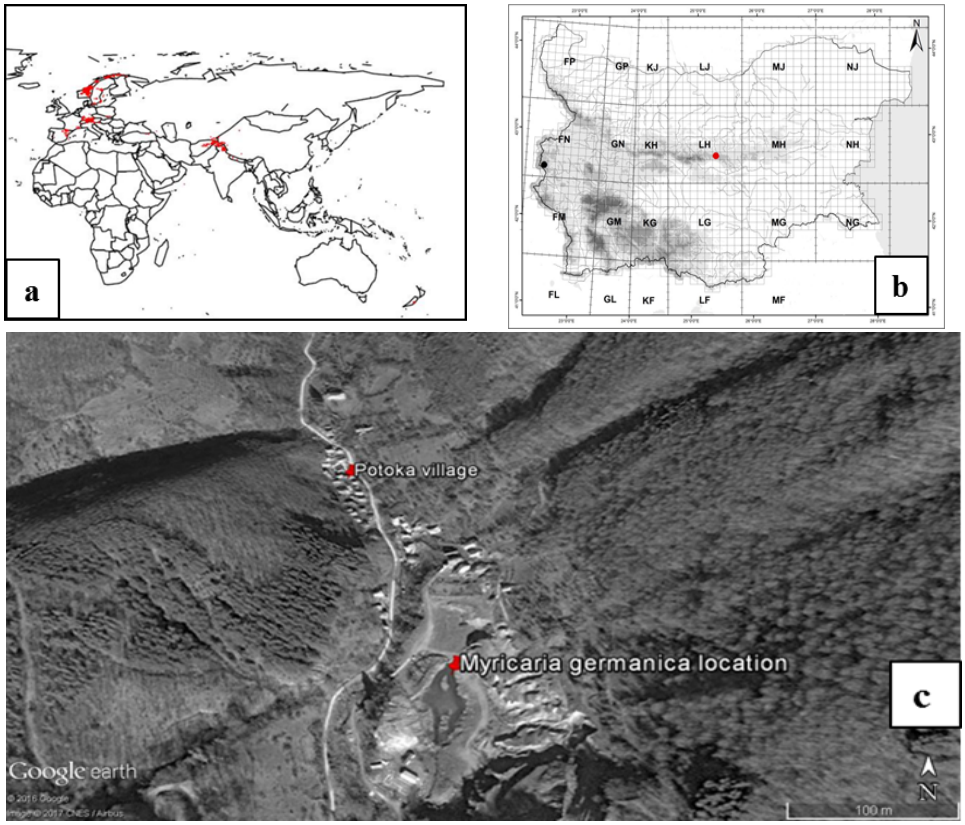


**Fig. 1.** Distribution range of *Myricaria germanica*: a) general distribution (in red); b) distribution in Bulgaria (● for extinct locality, ● for new locality); c) location of the species in Bulgarka Natural park, in the land of Potoka Village, floristic region Central Balkan range.

**Fig. 2.** *Myricaria germanica*: inflorescence (left) and individuals and habitat (right).

The species and the genera were reported for the first time in Bulgaria in 1997 for Milevska Mts – Znepole floristic region, Western Bulgaria (GUSSEV & DIMITROV, 1997). Up to this moment there were no data for the natural distribution of *Myricaria germanica* in Bulgaria or its introducing. Later on, strong successional processes in the habitat of the species in Milevska Mts. led to serious habitat alterations and during following field trips the species was not repeatedly established in the reported locality. The report of GUSSEV & DIMITROV (1997) was the motive for the inclusion of *Myricaria germanica* in the Key to the plants in Bulgaria (CHESHMEDZHIEV, 2003). In May 2007 the species was established by the authors of the present study in floristic region Central Balkan range, in the valley of the River Syvek, Gabrovo district, at the territory of Bulgarka Natural Park (V$^{th}$ category of nationally designated protected area). This locality remains the only known habitat of *M. germanica* in Bulgaria up to now.

The species was evaluated according to the criteria of the IUCN Red List Cathegories as "Critically Endangered" [CR A1ac; B1ab(i,ii,iii)+2ab(ii)]. It is included in the Red list of the Bulgarian vascular plants (PETROVA & VLADIMIROV, 2009) and in the Red Book of the Republic of Bulgaria, Vol. I under the category "Critically Endangered" (GUSSEV, 2015). *M. germanica* is a species protected by the law – it is included in the Annex III of the Biodiversity Act (2002). The location of the species in Bulgarka Natural Park was reported by APOSTOLOVA *et al.* (2012) for the Important Plant Areas project in Bulgaria.

Within the boundaries of its area of distribution *M. germanica* grows in the valleys of mountain rivers on unstable sandy and gravel deposits and on sediment soils with high level of the underground water in a diapason of (630) 1000-2350 m a.s.l. The species often plays a pioneer role in the occupation of areas disturbed by erosion processes (GUSSEV & DIMITROV, 1997). This characteristic determines the unstable and sometimes transitional character of its habitat.

The population of the species in Bulgarka Natural Park (the Central Balkan range) consists of more than 30 individual shrubs, most of them at age of about 20 years. The population develops in a *Salix purpurea* community with the participation of *Acer pseudoplatanus, Clematis vitalba, Cornus sanguinea, Euphrasia salisburgensis, Tussilago farfara*, and accompanied by several other shrubby willows - *S. caprea, S. cinerea, S. elaeagnos, S. fragilis, S. alba* (Table 2, Fig. 2). We established two neighboring localities of *M. germanica* along the River Syvyak which we considered different phytocoenological relevés. The first stand is directly near the stream and the second is slightly aside and raised above the water level with some species penetrating from the surrounding grassland habitats – *Agrostis capillaris, Calamagrostis pseudophragmites, Dactylorhiza saccifera, Epilobium hirsutum, Eupatorium cannabinum, Lythrum salicaria, Mentha longifolia, Ophrys cornuta, Spiranthes spiralis* and others. The phytogeographical spectrum of *M. germanica* communitiy (Fig. 3) shows the prevalence of geoelements of the Boreal type, totally 52% - these are Boreal, subBoreal, Euro-Sibirian, Euro-Asian and Euro-West Asian elements. The central European origin and distribution of *M. germanica* communities is confirmed by the elements of the European type – these are European, Euro-Mediterranean and Euro-Med-Central Asian geoelements (totally 16%). And the Mediterranean type consisting of Mediterranean and subMediterranean geoelements is presented by 21% totally. The phytogeographical spectrum, the species composition with predominance of *Myricaria germanica* and *Salix purpurea* and the ecological conditions– gravel substrate, high level of belowground water and lack of continuous floods, are features showing affiliation of *M. germanica* phytocoenoses to ass. *Salici-Myricarietum* Moor, 1958 and alliance *Salicion elaeagno-daphnoidis* (Moor, 1958) Grass, 1993 of class *Saliceteta purpuraeae* Moor ,1958 (TRINAJSTIČ, 1992; GUSSEV & DIMITROV, 1997; CHYTRÝ, 2013). The latter unifies willow and tamarisk scrub and wood of margins of lowland and mountain rivers of temperate to arctic zones of Europe and in Greenland (MUCINA *et al.,* 2016). Additional investigations however in similar stands of this vegetation in Bulgaria are necessary for a detailed syntaxonomical survey.

*Myricaria germanica* meso-hygrophyte communities forming riverine vegetation on gravel substrates traditionally are affiliated to habitat F9.1 Temperate and boreal riparian scrub of the EUNIS classification scheme (EUNIS, 2017. The habitat is listed in the European red list of habitats (ARONSSON, 2017) and assessed as "Least concern" at a European level and also included in Annex I of the Habitats' Directive under 3230 Alpine rivers and their ligneous vegetation with *M. germanica.* This habitat however could not be reported for Bulgaria on the basis of our research because of the highly anthropogenic origin of *M. germanica* locality (positioned at a former quarry) and the complex character of the vegetation (Table 2).

**Table 2.** Phytocoenological characteristic of the localities of *Myricaria germanica* in Central Balkan range. The abundance value for each species is pointed according to the 7-degree Braun-Blanquet scale. Some species with low score occurring in only one stand are omitted. Abbreviations: t – tree, s – shrub, h – herb.

| Geoelement | Biological type/layer | Location | 1 | 2 |
|---|---|---|---|---|
| | | GPS coordinates | | |
| | | Altitude | 691 | 695 |
| | | Aspect | NW | W |
| | | Slope (degrees) | 40 | 30 |
| | | Rocks | dolomite | dolomite |
| | | Humidity | wet | moist |
| | | Community area (m²) | 200 | 200 |
| | | Cover total (%) | 40 | 30 |
| | | ***ass. Salici-Myricarietum* Moor 1958** | | |
| Eur-WAs | s | *Myricaria germanica* Desv. | 1 | 1 |
| | | **class Saliceteta purpuraeae Moor 1958** | | |
| Eur-Med-CAs | s | *Salix purpurea* L. | 3 | 3 |
| subMed | s | *Salix elaeagnos* Scop. | + | |
| Eur-As | t+s | *Salix fragilis* L. | 1 | 1 |
| Eur-As | t+s | *Salix alba* L. | 1 | 1 |
| Eur-As | h | *Calamagrostis epigeios* (L.) Roth | + | |
| | | **Others** | | |
| subBoreal | t+s | *Salix caprea* L. | 1 | 1 |
| Eur-As | s | *Salix cinerea* L. | + | |
| Eur | | *Clematis vitalba* L. | 1 | + |
| subMed | s | *Cornus sanguinea* L. | 1 | 1 |
| Boreal | h | *Agrostis stolonifera* L. | + | + |
| Eur-As | h | *Calamagrostis pseudophragmites* (Haller f.) Koeler | + | + |
| Eur | h | *Campanula rapunculoides* L. | + | |
| Eur-As | h | *Carex distans* L. | + | + |
| Eur-As | h | *Carex divulsa* Stokes | + | |
| Kos | h | *Carex flacca* Schreber | + | |
| subMed | h | *Carex pendula* Hudson | + | + |
| Eur-Sib | h | *Chondrilla juncea* L. | + | |
| Med | h | *Cirsium creticum* (Lam.) D'Urv. | 1 | 1 |
| Eur-Sib | h | *Dactylorhiza saccifera* (Brongn.) Soó | + | + |
| Boreal | h | *Epilobium hirsutum* L. | 1 | |
| Boreal | h | *Erigeron acer* L. | + | |
| Eur-As | h | *Eupatorium cannabinum* L. | 1 | 1 |
| Boreal | h | *Juncus articulatus* L. | r | + |
| subBoreal | h | *Juncus bufonius* L. | + | |
| Eur | h | *Lysimachia nummularia* L. | 1 | 1 |
| subBoreal | h | *Lythrum salicaria* L. | 1 | 1 |
| Eur-As | h | *Melilotus officinalis* (L.) Pallas | + | + |
| Eur-Sib | h | *Mentha longifolia* (L.) Hudson | 1 | 1 |
| Kos | h | *Plantago lanceolata* L. | + | |
| Eur-Med | h | *Pulicaria dysentherica* (L.) Bernh. | 1 | |
| Eur-As | h | *Tussilago farfara* L. | 1 | 1 |

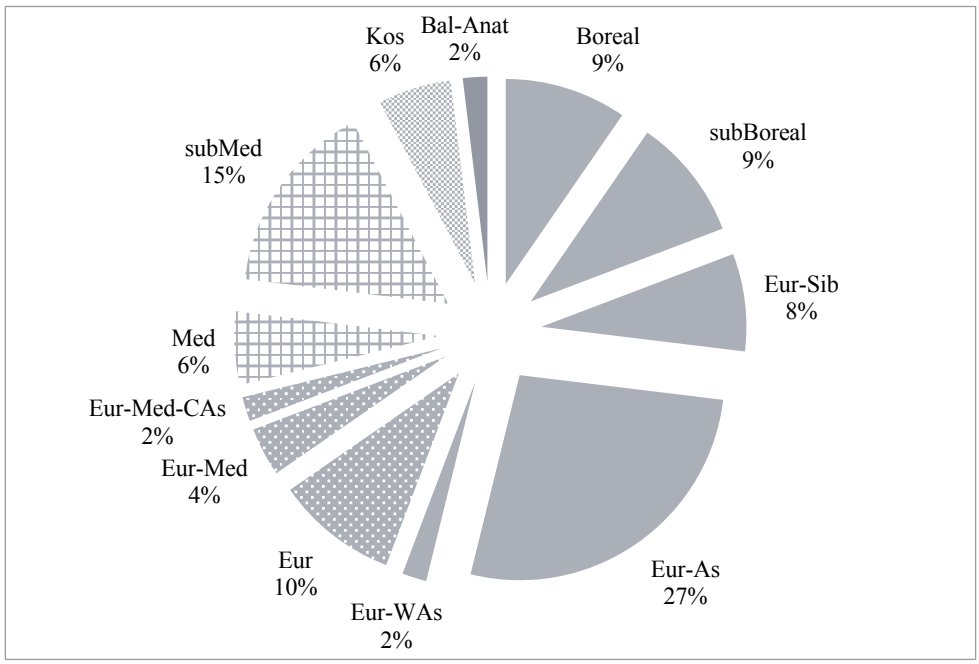


**Fig. 3**. Phytogeographical spectrum of *Myricaria germanica* community. Slices for the proportions of floristic elements of the same type (for ex. the Boreal, European, Mediterranean type) are in the same pattern of fill.

At that moment the habitat of the species could only be affiliated to J3.3 Recently abandoned above-ground spaces of extractive industrial sites of the J level of EUNIS classification designating the artificial habitats (EUNIS, 2017). The presence of species of conservation importance in *M. germanica* community despite its anthropogenic origin (*Dactylorhiza saccifera, Ophrys cornuta* and *Spiranthes spiralis)* raises the question for future monitoring and protection activities of this habitat.

**Conclusions**

The presented research confirms that *M. germanica* should be considered as "Crytically endangered". Its population occupies less than 10 km$^2$ area with only one location in Bulgaria at the territory of Bulgarka Natural Park in the Central Balkan range.

*Myricaria germanica* is a dominant species forming riverine communities with transitional and dynamic successional status determined as azonal vegetation with syntaxonomical position in *Salicion elaeagno-daphnoidis* (Moor, 1958) Grass 1993 of class *Saliceteta purpuraeae* Moor, 1958. The position of *M. germanica* population at a former quarry determines the affiliation of its habitat to level J of the EUNIS classification of artificial habitats up to the present moment. The present research confirms the assumption of GUSSEV & DIMITROV (1997) that *M. germanica* spread in Bulgaria is a result of probably natural transportation of seeds to the eastern part of the Balkan Peninsula. There is a necessity of profound and long-term observations and researches on the reproduction and biology of the species and the dynamics of its population. Future protection activities and monitoring over the status and distribution of its habitat are recommended in terms of the ecological importance of *M. germanica* as a pioneer having the capacity to colonize new deposits of gravels and set up new biocoenoses (DANCI *et al.,* 2014) not only in the case of natural morphodynamics of mountain streams but also in abandoned and anthropogenically influenced riverside territories.

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