A new natural locality of *Inula spiraeifolia* (*Asteraceae*) in Southwest Bulgaria

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Abstract. A new locality of the rare and endangered species *Inula spiraeifolia* L. (*Asteraceae*) is reported, which confirms the species occurrence in Bulgaria. The locality is situated in the Valley of River Struma, about 6 km northwards from Kresna, at 210–230 m a.s.l. The species occurs in a shrubland habitat and is represented by 30–40 individuals dispersed unevenly across a relatively small area of 0.1 ha. The habitat is dominated by small trees and shrubs and has a relatively rich species composition, with predominance of sub-Mediterranean floristic elements. A concise description of the locality is presented and the need in conservation activities is discussed, including *in situ* measures consisting of monitoring, and *ex situ* measures comprising storage of seeds in a gene bank and establishment of at least one *ex situ* collection within the framework of a research project.

Key words: Bulgarian flora, *Compositae*, conservation, endangered plants, new plant records

Introduction

Genus *Inula* L. (*Asteraceae*) is represented in the Bulgarian flora by 10 to 12 species. Assyov & Petrova (2012) included 12 species, while Kuzmanov (2012) listed 10 numbered species. He left two species – *I. spiraeifolia* L. and *I. thapsoides* Spreng. – unnumbered, due to the lack of evidence on their occurrence in Bulgaria.

The natural range of *I. spiraeifolia* includes the Mediterranean region, spanning from South France to Turkey, including the Balkan Peninsula, and northwards to Hungary and Switzerland. The species presence is questionable in Spain and Romania (Greuter 2006+).

Inula spiraeifolia is the only Bulgarian species of the genus considered important from a conservation viewpoint. It is listed in the two editions of the *Red Data Book of Bulgaria* (Ganchev 1984; Vladimirov 2015) and the *Red List of Bulgarian Vascular Plants* (Vladimirov 2009), and is protected by the Biodiversity Act (Anonymous 2002). Even though its putative occurrence in the Bulgarian flora includes three floristic regions (Assyov & Petrova 2012), all localities are considered doubtful and need confirmation (Vladimirov 2015).

Vladimirov (2015) pointed out that information about the species' occurrence in Bulgaria lists the following floristic regions: Black Sea Coast (*Northern*), Forebalkan and Valley of River Struma (*Southern*), and the vicinity of Levunovo village (all localities not verified). Assyov & Petrova (2012) reported that in Southwest Bulgaria the species occurs in the floristic region of West Frontier Mountains, but not in

the Valley of River Struma. There are only two specimens in the herbarium collections in Bulgaria: one from the Northern Black Sea Coast (SOM 77306, leg. K. Engelhardt) and one from the West Frontier Mountains (SOM 165765, leg. D. Dimitrov).

In this paper, we report a new locality of the species in Southwest Bulgaria, in the floristic region of the Valley of River Struma.

Material and methods

Field studies were carried out in July 2018. The groups and individuals of *I. spiraeifolia* were documented after a thorough inventory of the location. All plant species were recorded and identified according to Delipavlov & Cheshemdzhiev (2003). Specimens of the target species (*I. spiraeifolia*) were deposited in the Herbarium Collection of the Institute of Biodiversity and Ecosystem Research (IBER) of the Bulgarian Academy of Sciences (SOM). The analysis of floristic elements followed Walter (1970; modified by Assyov & Petrova 2012).

Results and discussion

Inula spiraeifolia has been found in the Valley of River Struma, about 6 km northwards from Kresna, at 210–230 m a.s.l., FM72, 41°45'37"N, 23°09'15"E, 13.08.2018, coll. *I. Aneva* & *P. Zhelev* (SOM 176695, 176696) (Fig. 1).

The size of locality was approximately 50 × 20 m, with about 30–40 individuals scattered across the area and growing in stony and sandy spots, usually with a scarce plant cover. There were also some small (~20 m^2) isolated spots at a distance of 300 m. Some other groups of individuals could be possibly found after a thorough inventory of the region and the information about the population size could be corrected.

The population of *I. spiraeifolia* was situated in the lowest part of the slope. However, the river was too remote and practically did not affect the soil humidity. The microhabitat where *I. spiraeifolia* occured was with northern exposition, a more important circumstance for maintaining the soil humidity than the river proximity.

Part of the habitat was of anthropogenic origin: an embankment after tunneling the slope for a railway track. Because the railway construction works took place in 1940–1965, and the tunneling in particular in 1943 (Simeonov & al. 1987; Deyanov 2005), it could be assumed that there was sufficient time for the plants to colonize the embankment. The conditions could have encouraged particularly a plant species with limited competition abilities, including anthropophytes.

The locality was situated in a shrubland habitat dominated by small trees and shrubs. The total plant cover was about 50 %. Although it was difficult to outline a dominating species in the tree and shrub layer, the most frequent ones were *Ostrya carpinifolia* Scop., *Pistacia terebinthus* L. and *Fraxinus ornus* L. Other small to medium-sized trees and shrubs were *Celtis australis* L., *Ulmus minor* Mill., *Carpinus orientalis* Mill., and *Prunus mahaleb* L. Gymnosperms were represented by *Juniperus excelsa* M. Bieb. and *J. deltoides* R.P. Adams, occurring as single individuals. Other small trees and shrubs recorded in the locality were: *Asparagus acutifolius* L., *Chamaecytisus supinus* (L.) Link., *Clematis vitalba* L., *Cornus mas* L., *Coronilla emerus* L., *Ficus carica* L., *Hedera helix* L., *Jasminum fruticans* L., *Paliurus spina-christi* Mill., *Prunus spi-*

Fig. 1. *Inula spiraeifolia* in its natural locality (photos: Ina Aneva).

nosa L., *Pyrus amygdaliformis* Vill., *Pyrus pyraster* Burgsd., and *Rosa canina* L.

Floristic composition of the microhabitat was more or less typical of the region, albeit with presence of some more trivial plants, including anthropophytes. Besides *I. spiraeifoia*, the herbaceous layer was represented by small groups or single individuals of the following species (in alphabetical order): *Achillea clypeolata* Sm., *Achnatherum bromoides* (L.) P. Beauv., *Asplenium trichomanes* L., *Amaranthus retroflexus* L., *Aurinia saxatilis* (L.) Desv., *Berteroa incana* (L.) DC., *Bromus squarrosus* L., *Calamintha nepeta* (L.) Savi, *Centaurea solstitialis* L., *C. stoebe* L., *Ceterach officinarum* DC., *Chenopodium album* L., *Chondrilla juncea* L., *Cichorium intybus* L., *Clinopodium vulgare* L., *Clypeola jonthlaspi* L., *Cynosurus echinatus* L., *Dactylis glomerata* L., *Dianthus armeria* L., *Dichanthium ischaemum* (L.) Roberty, *Erodium cicutarium* (L.) L'Hér., *Eryngium campestre* L., *Euphorbia cyparissias* L., *E. maculata* L., *E. myrsinites* L., *Festuca valesiaca* Gaudin, *Galium divaricatum* Lam., *Gypsophila muralis* L., *Herniaria incana* Lam., *Hypericum perforatum* L., *Marrubium peregrinum* L., *Odontites serotina* (Lam.) Dumort., *Plumbago europaea* L., *Poa annua* L., *Polygonum aviculare* L., *Portulaca oleracea* L., *Scleranthus annuus* L., *Sedum album* L., *S. anopetalum* DC., *S. caespitosum* (Cav.) DC., *Sempervivum marmoreum* Griseb., *Setaria viridis* (L.) P. Beauv., *Solanum nigrum* L., *Teucrium chamaedrys* L., *T. polium* L., *Thymus callieri* Velen., *Tribulus terrestris* L., *Umbilicus rupestris* (Salisb.) Dandy, *Vincetoxicum hirundinaria* Medicus, and *Viola suavis* M. Bieb. Similarly to trees and shrubs, no clearly dominating species could be distinguished. Some more noticeable groups were formed by *Achnatherum bromoides*, *Dactylis glomerata* and *Plumbago europaea*, while the other species occurred singly or with few individuals.

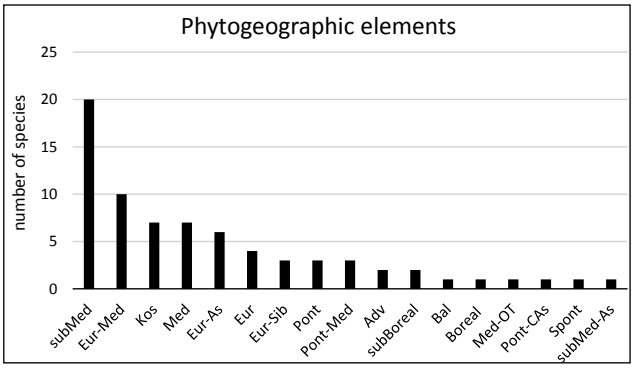

Fig. 2. Floristic elements in the locality of *I. spiraeifolia.*

The 73 species recorded in the survey included 12 trees, 10 shrubs, 19 annual and 32 perennial herbaceous species. Analysis of the floristic elements revealed that Mediterranean component dominated the origin of recorded species (Fig. 2). Most numerous were the sub-Mediterranean floristic elements (20 species, or 27 %). Altogether, there were 42 species with a Mediterranean component (Med + Med-OT + subMed + Eur-Med + Pont-Med + subMed-As), which actually characterizes the flora in the locality. The European and Eurasian elements were represented by 10 species (14 %), and Cosmopolites and Adventive species numbered 12 (14 %). The latter group reflected the anthropogenic impact on the locality.

Since the inventory was made in summer, the floristic list was incomplete, missing some of the short-lived spring annuals and bulbous plants. However, the objective of the present study was not to explore the flora of the locality, which is more or less well known, but to characterize and focus attention on the new locality of an endangered species, which needs conservation measures.

The species is included in the *Red List of the Bulgarian Vascular Plants* (Vladimirov 2009) in the category Endangered and, according to IUCN hierarchical numbering system of criteria, its national conservation status is indicated as EN B2ab(ii,iii). It is protected under the Biodiversity Act of Bulgaria (Anonymous 2002). Practical conservation efforts should encompass the following:

– *In situ* conservation measures

In the newly discovered locality, the species did not seem threatened by any important environmental and/or anthropogenic factors. The locality belonged to the forest fund, unsuitable and not used for livestock grazing. The nearby dirt road seemed seldom used by people. The only hypothetic threat could come from forest fires, especially bearing in mind the adjacent railway. Therefore, *in situ* measures could consist of monitoring and, if necessary, declaring some kind of protection for the locality.

– *Ex situ* conservation measures

Besides collection and deposition of seeds in the National Seed Genebank in Sadovo, which is a very essential measure, the authors recommend creation of an *ex situ* collection from seeds collected at the natural locality. Such collection, in case of necessity, could also serve as a source of material for re-introduction in the natural habitat.

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