

Study of the vegetation and habitats of the Ranislavtsi Refugial Complex of wet meadows, Kostinbrod Municipality, West Bulgaria

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Abstract. The object of this study is the Ranislavtsi Wet Meadows Complex, Kostinbrod Municipality. This is a boreal refugium, very rich in rare and endangered plant species. Some of these species have unique localities in the country and even in the Balkans. Three associations have been identified – *Junco effusi-Molinietum caeruleae*, *Deschampsietum cespitosae*, and *Caricetum acutiformis*, which represent natural habitats that are target objects of NATURA 2000 site BG0000322 Dragoman. These natural habitats have been mapped according to the classification of the Habitat Directive. The origin of plant communities and the impact of human activities on them have been analyzed. Some practical measures to protect and restore the complex of wet meadows are suggested.

Key words: associations, boreal relicts, habitat map, wet meadows

Introduction

The Ranislavtsi wet meadows located between the villages Tsruklevtsi and Buchin Prohod, and the Ponor Plateau are part of the Dragoman Marsh Karst Complex (Fig. 1). The Dragoman Karst Complex is located in West Bulgaria, within the administrative borders of Sofia and within the boundaries of municipalities of Dragoman, Godech, Slivnitsa, and Kostinbrod. This is the largest wetland area (14967 ha) in Bulgaria included in the Ramsar Convention. The area comprises BG0000322 Dragoman Protected Zone (Fig. 2) for conservation of the natural habitats and species (Directive 92/43/EEC), and partially Rayanovtsi Protected Zone for conservation of the wild birds (Directive

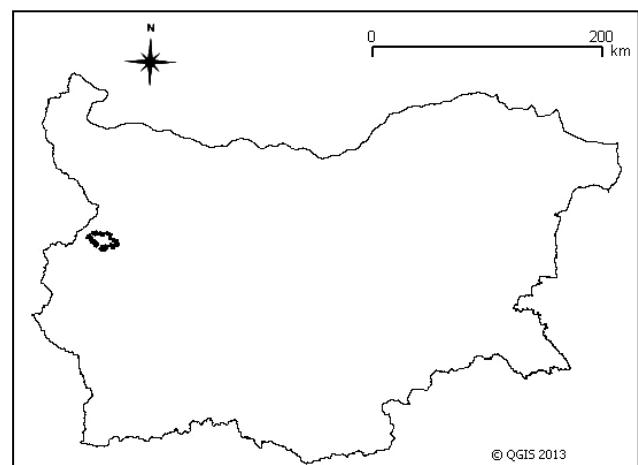


Fig. 1. Location of the Dragoman Marsh Karst Complex and NATURA 2000 site BG0000322 Dragoman on the map of Bulgaria.

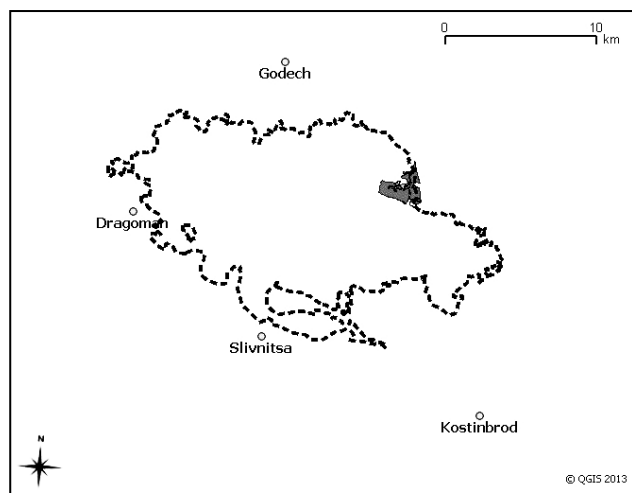


Fig. 2. Location of the Ranislavtsi Wet Meadows Complex on the map of NATURA 2000 site BG0000322 Dragoman.

2009/147/EC). The Ranislavtsi Wet Meadows Complex covers an area of 359 ha.

Despite the proximity of the Complex to the Bulgarian capital of Sofia, it is a poorly studied area in terms of biotic components. In the last few years alone, some new localities of rare species unknown to Bulgaria and even to the Balkan Peninsula were discovered and published. Such species are *Plantago maxima*, *Salix rosmarinifolia*, *Lathyrus palustris*, and *Pedicularis palustris* (Hajek & al. 2006; Tzonev & Karakiev 2007). The various wet meadows in the Ranislavtsi region have not been object of any special studies in terms of their syntaxonomy and belonging to conservation-significant natural habitats. That is why, we have made them subject of this work. The vast wet meadows around the marshes and the Ranislavtsi Complex are unique because of their relict flora, more characteristic of the more northern parts of Europe and of the mountain regions in Bulgaria. The Complex provides exclusive habitats for many plants, including the Giant Plantain (*Plantago maxima*), Rosemary Leaf Willow (*Salix rosmarinifolia*), Low Violet (*Viola pumila*), Fritillary (*Fritillaria meleagroides*), and Aldrovanda (*Aldrovanda vesiculosa*).

The aim of this study is to research the important Ranislavtsi Complex with its conservation-significant species and plant communities on the basis of the phytosociological methodology. Another aim is to suggest measures for their protection and restoration. Map of the target habitats in the Complex from the Dragoman site of NATURA 2000 was also prepared.

Material and methods

The study was carried out in the period 2011–2012. The research of vegetation was performed according to the methodology of Braun-Blanquet's (Sigmatic) School (Braun-Blanquet 1964; Mueller-Dombois & Ellenberg 1974; Maarel 1979). Sample plots of 25 m² have been used for the phytosociological data. The total number of sample plots was 30. The exact coordinates of the plots were identified by GPS. The map of NATURA 2000 habitats was prepared with the help of the Quantum GIS Program (<http://www.qgis.org/>) on the basis of orthophotographs taken in 2006 (Fig. 3).

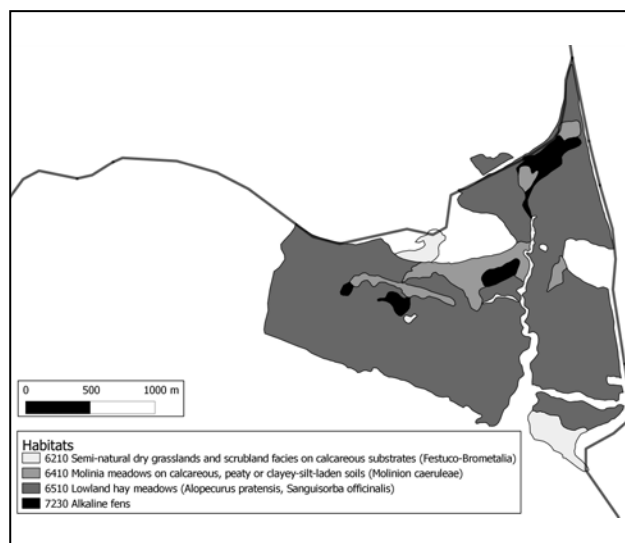


Fig. 3. A map of habitats in the Ranislavtsi Wet Meadows Complex.

The nomenclature of vascular plants follows Kozhuharov (1992). The floristic elements were identified according to Assyov & al. (2006). The plant life-form of each species was given according to Raunkiaer (1937).

Cluster analysis was performed with the SYN-TAXA program (Podani 2002). In tabular processing, the relevés were arranged in an order determined by the classification (cluster) dendrogram. The diagnostic species were determined on the basis of literature (Horvatić 1930; Horvat & al. 1974; Solomakha 1996; Kojić & al. 1998; Sanda & al. 1999; Borhidi 2003; Chytry 2007; Janišová & al. 2007). Nomenclature of the syntaxa is in concordance with the International Code of Phytosociological Nomenclature (Weber & al. 2000).

Results

A cluster analysis of the relevés differentiated three major vegetation groups (Fig. 4), which could be referred to different associations (Table 1) and, respectively, to NATURA 2000 habitats. The first control relevé of the surrounding dry hills was abandoned because of a significant difference with the others. The other relevés were divided during cluster analysis into the following groups, which coincide with the three target habitats of the NATURA 2000 site BG0000322 Dragoman:

— Mesophilous meadows with varying degree of xerophytisation (in the cluster dendrogram the relevés 4, 7, 22, 23, 24, 28, 9, 21, 6, 27, 5, 15, 8, 14, 25, 20), which represent Habitat 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) from the Habitat Directive. This vegetation type claims the largest share in the Complex and covers an area of 303.67 ha.

— Wet meadows (in the cluster dendrogram relevés 2, 3, 10, 13, 16, 12, 11, 26, 17, 18, 19) – Habitat Directive: 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*). This vegetation type in the Complex covers an area of 26.67 ha.

— Alkaline fens and bogs (relevés 29, 30) – Habitat Directive: 7230 Alkaline fens. This vegetation type in the Complex covers an area of 13.89 ha.

Two other associations – *Eleochariti uniglumis-Caricetum distantis* and *Caricetum distichae* – were identified in the Complex by Hajek & al. (2008). They have

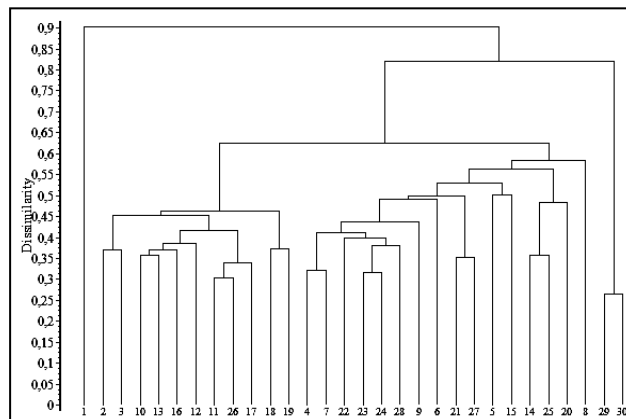


Fig. 4. Cluster dendrogram of the relevés using the Horn index.

not been confirmed during the recent studies. The probable reason is that the study of Hajek & al. (2008) was focused on the relict alkaline fens, which occupy a very small area in the Ranislavtsi Complex. The present work is focused on the mesophilous and wet meadows, which occupy the largest area in the Complex. The aim of our work was also to cover a maximum part of the Complex and to put the relevés within at least three dominating types of communities.

However, the syntaxa identified by Hajek & al. (2008) are also included in the syntaxonomical scheme of the Ranislavtsi Complex. A small part (14.75 ha) of the xerophyllous herbaceous communities (Habitat 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)) was also mapped out and included in the map.

Syntaxonomical scheme of the Ranislavtsi Complex

Class *Phragmito-Magno-Caricetea* Klika in Klika & Novak 1941

Order *Magno-Caricetalia* Pignatti 1953

Alliance *Magno-Caricion gracillis* Gehu 1961

Association *Caricetum acutiformis* Eggler 1933

Association *Caricetum distichae* Nowinski 1927 (identified by Hajek & al. 2008)

Class *Scheuchzerio palustris-Caricetea nigrae* Tüxen 1937

Order *Caricetalia davallianae* Braun-Blanq. 1949

Alliance *Caricion davallianae* Klika 1934

Association *Eleochariti uniglumis-Caricetum distantis* Hajek & al. 2008

Class *Molinio-Arrhenatheretea* Tüxen 1937

Order *Molinetalia* Koch 1926

Alliance *Molinion caeruleae* Koch 1926

Association *Junco effusi-Molinietum caeruleae* Tüxen 1954

Alliance *Deschamsion cespitosae* Horvatic 1931

Association *Deschampsietum cespitosae* Horvatic 1930

Association *Deschampsietum cespitosae* Horvatic 1930

This association (Table 1 – relevés from 12 to 27) was represented in the mesophilous and xeromesophilous meadows dominated by different mesophilous grasses. The total vegetation cover of all relevés varied between 80-95%. The wet hay meadows occupied the largest area in the Ranislavtsi Complex. They occurred both in the valley and also on slightly elevated small hills. The species composition was variable and depended on many factors: micro promotions and micro demotions of the relief, ploughing in the past, availability of arable lands in the vicinity, and livestock grazing. A major factor was soil humidity and soil nutrients (Hájková & al. 2006). It was typical of this type of communities that even in spring they did not retain any water layer, although the soil may be too dry in summer.

There was no „good” diagnostic group of species, because of the floristic variability and wide range of distribution of the association. The most frequently occurring species were widespread in the mesophilous meadows in the temperate parts of Europe and Asia. The diagnostic species of the association in the Complex are *Deschampsia cespitosa*, *Alopecurus pratensis* and *Cirsium canum* – all dominants in many meadow communities in Central and Southeast Europe. *Deschampsia cespitosa* could also dominate and it formed the first layer of the phytocoenosis. Its height varied from 0.5 m to 1 m. Other dominant species were *Arrhenatherum elatius*, *Molinia caerulea*, *Galium verum*, *Filipendula vulgaris*, and *Rhinanthus rumelicus*.

The following species had the highest occurrence in the species composition: *Deschampsia cespitosa* (69%), *Molinia caerulea* (50%), *Briza media* (63%), *Alopecurus pratensis* (44%), *Ranunculus acris* (88%), *Rumex acetosa* (81%), *Betonica officinalis* (88%), *Serratula tinctoria* (69%), *Rhinanthus rumelicus* (94%), *Trifolium hybridum* (44%), *Centaurea phrygia* (100%), *Plantago lanceolata* (69%), *Stellaria graminea* (88%), *Leucanthemum vulgare* (75%), *Polygala vulgaris* (69%), *Oenanthe stenoloba* (81%), *Galium verum* (88%), *Filipendula vulgaris* (94%), *Achillea millefolium* (69%), *Euphrasia pectinata* (50%), *Trifolium pratense* (50%), *Lotus corniculatus* (44%), *Trifolium patens* (44%), *Festuca pratensis* (44%), and *Campanula sparsa* (56%).

Some nitrophilous species, such as *Cirsium ligulare* (69%), *Cirsium arvense* (25%), etc., have increased in the degraded areas. The rare species in the meadows were *Viola pumila*, *Salix rosmarinifolia*, *Galium bo-*

reale, etc. According to the Habitats Directive, these meadows represent a natural habitat: Habitat 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*).

Analysis of the phytogeographic structure of the studied flora has shown the following geographical elements: Euroasian 15%, Euromediterranean 14%, Boreal 13%, European 12%, Submediterranean 8%, Subboreal 8%, Eurosiberian 8%.

Distribution of the species life-forms in the association was as follows: phanerophytes 3%, hemicryptophytes 76%, cryptophytes 5%, and therophytes 16%. The hemicryptophytes were over-represented in the biological spectrum, which is characteristic of the flora of the temperate zone and especially of the mesophilous grasslands dominated by perennial herbaceous plants.

The association was described in Croatia by Horvatic (1930), but it was also found in Romania (Sanda & al. 1999). In the meadow communities in West Bulgaria, studies have been so far conducted mainly into the alliances *Arrhenatherion* and *Cynosurion* (Velev & al. 2010, 2011). Such communities of the alliance *Deschampsion cespitosae* were described in many places across Europe: the Ukraine (Solomakha 1996), Serbia (Kojić & al. 1998), Hungary (Borhidi 2003), Slovakia (Janišová & al. 2007), and the Czech Republic (Chytrý 2007). The association was identified for the first time in Bulgaria, in spite of the fact that the alliance was already identified in Bulgaria by Hájková & al. (2006).

The hay meadows provide habitat for the following rare boreal relict species:

Northern Bedstraw (*Galium boreale* L.) – the species was included in the former *Red Data Book of the Republic of Bulgaria* (Anchev 1984), but it was not included in the new edition of the *Red Data Book of Bulgaria*, vol. 1. *Plants and Fungi*. It was assessed as Vulnerable in the *Red List of Bulgarian Plants and Fungi* (Anchev & Goranova 2009). In the wet meadows, it was found only along the drainage canals or small streams, forming micro-populations on small areas, although numerous and with a pronounced dominance of the species.

Rosemary Leaf Willow (*Salix rosmarinifolia* L.) – the species is included in Annex 3 of the Biodiversity Act and in the new edition of the *Red Data Book of Bulgaria*, vol. 1. *Plants and Fungi*; it was assessed as Critically Endangered (Apostolova & Tsoneva 2011). Its only locality in Bulgaria is in the Ranislavtsi Complex, which is also one of the few in the Balkans (Skvortzov

1999). Just a small part of its population was covered by that natural habitat, respectively – mesophilous meadows. It prefers moist meadows, discussed further below.

Low Violet (*Viola pumila* Chaix.) – this species was included in Annex 3 of the Biodiversity Act and the new edition of the *Red Data Book of Bulgaria*, vol. 1. *Plants and Fungi*: it was assessed as Endangered (Apostolova & Meshinev 2011). The area of Ranislavtsi Complex is one of its few localities in Bulgaria. Its largest major habitat is in the Dragoman Protected Zone.

Association *Junco effusii-Molinietum caeruleae* Tuxen 1954

The hygromesophilous (moist or wet) meadows (Table 1 – relevés from 1 to 19), dominated also by *Deschampsia cespitosa* and *Sanguisorba officinalis*, rate second in distribution and surface area in the Ranislavtsi Complex. These meadows are heavily waterlogged. They keep a shallow water layer (about 0.10 meters) until June, and thus occupy low areas, mainly around the canal that drains the surface water from the area of Tsruklevtsi village and flows south-eastwards. After that it discharges into the stream, which in turn drains the moist area between the villages of Buchin Prohod and Tsruklevtsi.

The total vegetation coverage is within the range of 80-90%. In the second area, the wet meadows transit smoothly from the mesophilous meadows of alliance *Deschampsion cespitosae* to the alkaline fens of alliance *Caricion davallianae*. These meadows have a high conservation value because they provide habitat to some of the rarest plants in the area, as well as in Bulgaria, such as *Salix rosmarinifolia* and *Plantago maxima*. The hay meadows are used for mowing in the second half of July, when finally the surface water disappears. Typical of their floristic composition are the boreal relict species, most occurring at significantly higher altitudes (above 1000 m) in the mountains of Bulgaria. Diagnostic species of the association are *Molinia caerulea*, *Juncus effusus*, *Potentilla erecta*, *Luzula multiflora*, *Briza media*, *Lychnis flos-cuculi*, and *Sanguisorba officinalis*.

The following plants are typical and have high occurrence in their floristic composition: *Juncus conglomeratus* (55%), *Potentilla erecta* (87%), *Rumex acetosa* (55%), *Betonica officinalis* (64%), *Iris sibirica* (55%), *Sanguisorba officinalis* (100%), *Luzula multiflora* (55%), *Alopecurus pratensis* (55%), *Trifolium hybridum* (73%), *Cirsium canum* (55%), *Cirsium*

ligulare (55%), *Ranunculus acris* (100%), *Oenanthe stenoloba* (100%), *Myosotis scorpioides* (82%), *Stellaria graminea* (64%), *Orchis elegans* (82%), *Bistorta major* (64%), *Plantago lanceolata* (64%), *Centaurea phrygia* (55%), *Rhinanthus rumelicus* (55%), *Juncus articulatus* (45%), *Filipendula vulgaris* (64%), *Salix rosmarinifolia*, *Serratula tinctoria* (64%), *Deschampsia cespitosa* (100%), and *Molinia caerulea* (45%).

Hemicryptophytes dominate among the plant life-forms: 85%. Cryptophytes account for 5%, therophytes for 7% and phanerophytes for 3%. Euroasian species prevail in the phytogeographical spectrum with 13%, followed by boreal 12%, cosmopolitan 12%, European – 12%, Euromediterranean 12%, Subboreal 10%, Submediterranean 7%, Eurosiberian 7%, etc.

Studies into the meadow communities in West Bulgaria have been carried out mainly on the alliances *Arrhenatherion* and *Cynosurion* (Velev & al. 2010, 2011). This association was mentioned for the first time in Bulgaria by Hajek & al. (2006), but without any published relevés. It is also known from the Ukraine (Solomakha 1996), Serbia (Kojić & al. 1998), Romania (Sanda & al. 1999), Hungary (Borhidi 2003), Slovakia (Janišová & al. 2007), and the Czech Republic (Chytrý 2007). The floristic structure of meadows includes many boreal species of relict origin. The habitat in the Ranislavtsi Complex is refugial in character. Although these communities are isolated from similar communities from the mountains of the Balkan Peninsula and in the valleys and lowlands of Central and North Europe, their syntaxonomy is not different.

According to the Habitats Directive, these meadows provide the natural habitat 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*), which is very rare for the country.

The following conservation-significant species have been found in the hay wet meadows:

Rosemary Leaf Willow (*Salix rosmarinifolia* L.) – it prefers wet meadows and seldom occurs in mesophilous meadows.

Giant Plantain (*Plantago maxima* Jacq.) – this species is a boreal relict and its only locality in Bulgaria and on the Balkan Peninsula is in the Ranislavtsi area. Its population is sparse and occupies a limited space. The species is listed in Appendix 3 of the Biodiversity Act and is assessed as Critically Endangered (Tzonev & Karakiev 2007). Its only known population in Bulgaria and in the Balkans occurs in the association *Junco effusii-Molinietum caeruleae*.

Table 1. Continuation.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36			
<i>Ononis arvensis</i> L.		Eur-As	H												0	0						+	+	+	+														
<i>Cruciata laevipes</i> Opiz		Submed-Cas	H												0	0																							
<i>Thymus</i> sp.			H												0	0																							
<i>Geranium sanguineum</i> L.		Eur	H												0	0																							
<i>Silene otites</i> (L.) Wibel		Eur-Med	H												0	0																							
<i>Genista tinctoria</i> L.		Eur-Sib	H												3	0																							
<i>Danthonia alpina</i> Vest		Eur	H												3	0																							
<i>Agrostis capillaris</i> L.		Boreal	H												3	0																							
<i>Oenanthe banatica</i> Heuff.		Eur	H												1	2	0																						
<i>Pyrus pyrastifera</i> Burgsd.		Submed	Ph												1	0																							
<i>Koeleria macrantha</i> (Ledeb.) Schult.		Eur	H												0	0																							
<i>Lythrum salicaria</i> L.		Subboreal	H												3	1	9																						
<i>Carex distans</i> L.		Eur-As	H												1	9																							
<i>Carex punctata</i> Gaudin		Eur-Med	H												2	18																							
<i>Vicia hirsuta</i> (L.) Gray		Eur-Med	Th												0	0																							
<i>Matricaria perforata</i> Mérat		Eur-Med	Th												0	0																							
<i>Cruciata pedemontana</i> (Bellardi) Ehrend.		Med-Cas	H												0	0																							
<i>Ajuga genevensis</i> L.		Sub-Pont	H												0	0																							
<i>Vicia sativa</i> L.		Eur-Med	Th												0	0																							
<i>Pastinaca hirsuta</i> Pančić		Balkan	H												0	0																							
<i>Hypochoeris maculata</i> L.		Eur-Sib	H												0	0																							
<i>Potentilla alba</i> L.		Pont-Pann	H												0	0																							
<i>Tragopogon dubius</i> Scop.		Eur-Med	Th												0	0																							
<i>Elymus repens</i> (L.) Gould.		Boreal	H												0	0																							
<i>Convolvulus arvensis</i> L.		Kos	H												0	0																							
<i>Bromus mollis</i> L.		Boreal	Th												0	0																							
<i>Pedicularis palustris</i> L.		Eur-As	H												0	0																							
<i>Equisetum palustre</i> L.		Boreal	Cr												0	0																							

Localities: 1. 42564387 N 02308528 E; 2. 4256438 N 02308566 E; 3. 42565344 23085886 E; 4. 42563812 N 23084890 E; 5. 42563598 N 23085189 E; 6. 42564066 N 23084575 E; 7. 42564405 N 23090235 E; 8. 42565447 N 23090977 E; 9. 42563816 N 23085304 E; 10. 42563927 N 23085537 E; 11. 42564105 N 23085464 E; 12. 4256517 N 02309042 E; 13. 42570094 N 02309042 E; 14. 42565495 N 23092837 E; 15. 42565603 N 23092557 E; 16. 42565122 N 23091700 E; 17. 42571068 N 23091953 E; 18. 42565476 N 23085876 E; 19. 42565410 N 23093240 E; 20. 4257223 N 02309182 E; 21. 42570977 N 23092601 E; 22. 4256592 N 02309046 E; 23. 42563626 N 23084920 E; 24. 42565505 N 23085502 E; 25. 42563654 N 23084826 E; 26. 42565390 N 23091213 E; 27. 42564449 N 23090414 E; 28. 42571103 N 23091622 E; 29. 42571163 N 23091447 E.

Dates: 1, 2, 12, 20, 22 – 07.06.12; 3, 7, 13, 18, 24 – 19.06.12; 4, 5, 6, 9, 23, 25 – 20.06.12; 8, 17, 21, 26, 28, 29 – 22.06.12; 10, 11, 14, 15, 16, 19, 27 – 21.06.12.

Legend:

Geolegends: **Balkan** – Balkan endemic; **Boreal** – boreal; **Eur** – European; **Eur-As** – Euroasian; **Eur-Med** – Euro-Mediterranean; **Eur-Nam** – Euro-North American; **Eur-OT** – Euro-Orlando-Turanean; **Eur-Sib** – Euro-Siberian; **Eur-Submed** – Euro-submediterranean, **Kos** – Cosmopolitan; **Med** – Mediterranean; **Med-Cas** – Mediterranean-Central Asian; **Pont-Med** – Ponto-Mediterranean; **Pont-Pan** – Ponto-Pannonian; **Pont-Sib** – Ponto-Siberian; **Subboreal** – subboreal; **Submed-Cas** – Submediterranean-Central Asian; **Submed** – Submediterranean. **Plant life-forms:** **Ph** – Phanerophytes; **H** – Hemicryptophytes; **Cr** – Cryptophytes; **Th** – Therophytes.

Association *Eleochariti uniglumis-Caricetum distantis*

The alkaline fens include some plant communities of diverse origin, species composition and syntaxonomy, ranging from typically boreal peatlands to eutrophic ponds. Characteristically, these fens occupy the most humid areas in the Ranislavtsi Complex, where a layer of water stays after June.

This association is described in detail by Hajek & al. (2008). The diagnostic species are *Gratiola officinalis*, *Mentha aquatica*, *Eleocharis uniglumis*, *Potentilla reptans*, *Carex distans*, *Carex hirta*, and *Cirsium canum*. There are also significant rare, relict and protected species in the floristic structure of the association.

Marsh Lousewort (*Pedicularis palustris* L.) – this species is included in Annex 3 of the Biodiversity Act and in the new edition of the *Red Data Book of Bulgaria*; it is assessed as Critically Endangered (Ignatova 2011). The area of Ranislavtsi is one of the last localities of this species in Bulgaria, which has probably disappeared from most other localities. It occurs mainly in the composition of the association *Eleochariti uniglumis-Caricetum distantis*, but part of the population inhabits the wet meadows with the alliance *Molinion*.

Association *Caricetum distichae* Steffen 1931

The association is mentioned by Hajek & al. (2006). It consists of mono-dominant communities of *Carex disticha*, a rare species enlisted in Annex 2a of the Biodiversity Act.

Association *Caricetum acutiformis* Egger 1933

The associations *Caricetum distichae* and *Caricetum acutiformis* form a complex in the wettest part of the meadows complex, close to the road between the villages of Buchin Prohod and Tsruklevtsi. Only two relevés in an alkaline waterlogged swamp belong to this association, with *Carex acutiformis* as the dominant species. The total vegetation cover is 95-100%. The height of the herbaceous layer reaches up to 1.2 m. Such species as *Lysimachia vulgaris*, *Lathyrus palustris*, *Poa palustris*, *Caltha palustris*, *Phragmites australis*, *Pedicularis palustris*, *Galium album*, *Bistorta major*, *Lathyrus pratensis*, *Ranunculus acris*, *Serratula tinctoria*, *Stellaria graminea*, *Juncus articulatus*, and *Anthoxanthum odoratum* inhabit the phytocenoses of the association.

Their biological spectrum is represented mostly by hemicryptophytes (84%) and cryptophytes (16%). Analysis of the phytogeographic structure reveals the following floristic elements: Boreal – 16%, Euroasian – 37%, Mediterranean – 5%, Cosmopolitan – 16%, European – 5%, Subboreal – 11%, Ponto-Siberian – 5%, Eurosiberian – 5%.

The following conservation-significant species occur in the alkaline fens, which are concentrated in the northern part of the Complex near the road Tsruklevtsi – Buchin Prohod:

Marsh Pea (*Lathyrus palustris* L.) – this species is included in Annex 2a of the Biodiversity Act and the new edition of the *Red Data Book of Bulgaria*, vol. 1. *Plants and Fungi*; it is assessed as Critically Endangered (Tosheva & al. 2011). Its only confirmed locality in Bulgaria is in the Ranislavtsi area. It was found in the composition of the associations *Caricetum distichae* (Hajek & al. 2006) and *Caricetum acutiformis*.

Marsh Lousewort (*Pedicularis palustris* L.) – it also occurs in the floristic structure of the association.

Discussion

As a result of the phytosociological study in the Ranislavtsi Wet Meadows Complex, the following findings and conclusions can be formulated: 125 species and subspecies of plants were identified in the sample plots. Five of them have conservation significance – *Salix rosmarinifolia*, *Plantago maxima*, *Lathyrus palustris*, *Pedicularis palustris*, and *Galium boreale*; and tree are Balkan endemics – *Campanula sparsa*, *Lychnis flos-cuculi* ssp. *subintegra* and *Pastinaca hirsuta*.

A comparative analysis of the distribution of plant life-forms in the two major associations *Deschampsietum cespitosae* and *Junco effusii-Molinietum caeruleae* has shown similar spectra, with a significant prevalence of hemicryptophytes. The group of Euroasian floristic elements prevailed in both associations. The hay meadows are characterized by the presence of the Mediterranean-Central Asian, Submediterranean-Central Asian, Pontic-Mediterranean, and Balkan endemics. The percentage contribution of the boreal (13%), Euro-Mediterranean (14%), Euroasian (15%), Submediterranean (8%), and Eurosiberian (8%) elements was higher than in the wet meadows, respectively 12%, 12%, 13%, 7%, and 7%. In the meadows of *Junco-Molinietum*, the cosmopolitan (12%), subbo-

real (10%) and Mediterranean (5%) elements dominated. They were respectively 5%, 8% and 3% in the meadows, dominated by *Deschampsia cespitosa*. This corroborates the fact that the mesophilous meadows differ by higher regional specificity amongst the herbaceous communities in the area.

There are no data on the flora and vegetation of this place which would allow drawing of conclusions about the origin and dynamics of their historical succession. All information about the history of the flora and vegetation is indirect and based on their present state. There is no doubt that with such a set of boreal relicts in them the flora and vegetation has refugial character (Hájek & al. 2009). They are isolated sufficiently from their likes, which are in the high mountains to the north of the country. The nearest locality of *Plantago maxima* is outside the Balkans, close to Sibiu town, Romania (Schneider-Binder 1978). *Salix rosmarinifolia* was known only from the Choklyovo Mire in Bulgaria, where prior to anthropogenic interference the natural conditions were very similar to those in the Ranislavtsi locality (Yordanov 1931). The localities of *Pedicularis palustris* and *Lathyrus palustris* have also been isolated and distant from one another and also are refugial. As refugial should be considered too the localities of the following species, with numerous populations in the Ranislavtsi Complex: *Potentilla erecta*, *Iris sibirica*, *Gentiana pneumonanthe*, *Dianthus superbus*, *Sanguisorba officinalis*, *Filipendula ulmaria*, *Eriophorum latifolium*, *Blysmus compressus*, *Parnassia palustris*, *Epipactis palustris*, etc. They are found mainly in bogs and fens in the mountains of Bulgaria, mostly in the subalpine vegetation belt. Thus the main conclusion is in favour of the relict origin and, respectively, of the primary character of grasslands, especially in the Ranislavtsi Wet Meadows Complex and wetlands.

On the other hand, the active economic use – mainly for mowing – indicates a significant anthropogenic interference in the present state of vegetation. Presently, there exist some hygrophytic trees in the area, such as *Salix cinerea* and *Salix alba*. It can be assumed that vegetation in the lower part of the valley was a complex of riparian forests and wet meadows in the past. The latter have preserved these relict boreal species. The climatic and edaphic characteristics of the region – continental climate and peat soils – are also not very suitable even for the most water-loving trees. The trees and shrubs have been greatly reduced in the Complex

at least in the course of several decades, because of the regime of hay management of these meadows. The periodical and annual phytomass removal above ground (including shoots of trees and shrubs) may probably allow the expansion of the mesophilous meadows in the area, which have replaced the destroyed or degraded forest communities. It could be concluded with some probability that vegetation in the past had belonged to a complex of wet meadows, bogs and riparian forests. The drainage and haymaking had apparently induced the changes within and in the location of marshy pastures. The trees and shrubs had decreased, while the mesophilous meadows gradually expanded, especially in the drained and degraded areas. The current state of vegetation at the Ranislavtsi Complex results from a characteristic combination of natural conditions (boreal refugium) and continuing anthropogenic activity. The communities include relict species with limited ecological flexibility. The ecosystem of the Ranislavtsi grasslands maintains a fragile ecological balance that could be disrupted or even destroyed by any activities, including those aimed at long-term positive goals.

We suggest the following measures for the protection and restoration of the flora and vegetation of the Ranislavtsi wet meadows, adapted to the type of property and the way of use of the territory:

- Restoration of the water regime in the eastern part of the complex and monitoring of changes within the plant communities, of dominant and conservation-significant species.

- Setting apart of at least three sections of 1-2 acres, which should not be subjected to mowing for two consecutive years, and monitoring of changes in the vegetation and species populations in these areas. These areas must be in the moist and mesophilous meadows.

- Declaring the Ranislavtsi Complex a protected area. This will be difficult to achieve for the following reasons: the greatly fragmented ownership of grasslands, which are predominantly private and the LIFE project “Pilot network of small protected sites for plant species in Bulgaria using the plant micro-reserve model” of the Institute of Biodiversity and Ecosystem Research – BAS, which foresees small protected areas in the localities of *Plantago maxima* and *Lathyrus palustris*. It would be more appropriate to create a large protected area in the Complex so as to facilitate coordination of the restoration activities and management of the area.

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