

NEW DATA ABOUT *FRITILLARIA MELEAGROIDES* IN ROMANIA

Culiță SÎRBU^{1*}, Adrian OPREA², Mykyta PEREGRYM³

¹ University of Agricultural Sciences and Veterinary Medicine “Ion Ionescu de la Brad”,
Faculty of Agriculture, 700487, Iași – Romania

² University “Alexandru Ioan Cuza”, Botanical Garden “Anastasiu Fătu”, 700487, Iași – Romania

³ Eszterházy Károly University, Leányka Str., 6-8, Eger, 3300 – Hungary

* Corresponding author. E-mail:culita69@yahoo.com

Abstract: *Fritillaria meleagroides*, a rare species recently registered in the Romania's vascular flora, has been identified in two other new localities from the north-eastern part of the country. The average density of reproductive individuals of *F. meleagroides* in the area of Cotu Morii has been estimated at 3.7 individuals per m². The paper reveals the structure and some ecological peculiarities of plant communities in which *F. meleagroides* grows at Cotu Morii (Iași county), and Ștefănești (Botoșani county). The protection of this species in Romania by declaring a natural reserve at Cotu Morii (Iași county) is supported in the paper. At Cotu Morii, besides *F. meleagroides*, other rare and threatened plant species have been identified, including *Bulbocodium versicolor*, which is reported here for the first time from the Iași county.

Key words: Jijia and Bașeu river basins, Liliaceae, plant communities, population density, salty meadows, vascular flora.

Introduction

In our previous paper [OPREA & al. 2015], we reported for the first time in the vascular flora of Romania the species *Fritillaria meleagroides* Patrin ex Schult. & Schult. f. (Liliaceae), identified in the northern part of the Cotu Morii village (Popricani commune, Iași county). This place is located at the western limit of natural area of *F. meleagroides*, which stretches from the North-West China and Central Asia to the Eastern Europe (European Russia, Ukraine and Bulgaria) [CHEN & MORDAK, 2000; KOROTCHENKO & ORLOV, 2009; LOZINA-LOZINSKAYA, 1935; YANEV, 1964].

Since *F. meleagroides* is an endangered species in a large part of its natural range, including eastern Europe [IVANOVA, 2015; KOROTCHENKO & ORLOV, 2009; PETROVA & VLADIMIROV, 2009], we expressed the view that urgent actions to protect its populations from Romania should be introduced [OPREA & al. 2015].

Some preliminary data on the habitat and plant communities which host *F. meleagroides* in north-eastern Romania were previously presented by us [OPREA & al. 2015].

The present study is a continuation of our previous work and was undertaken to obtain additional information on the population structure, ecology and phytosociology of this rare species, in order to support its *in situ* conservation.

Another aim of this paper is to report *F. meleagroides* from other new localities in North-Eastern Romania, not mentioned in our previous paper, or by other authors until now (although we have some reason to assume that the species has been met in at least one of those new localities some decades ago, but its presence has been overlooked, due to possible confusion with a much better known species *F. meleagris*).

Material and methods

Floristic research was performed on the itinerary, during our field work (April 2016, 2019), in the North-East Romania. Specimens collected on the field were deposited in the herbarium of the University of Agricultural Sciences and Veterinary Medicine (IASI) in Iași. The geographic coordinates were recorded using an eTrex Legend HCx GPS system.

To estimate population size and density of *F. meleagroides*, a survey was performed in April 2016, in the Northern part of the Cotu Morii village (Popricani commune, Iași county), in the same area described in our previous work [OPREA & al. 2015]. The sampling area covers approx. 63 ha (excluding the plowed lands and abandoned crops). This territory was divided on map into squares of 100×100 m, and sampling plots of 2×2 m were established in the center of each 100×100 square, in which individuals of *F. meleagroides* were counted. The population density was afterwards expressed as number of individuals per square meter. Only reproductive individuals (at the flowering stage) were considered.

Phytosociological survey was made in April 2016, according to the standard Central European phytosociological methodology [BORZA & BOȘCAIU, 1965; BRAUN-BLANQUET, 1964; CRISTEA & al. 2004].

The nomenclature of the plant taxa follows SÂRBU & al. (2013).

Results and discussion



Figure 1. *Fritillaria meleagroides*, North of the Ștefănești town, Botoșani county

a) New localities with *Fritillaria meleagroides* in North-Eastern Romania

On April, the 10th, 2016, we identified *F. meleagroides* (Figure 1) in a new locality, in North-Eastern part of Romania (at a distance of approx. 80 Km, North – Northwest to the first reported locality), namely North of the Ștefănești town, Botoșani county (N47°48'24.50", E27°11'39.60"; alt. 62 m; N47°48'22.59", E27°11'44.12"; alt. 62.5 m), on the hay meadow from the right side of the Bașeu river and the left side of the road between the Ștefănești town and Stâncă village (Figure 2). This population was not very rich, consisting of several hundred individuals scattered on the river meadow. Upstream, toward the Murguța village, the meadow is grazed by sheep and no individual of *F. meleagroides* was found on the grazed area. The habitat of the species in the new place is very similar to that from the Cotu Morii village (Iași county) [OPREA & al. 2015],

namely a river meadow with a vegetation specific to the order *Potentillo-Polygonetalia* R. Tx. 1947 (see below a more detailed description of plant communities), on soils which, according to VASILINIUC & SECU (2007), are represented by fluvisols in association with gleysols, more or less salinized.

In addition, recent investigations on the field (April, the 12th, 2019), carried out first by the second author, at the suggestion of Mr. G. Davideanu, from the Museum of Natural Sciences in Iași (to whom we are very grateful), led us to identify a new, very rich population of *F. melagroides* between Larga Jijia, Mihail Kogălniceanu and Țigănași villages, Iași county, on the Jijia river meadow (N47°19'35.20", E27°25'55.17"; N47°19'39.71", E27°25'55.14"; N47°19'35.25", E27°25'53.68). This place is not far away from Cotu Morii (approx. 10 Km to the West, following the course of the Jijia River) (Figure 3, Figure 4).

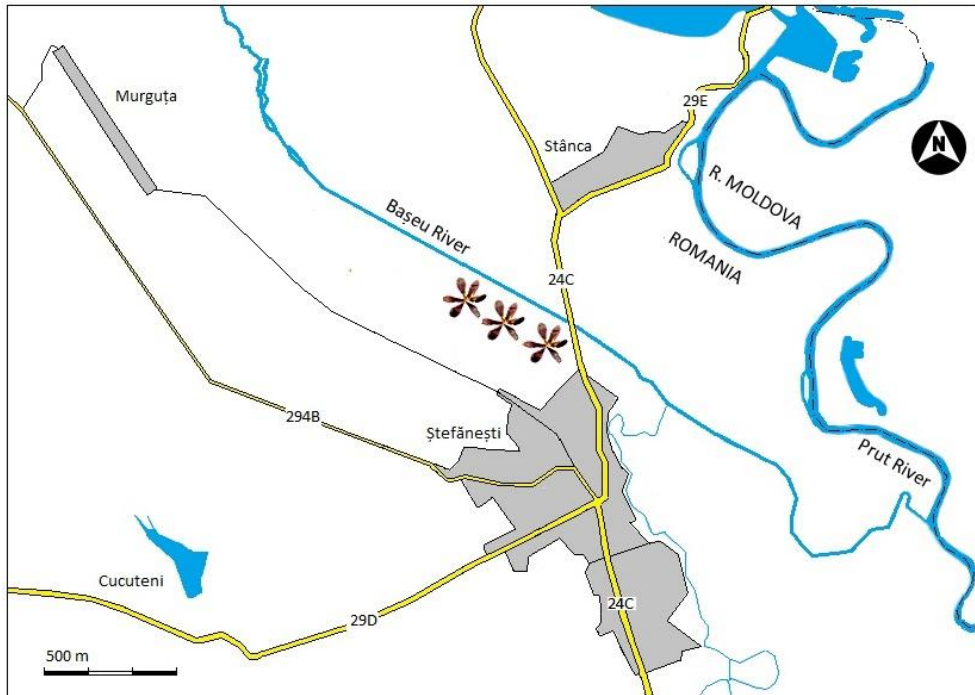


Figure 2. Location of *Fritillaria meleagroides* in the surroundings of Ștefănești town, Botoșani county, on the lower meadow of the Bașeu River

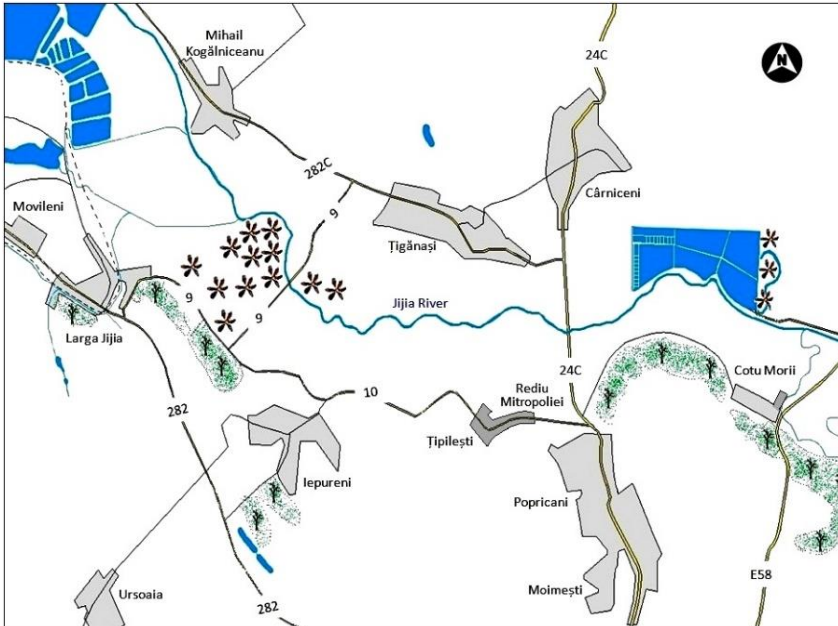


Figure 3. Location of *Fritillaria meleagroides* on the lower meadow of the Jijia River, Iași county. Both the previously known population (on the right), and the recently discovered one (on the left) are marked on the map



Figure 4. Population of *Fritillaria meleagroides* between the Țigănași, Larga Jijia and M. Kogălniceanu villages (Iași county)

b) An estimation of the population density (at Cotu Morii, Iași county)

According to our current data, *F. meleagroides* has very rich populations in Cotu Morii, far exceeding our previous estimate [OPREA & al. 2015]. The number of reproductive individuals of *F. meleagroides* in the sampling area at Cotu Morii (Iași county) varied widely among sample plots, from 0 to 16.25 per m², with a mean (\pm standard deviation) of 3.78 ± 3.73 per m². In 93.6% of the sample plots, *F. meleagroides* was represented by at least one reproductive individual. The distribution of the mean number of reproductive individuals per m² in the study area is shown in Figure 5.

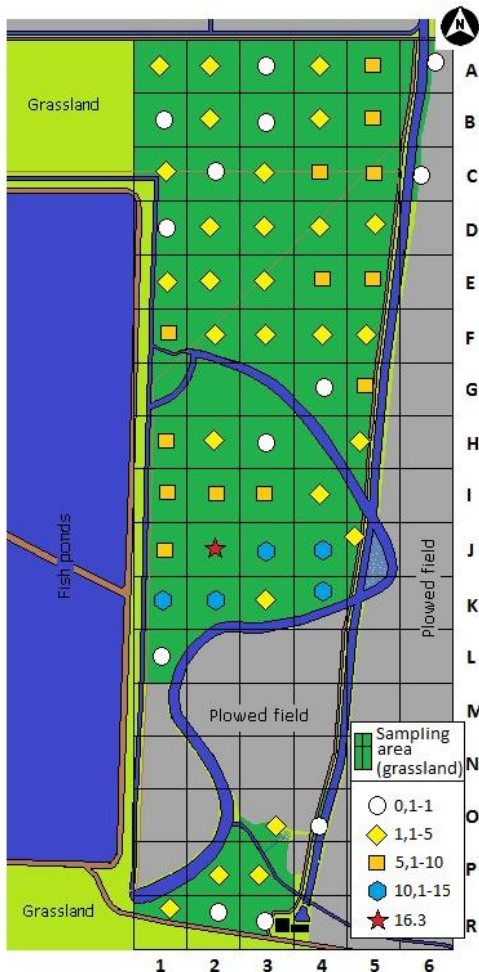


Figure 5. Sampling area to estimate the number of reproductive individuals of *Fritillaria meleagroides* at Cotu Morii (Iași county)

The number of individuals was smaller in the peripheral areas of the studied territory. In the more humid places, usually invaded by *Phragmites australis* (e.g., G1-G3, H4, Figure 5), either no individual was recorded, or those were very rare. Rare, solitary individuals have also been found on plowed fields, in abandoned arable areas, or on the edges of the channels, but in those places we did not made any registrations.

According to the literature, in the related species *F. meleagris*, the ratio between the reproductive (flowering) and vegetative (juvenile, subadults) individuals vary considerably, depending on the site, between 0.056 and 0.128 [CSERGŐ & FRINK, 2003] or between 0.016 and 0.667 [ZHANG, 1983]. As mentioned above, in our survey on *F. meleagroides* population at Cotu Morii, only individuals in the reproductive stage were registered, but it would be expected this ratio to vary greatly in this species, too.

c) Phytosociological data, with some historical considerations

According to our field data, both at Cotu Morii, in the lower basin of the Jijia river (Iași county), and to the North of Ștefănești town, in the basin of Bașeu river (Botoșani county), *F. meleagroides* enters into the structure of the association *Rorippo austriacae-Agropyretum repentis* [Timár, 1947] R. Tx. 1950, alliance *Potentillion anserinae*

R. Tx. 1947, order *Potentillo-Polygonetalia* R. Tx. 1947, class *Molinio-Arrhenatheretea* R. Tx. 1937 (Table 1).

NEW DATA ABOUT *FRITILLARIA MELEAGROIDES* IN ROMANIA

The association *Rorippa austriacae-Agroropyretum repentis* has been previously cited (by a single relevé) from Cotu Morii (Iași county) by CHIFU & al. (1998), along with two other plant communities, all from the same alliance (*Potentillion anserinae*), namely: *Rumici crispi-Agrostietum stoloniferae* Moor 1958 (one relevé) and *Dactylido-Festucetum arundinaceae* Tx. 1950 (two relevés). However, no species of *Fritillaria* was listed in any of the phytocoenoses reported by the above mentioned authors.

Table 1. Species composition of the plant communities with *Fritillaria meleagroides* (association *Rorippa austriacae-Agroropyretum repentis* (Timár 1947) R. Tx. 1950)

Date and place of relevés:	rel. 1-6: 05.apr.2016, Cotu Morii, Iași county						rel. 7-12: 11.apr.2016, Ștefănești, Botoșani county						K
	100	100	100	100	100	100	100	100	100	100	100	100	
Relevé area (m ²)	90	100	100	95	100	100	100	100	100	95	95	100	
General coverage (%)	1	2	3	4	5	6	7	8	9	10	11	12	
Relevé no.	35	34	34	43	33	33	18	28	30	27	26	27	
Number of species	1	1	+	1	+	+	+	+	+	+	+	+	V
Fritillaria meleagroides													
Charact. association													
Elymus repens ssp. repens	3	4	4	4	4	4	5	5	4	4	3	3	V
Rorippa austriaca	.	+	.	+	.	.	.	.	.	.	+	+	II
Potentillion anserinae & Potentillo-Polygonetalia													
Oenanthe silaifolia	+	+	.	+	+	.	+	+	.	+	.	+	IV
Rumex crispus	.	+	+	+	+	+	+	+	+	+	.	+	IV
Serratula coronata	+	1	1	+	1	+	.	.	.	.	.	.	III
Silaum silaus	+	.	.	+	+	+	.	.	.	+	+	.	III
Carex melanostachya	1	.	+	+	+	+	.	+	.	.	.	.	III
Rorippa sylvestris ssp. sylvestris	.	+	.	+	.	.	+	.	+	+	+	+	III
Potentilla reptans	.	+	.	.	+	.	.	.	+	1	+	c	III
Bromus commutatus	.	.	+	+	.	.	.	+	+	+	.	+	III
Agrostis stolonifera ssp. stolonifera	1	.	+	+	.	+	.	.	.	.	.	.	II
Inula britannica	.	.	.	.	.	+	.	+	.	.	.	.	I
Rumex confertus	+	.	.	.	.	.	.	.	.	+	.	.	I
Lythrum virgatum	+	.	.	.	.	.	.	.	.	.	.	.	I
Carex hirta	+	.	.	.	.	.	.	.	.	.	.	.	I
Ranunculus repens	.	+	.	.	.	.	.	.	.	.	.	.	I
Plantago major ssp. major	.	.	+	.	.	.	.	.	.	.	+	.	I
Scutellaria hastifolia	.	.	.	.	+	+	.	.	.	.	.	.	I
Potentilla anserina ssp. anserina	.	.	.	.	+	+	.	.	.	.	.	.	I
Juncus compressus	.	.	.	.	.	.	.	.	.	+	.	.	I
Trifolium hybridum ssp. elegans	.	.	.	.	.	.	.	.	.	.	+	.	I
Molinio-Arrhenatheretea													
Alopecurus pratensis ssp. pratensis	2	2	2	1	2	2	1	+	2	.	3	3	V
Poa pratensis ssp. pratensis	.	+	+	1	+	+	+	+	1	1	1	+	V
Taraxacum officinale	.	.	.	.	.	.	+	+	+	+	+	.	III
Vicia cracca	.	.	.	.	.	.	.	+	+	+	+	+	III
Lotus corniculatus	+	.	.	.	.	.	.	.	.	.	+	+	II
Plantago lanceolata ssp. lanceolata	.	.	.	+	.	.	.	+	+	.	+	.	II
Symphytum officinale ssp. officinale	.	.	.	+	+	+	.	.	.	.	.	.	II
Rhinanthus rumelicus	.	.	.	.	.	.	.	+	+	.	.	+	II
Lathyrus pratensis	.	+	.	.	.	.	.	.	.	.	.	.	I

Dactylis glomerata ssp. glomerata	.	.	.	.	+	.	.	.	.	.	.	.	I
Thalictrum lucidum	.	.	.	.	.	+	.	.	.	.	.	.	I
Achillea millefolium ssp. millefolium	.	.	.	.	.	.	+	.	.	.	.	+	I
Trifolium repens ssp. repens	.	.	.	.	.	.	.	.	.	+	.	+	I
Stellaria graminea	.	.	.	.	.	.	.	.	.	.	+	.	I
Trifolium pratense ssp. pratense	.	.	.	.	.	.	.	.	.	.	.	+	I
Phragmitetea													
Carex acutiformis	+	.	.	+	.	.	.	.	.	.	.	.	I
Iris pseudacorus	+	.	.	.	.	.	.	.	.	.	.	.	I
Lythrum salicaria	+	.	.	.	.	.	.	.	.	.	.	.	I
Phragmites australis ssp. australis	+	.	.	+	.	+	.	.	.	+	.	.	I
Galium palustre ssp. palustre	.	.	.	.	.	+	.	.	.	.	.	.	I
Carex vulpina	.	.	.	.	.	.	+	.	.	.	.	.	I
Eleocharis palustris ssp. palustris	.	.	.	.	.	.	.	.	.	.	.	+	I
Festuco-Puccinellietea													
Scorzonera cana	+	.	+	+	+	.	.	+	+	1	+	+	IV
Limonium gmelinii	+	+	+	+	+	+	.	.	.	.	.	.	III
Iris halophila	1	+	+	+	+	+	.	.	.	.	.	.	III
Cerastium dubium	.	+	+	+	.	.	+	.	+	.	.	+	III
Beckmannia eruciformis	+	.	.	.	.	.	+	.	.	.	.	+	II
Rhaponcticum serratuloides	.	+	+	.	+	.	.	.	.	.	.	.	II
Dianthus pratensis ssp. racovitzae	.	+	+	.	.	+	.	.	.	.	.	.	II
Ranunculus sardous	.	.	.	.	.	.	.	.	+	.	+	+	II
Juncus gerardii	+	.	.	.	.	.	.	.	.	+	.	.	I
Peucedanum latifolium	.	.	.	+	.	+	.	.	.	.	.	.	I
Ranunculus pedatus	.	.	.	+	.	.	.	.	.	.	.	.	I
Iris brandzae	.	.	.	+	.	.	.	.	.	.	.	.	I
Carex distans	.	.	.	.	.	+	.	.	.	.	.	.	I
Rorippa sylvestris ssp. kernerii	.	.	.	.	.	+	.	.	.	.	.	.	I
Trifolium fragiferum ssp. fragiferum	.	.	.	.	.	+	.	.	.	.	.	.	I
Lotus tenuis	.	.	.	.	.	.	.	+	.	.	.	.	I
Matricaria chamomilla	.	.	.	.	.	.	.	.	+	.	.	.	I
Puccinellia distans ssp. limosa	.	.	.	.	.	.	.	.	.	+	.	.	I
Festuco-Brometea													
Galium verum	+	+	+	+	+	+	.	+	.	+	+	.	IV
Achillea setacea	+	+	+	+	+	+	.	+	+	.	+	.	IV
Filipendula vulgaris	+	+	+	+	+	+	.	.	.	.	.	.	III
Carex praecox ssp. praecox	.	+	+	+	.	.	+	.	1	1	+	.	III
Fragaria viridis ssp. viridis	+	.	.	.	.	.	.	.	.	.	.	.	I
Medicago falcata	.	.	.	.	+	.	.	.	.	.	.	.	I
Arenaria serpyllifolia	.	.	.	.	.	.	.	.	+	.	.	.	I
Festuca valesiaca	.	.	.	.	.	.	.	.	+	.	.	.	I
Artemisietea vulgaris													
Euphorbia virgata ssp. virgata	.	+	+	+	+	+	.	.	.	.	.	.	III
Cardaria draba	.	.	+	.	.	.	.	+	+	+	+	.	III
Cichorium intybus	.	.	.	.	+	.	.	+	.	.	+	.	II
Picris hieracioides ssp. hieracioides	.	.	+	.	+	.	.	.	.	.	.	.	I
Salvia nemorosa ssp. nemorosa	.	.	.	+	.	+	.	.	.	.	.	.	I
Daucus carota ssp. carota	.	.	.	.	+	.	.	.	.	.	.	.	I

NEW DATA ABOUT *FRITILLARIA MELEAGROIDES* IN ROMANIA

<i>Convolvulus arvensis</i>	.	.	.	.	.	.	.	+	+	.	.	.	I
<i>Crepis setosa</i>	.	.	.	.	.	.	.	+	.	.	.	.	I
<i>Medicago lupulina</i>	.	.	.	.	.	.	.	.	.	.	+	.	I
Stellarietea mediae													
<i>Lathyrus hirsutus</i>	+	+	+	+	+	+	+	+	+	+	.	.	V
<i>Vicia tetrasperma</i>	+	+	+	.	.	+	+	+	+	+	+	+	V
<i>Trigonella caerulea</i>	+	+	.	+	+	.	+	1	+	1	.	+	IV
<i>Vicia sativa</i> ssp. <i>sativa</i>	+	.	+	+	+	.	+	.	+	+	+	+	IV
<i>Cirsium arvense</i>	+	+	+	+	+	+	.	.	.	.	.	.	III
<i>Lathyrus tuberosus</i>	+	+	.	+	+	+	.	.	+	.	.	.	III
<i>Vicia pannonica</i> ssp. <i>pannonica</i>	+	+	+	+	+	.	.	.	+	.	.	.	III
<i>Vicia hirsuta</i>	.	+	+	+	.	.	.	.	+	+	.	.	III
<i>Veronica arvensis</i>	.	.	+	.	.	.	.	+	+	.	+	.	II
<i>Allium rotundum</i> ssp. <i>rotundum</i>	.	.	+	.	+	.	.	+	.	.	.	.	II
<i>Vicia villosa</i>	.	.	.	+	.	.	+	.	.	.	.	+	II
<i>Capsella bursa-pastoris</i>	.	+	.	.	.	.	.	.	.	.	.	+	I
<i>Tripleurospermum inodorum</i>	.	+	.	.	.	.	.	.	.	.	.	.	I
<i>Lathyrus nissolia</i> ssp. <i>nissolia</i>	.	.	.	+	.	.	.	.	.	.	.	.	I
<i>Lactuca serriola</i>	.	.	.	+	.	.	.	.	.	.	.	.	I
<i>Erysimum repandum</i>	.	.	.	.	.	.	.	.	.	.	+	+	I
Variae													
<i>Allium scorodoprasum</i>	+	+	+	+	+	+	.	+	+	+	.	.	IV
<i>Trifolium campestre</i>	+	+	+	+	+	.	+	+	.	+	.	+	IV
<i>Asparagus officinalis</i> ssp. <i>officinalis</i>	+	+	+	+	+	+	.	.	.	.	.	.	III
<i>Galium rubioides</i> ssp. <i>rubioides</i>	+	+	.	.	.	+	.	.	.	.	.	.	II
<i>Bulbocodium versicolor</i>	.	.	+	.	.	.	.	.	.	.	.	.	I
<i>Myosotis arvensis</i> ssp. <i>arvensis</i>	.	.	.	+	.	.	.	.	.	.	.	.	I
<i>Ranunculus polyanthemus</i> ssp. <i>polyanthemoides</i>	.	.	.	.	.	+	.	+	.	.	.	.	I

Previously, a rather extensive description of the grasslands in the lower basin of the Jijia river was published by RĂVĂRUȚ & al. (1968). The association “*Agropyretum repentis*” was marked on a map, north of Victoria village (not very far from Cotu Morii village), but within its plant structure (and to all other plant communities described by the cited authors in the lower basin of Jijia river) no species of *Fritillaria* was recorded.

On the other hand, the Basin of Bașeu River has been extensively studied from botanic point of view by Professor Gh. MIHAI, in the past. In his PhD thesis [MIHAI, 1969], as well as in a subsequent paper [MIHAI, 1971a], he reported from the Bașeu river basin, among other rare plants, *F. meleagris* L. from Ștefănești, “on salty marshy meadows”. The same author [MIHAI, 1971b] reported *F. meleagris* (AD +), in a phytocoenosis of the association *Alopecuretum pratensis* Nowinski 1928, subassociation *poëtosum pratensis* Soó 1957 (although *Poa pratensis* was missing there), classified in the alliance “*Agrostion albae* Soó 1957” – a name currently [COLDEA, 2012] considered as a synonym for the alliance *Deschampsion caespitosae* Horvatić 1930. This phytocenosis, including some facultative or obligate halophytes (e.g. *Beckmannia eruciformis*, *Ranunculus sardous*, *Rorippa sylvestris* ssp. *kernerii*, *Juncus gerardii*, *Limonium gmelinii*), was recorded on a strongly grazed meadow in the surroundings of the Murguța village, approx. 5 Km upstream of Ștefănești town (see map in Figure 1), on salty soils (solonetz), with pH=8 (according to the cited author). As a matter of fact, according to recent literature [COLDEA, 2012], those stational conditions are not suitable

for the alliance *Deschampsion caespitosae* Horvatić 1930 (syn.: *Agrostion albae* Soó 1957; *Agrostion stoloniferae* Soó (1943) 1971), but for alliance *Potentillion anserinae* R. Tx. 1947 (syn. *Agrostion stoloniferae* Görs 1966 in Oberd. & al. 1967).

In our fieldwork on the surveyed area for this paper, we have not found at all *F. meleagris*, but only *F. meleagroides*. Therefore, we assume that the mention of *F. meleagris* in this locality was due to misidentification. If this assumption is correct (although it cannot be proven by voucher specimens collected at that time), it follows that *F. meleagroides* was found in Romania about 5 decades ago, but it remained unknown until recently due to the confusion with *F. meleagris*.

MITITELU & BARABAȘ (1975) also indicated *F. meleagris* (K=I) from the Prut river meadow, within the association “*Agrostetum stoloniferae* (Ujvarosi 1941) Arvat 1939”, classified in the alliance *Agrostion stoloniferae* Soó 1933, order *Molinietalia* W. Koch 1926. Unfortunately, one cannot know in which of the listed localities (Berezeni, Vetrișoia, Stâncă-Ștefănești, Râșești, Cristești, Bosia, Oancea, Probota, Vlădești, Trifești, Brănești, Galați) *Fritillaria* was identified, since the table given by the authors in that paper is a synthetic one. It is not excluded, however, that *Fritillaria* was present in the relevé registered at Stâncă-Ștefănești (Botoșani county), a place near Ștefănești town, where we identified *Fritillaria meleagroides*. Regardless of the accurate location of that phytocenosis with *Fritillaria* along the Prut river meadow, the presence of other more or less halophilous species (such as *Trifolium fragiferum* ssp. *fragiferum*, *Oenanthe silaifolia*, *Ranunculus sardous*, *Mentha pulegium*, *Inula britannica*), in the structure of the association given by the above mentioned authors indicates rather the presence of *F. meleagroides* than *F. meleagris*.

Due to its linear leaves, easily confused with those of the dominant *Poaceae*, the individuals of *F. meleagroides* is easily distinguishable within the phytocoenosis structure only during the flowering time (April), when its stems having nodding flowers, are easily noticeable in the relatively low vegetation. With the full development of the dominant or subdominant *Poaceae* (*Elymus repens*, *Alopecurus pratensis*, etc.), *F. meleagroides* can only be hardly noticed. This may explain its lack on some of the previous phytosociological records [RĂVĂRUȚ & al. 1968; CHIFU & al. 1998].

The phytocoenoses of *Rorippo austriacae-Agropyretum repentis*, in which *F. meleagroides* was identified by us, have a wide distribution, both along the Jijia meadow river, at Cotu Morii, Țigănași, Larga Jijia, Mihail Kogălniceanu (Iași county), as well as along the Bașeu plain, on the river meadow, north of Ștefănești town (Botoșani county). They occupy flat, meadow land, with aluviosols (fluvisols), more or less salinized, in some places associated with saline soils, with phreatic water at shallow depth, and temporary stagnation of the rainfall waters in the spring season.

The vegetation is dominated by *Elymus repens*, with *Alopecurus pratensis* ssp. *pratensis* as a subdominant (rarely codominant), while the species *F. meleagroides*, although present in all the recorded relevés, has a reduced coverage, up to 10%.

Besides *F. meleagroides*, other rare and threatening species, according to IUCN criteria [DIHORU & NEGREAN, 2009; OLTEAN & al. 1994], are also included in the plant structure of phytocoenoses, as: *Bulbocodium versicolor* (VU), *Dianthus pratensis* ssp. *racovitzae* (CR), *Iris brandzae* (LR), *I. halophila* (R), *Serratula coronata* (R), *Rhaponticum serratuloides* (R). To mention, *Bulbocodium versicolor* (Figure 6) is reported here for the first time in Iași county. It should be noted, however, that all of these rare species were recorded only along the Jijia meadow river, at Cotu Morii (Iași county), but not in the phytocoenoses investigated in Bașeu river basin (Botoșani county).

NEW DATA ABOUT *FRITILLARIA MELEAGROIDES* IN ROMANIA

The phytocoenoses analyzed by us have a characteristic structure for the plant association (*Rorippo austriacae-Agrophyretum repentis*), with a weight of approx. 40% of the diagnostic species for the higher syntaxa (alliance, order, and class). Approximately a quarter of the recorded species belong to the ruderal vegetation (20% *Stellarietea mediae*, 6% *Artemisietea vulgaris*), reflecting the high anthropo-zoogenic impact in the communities containing *F. meleagroides*, impact which is manifested both by grazing with sheep or cattle and by rebuilding the land on some surfaces (by plowing, digging ditches or channels, etc.).

Phytocoenoses are dominated by hemicriptophytes (51%), with an important weight of therophytes (20%) and geophytes (19%). Helohidatophytes, in small numbers (about 4%), are generally settled down in some microdepressions, where the water stagnates for a longer time.

Phytogeographically, the Eurasian elements predominate (54.3%), followed at a long distance by the European (14.3%) and the general Pontic ones (11.4%). The endemic and subendemic elements deserve also a special attention. Although they are represented by one taxon each (*Dianthus pratensis* ssp. *racovitzae* and *Iris brandzae*, respectively), they contribute, besides *F. meleagroides* and other rare species above mentioned, to increase the conservative value of the meadows nearby the Cotu Morii village.



Figure 6. *Bulbocodium versicolor*, North of the Cotu Morii village

thermophilous, (meso-) hygrophilous, light alkalophilous, moderately nitrophilous and light- to moderately salty tolerant. The alternation between an excess moisture in spring, and land drought during the summer, makes possible the presence of both hygrophilous and xerophilous species within these plant communities (the latter, however, much less numerous).

Another important feature of these plant communities is a high presence of the obligatory halophilous species (e.g. *Scorzonera cana*, *Iris halophila*, *Cerastium dubium*, *Limonium gmelinii*, etc.), characteristic for the class *Festuco-Puccinellietea*, representing between 6.9% and 20.7% (13.1% in average) of the total number of species per relevé. In addition, many other salinity-tolerant plant species (e.g. *Oenanthe silaifolia*, *Silaum silaus*, *Inula britannica*, etc.) are present, too.

The important participation of the halophilous and ruderal species within the floristic structure of these communities is consistent with the literature data for the *Potentillion anserinae* alliance [BURDUJA & al. 1956; CHIFU & al. 1998; CHIFU & al. 2006; COLDEA, 2012; RĂVĂRUȚ & al. 1956].

The plant communities with *F. meleagroides* registered by us are generally heliophilous, meso-

The tolerance to the soil salinity of *F. meleagroides*, proven by a significant presence of halophilous plants which accompany it in the analyzed communities, is also consistent with the literature data [ARTIUSHENKO, 1979; GOLUB, 1994; GOLUB & SAVELJEVA, 1991; KOROTCHENKO & ORLOV, 2009; LOZINA-LOZINSKAYA, 1935; PROKUDIN & al. 1987]. By this feature, *F. meleagroides* obviously differs from *F. meleagris*, which actually is a halophobous plant [BORHIDI, 1995; ELLENBERG & al. 1992], although the two species resemble in that both are hygrophilous.

As a result of ecological differences, the two species develop in different phytocoenotic environments. Thus, *F. meleagroides* has been identified, as shown in this paper, in the structure of some communities within *Potentillion anserinae* alliance, whereas *F. meleagris* is known in the structure of plant communities from various alliances, such as: *Deschampsion caespitosae* Horvatić 1930 [SĂMĂRGHIȚAN & OROIAN, 2011], *Molinion* W. Koch 1926, *Calthion* Tx. 1937 and *Magno-Caricion elatae* W. Koch 1926 [CSERGŐ & FRINK, 2003], *Alnion incanae* Pawłowski, Sokołowski et Wallisch 1928 [BUJOREAN & GRIGORE, 1965], *Salicion cinereae* Müller et Görs ex Passarge 1961 [BUJOREAN & GRIGORE, 1965; ULARU & PARASCAN, 1970] or even in some meso-hygrophilous plant communities in *Lathyro hallersteinii-Carpinion* (Soó 1964) Boșcaiu 1979 [SEGHEDIN & al. 1979].

Consequently, *F. meleagris* should not be indicated as a characteristic species for the alliance *Potentillion anserinae* [CHIFU & al. 2006; SÎRBU & al. 2013], since this was due, in our opinion, to the fact that the individuals of *Fritillaria* in the Plain of Moldavia were previously [MIHAI, 1969, 1971a, 1971b; MITITELU & BARABAȘ, 1975] misidentified with *F. meleagris* (instead of *F. meleagroides*).

d) The need of conservation

Taking into account the botanical importance of the wet meadow near Cotu Morii village (Iași county), from the inferior basin of the Jijia river, supported by our present and previous studies, we reinforce our proposal [OPREA & al. 2015] to establish a nature reserve within this area. The territory is included in the perimeter of ROSCI0222 Sărăturile Jijia Inferioară-Prut. A rational exploitation of meadows through mowing or non-aggressive grazing, without major interventions (such as plowing the ground, digging other drainage channels, or the excessive collecting) would allow both the long-term survival of the rare species here (and on the other places with *F. meleagroides* above mentioned), as well as a good economic valorizing of the meadows.

Conclusions

Fritillaria meleagroides, a rare species recently reported in the Romania's vascular flora, was identified in other localities, as nearby of the Ștefănești town (Botoșani county), as well as between Țigănași, Mihail Kogălniceanu and Larga Jijia villages (Iași county). The number of reproductive individuals of *F. meleagroides* at Cotu Morii (Iași county) has been estimated. In the sample area, the population has an average density of 3.7 individuals per m². The paper reveals the structure and some ecological peculiarities of plant communities in which *F. meleagroides* grows at Cotu Morii (Iași county), and Ștefănești (Botoșani county). At Cotu Morii, besides *F. meleagroides*, other rare and threatened plant species have been identified (e.g. *Dianthus pratensis* ssp. *racovitzae*, *Iris brandzae* and *Bulbocodium versicolor*, the last species being a floristic novelty for the Iași county). The authors

recommend the protection of all these species and their habitat by declaring a natural reserve at Cotu Morii (Iași county).

References

- ARTIUSHENKO Z. T. 1979. *Fritillaria* L. In: FEDOROV A. (red.). *Flora partis Europae U.R.S.S.* Vol. 4: 236-237. Leningrad: Nauka.
- BORHIDI A. 1995. Social behaviour types, the naturalness and relative indicator values of the higher plants in the Hungarian Flora. *Acta Botanica Hungarica*. **39**(1-2): 97-181.
- BORZA A. & BOȘCAIU N. 1965. *Introducere în studiul covorului vegetal*. București: Edit. Acad. Române, 340 pp.
- BRAUN-BLANQUET J. 1964. *Pflanzensoziologie*, 3rd ed. Springer, Wien-New York, 865 pp.
- BUJOREAN G. & GRIGORE S. 1965. *Fritillaria meleagris* L. și ocotirea ei. *Ocotirea Naturii*. **9**(1): 61-68.
- BURDUJA C., DOBRESCU C., GRÎNEANU A., RĂVĂRUȚ M., CĂZĂCEANU I., BÎRCĂ C., RACLARU C. & TURENSCHI E. 1956. Contribuții la cunoașterea pajiștilor naturale din Moldova sub raport geobotanic și agroproductiv. *Studii și Cercetări Științifice, ser. Biologie și Științe Agricole, Academia R. P. Române, fil. Iași*. **7**(1): 1-37.
- CHEN X. & MORDAK H. V. 2000. *Fritillaria* L. In: WU Z. Y. & RAVEN P. H. (eds.). *Flora of China*. Vol. **24**: 127-133. St. Louis: Science Press, Beijing & Missouri Botanical Garden Press.
- CHIFU T., SÂRBU I., ȘTEFAN N., ȘURUBARU B. & ZAMFIRESCU O. 1998. Fitocenoze din clasa *Agrostietea stoloniferae* Oberd. in Oberd. et al. 1967 din bazinul inferior al Jijiei. *Buletinul Grădinii Botanice Iași*. **7**: 79-94.
- CHIFU T., MÂNZU C. & ZAMFIRESCU O. 2006. *Flora & vegetația Moldovei (România). I-II*. Iași: Edit. Univ. „Alexandru Ioan Cuza”.
- COLDEA Gh. 2012. Classe *Molinio-Arrhenatheretea*. pp. 191-234, In: COLDEA Gh. (ed.). *Les association végétales de Roumanie. Tome 2. Les associations anthropogènes*. Cluj-Napoca: Presa Universitară Clujeană, 482 pp.
- CRISTEA V., GAFTA D. & PEDROTTI F. 2004. *Fitosociologie*. Cluj-Napoca: Presa Universitară Clujeană, 394 pp.
- CSERGÓ A. M. & FRINK J. P. 2003. Some phytocoenological and population structure features of *Fritillaria meleagris* L. in the upper Șard Valley (Cluj County, Romania). *Contribuții Botanice Cluj*. **38**(2): 163-172.
- DIHORU G. & NEGREAN G. 2009. *Cartea roșie a plantelor vasculare din România*. București: Edit. Acad. Române.
- ELLENBERG H., WEBER H. E., DÜLL R., WIRTH V., WERNER W. & PAULISSEN D. 1992. Indicator values of plants in Central Europe. *Scripta Geobotanica*. **18**: 7-97.
- GOLUB V. B. 1994. Class *Asteretea tripolium* on the territory of the former USSR and Mongolia. *Folia Geobotanica Phytotaxonomica*. **29**: 15-54. <https://doi.org/10.1007/BF02807774>
- GOLUB V. B. & SAVELJEVA L. F. 1991. Vegetation of the Lower Volga Limans (basins without outflow). *Folia Geobotanica Phytotaxonomica*. **26**: 403-430. <https://doi.org/10.1007/BF02912776>
- IVANOVA D. 2015. *Fritillaria meleagroides* Schult. & Schult. f. In: PEEV D. & al. (eds.) 2015. *Red Data Book of the Republic of Bulgaria*, Vol. **1**: 242 pp. Sofia: BAS & MoEW.
- KOROTCHENKO I. A. & ORLOV A. A. 2009. *Fritillaria meleagroides* Patr. in ex Schult. et Schult. f. In: DIDUKH Y. P. (ed), *Tservona Kniga Ukraini. Roslynni svit*. 3rd ed. Kyiv: Globalconsalting.
- LOZINA-LOZINSKAYA A. S. 1935. *Fritillaria* L. In: KOMAROV V. L. (ed), *Flora SSSR*. Vol. **4**: 302-320. Leningrad: Nauka.
- MIHAI G. 1969. *Flora și vegetația din Bazinul Bașeului*. PhD Thesis. Univ. București.
- MIHAI G. 1971a. Contribuții floristice din Bazinul Bașeului. *Comunicări de Botanică*. **12**: 173-179.
- MIHAI G. 1971b. Cercetări asupra vegetației pajiștilor de luncă din Bazinul Bașeului. *Studii și Comunicări, Științele Naturii, Muzeul Județean Suceava*. **2**(1): 127-140.
- MITITELU D. & BARABAȘ N. 1975. Vegetația din lunca Prutului. *Studii și Comunicări, Muzeul de Științele Naturii Bacău*: 219-285.
- OLTEAN M., NEGREAN G., POPESCU A., ROMAN N., DIHORU G., SANDA V. & MIHĂILESCU S. 1994. Lista roșie a plantelor superioare din România. Institutul de biologie, Studii, sinteze, documentații de ecologie, București. **1**: 1-52.
- OPREA A., SÎRBU C. & PEREGRYM M. 2015. *Fritillaria meleagroides* in Romania. *Acta Horti Botanici Bucurestiensis*. **42**: 41-55. <https://doi.org/10.1515/ahbb-2015-0005>
- PETROVA A. & VLADIMIROV V. (eds.) 2009. Red list of Bulgarian vascular plants. *Phytologia Balcanica*. **15**(1): 63-94.

-
- PROKUDIN I. N., DOBROCHAEVA D. N., ZAVERUKHA B. V., CHOPIK V. I., PROTOPOPOVA V. V. & CRITSKAIA L. I. (eds.) 1987. *Opređelitel' vyshikh rastenii Ukrainy*. Kiev: Naukova Dumka.
- RĂVĂRUȚ M., CĂZĂCEANU I. & TURENSCHI E. 1956. Contribuțiuni la studiul pășunilor și fânețelor din depresiunea Jijiei superioare și a Bașăului și dealurile Copălău-Cozancea. *Studii și Cercetări Științifice, ser. Biologie și Științe Agricole, Academia R. P. Române, fil. Iași*. **7**(2): 93-34.
- RĂVĂRUȚ M., MITITELU D., TURENSCHI E., ZANOSCHI V., PASCAL P. & TOMA M. 1968. Contribuții la studiul vegetației pajiștilor din bazinul inferior al Jijiei. *Lucrări Științifice, Institutul Agronomic Iași, I. Agronomie-Horticultură*. /1968/: 129-153.
- SĂMĂRGHIȚAN M. & OROIAN S. 2011. Meadows with *Fritillaria meleagris* L. at Lunca Mureșului – Aluniș, Mureș county. *Argesis, Studii și Comunicări, ser. Științele Naturii*. **19**: 31-47.
- SÎRBU I., ȘTEFAN N. & OPREA A. 2013. *Plante vasculare din România. Determinator ilustrat de teren*. București: Edit. Victor B Victor, 1320 pp.
- SEGHEDIN T., FILIPAȘCU A. & BOȘCAIU N. 1979. Cercetări biocenologice în rezervația naturală Lunca Zamostei (județul Suceava). *Studii și Comunicări de Ocrotirea Naturii, Suceava*. **4**: 79-86.
- ULARU P. & PARASCAN D. 1970. Câteva date fitocenologice asupra lalelei pestrice (*Fritillaria meleagris* L.) în depresiunea Brașovului și împrejurimi. *Ocrotirea Naturii*. **14**(1): 69-72.
- VASILINIUC I. & SECUC.V. 2007. The soil cover of Bașeu Plain. *Factori și procese pedogenetice din zona temperată (ser. nouă)*. **6**: 81-94.
- YANEV A. 1964. *Fritillaria* L. In: JORDANOV D. (ed.). *Flora na Narodna Republika Bulgariya (Flora Reipublicae Popularis Bulgaricae)*. Vol. **2**: 254-265. Aedibus Acad. Sci. Bulgaricae, Serdicae.
- ZHANG L. 1983. Vegetation ecology and population biology of *Fritillaria meleagris* L. at the Kungsängen Nature Reserve, Eastern Sweden. *Acta Phytogeographica Suecica*. **73**: 92 pp.
-

How to cite this article:

SÎRBU C., OPREA A. & PEREGRYM M. 2019. New data about *Fritillaria meleagroides* in Romania. *J. Plant Develop.* **26**: 123-135. <https://doi.org/10.33628/jpd.2019.26.1.123>
