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Dedicated to Prof. dr. LJUDEVIT ILIJANIĆ on the occasion of his 70th birthday.

Salt meadows of the Birjučij Island Spit, Azov Sea. Classes *Juncetea maritimi* and *Bolboschoenetea maritimi*

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Phytosociological and ecological characteristics of four salt meadow associations from the classes *Juncetea maritimi* and *Bolboschoenetea maritimi* of the Birjučij Island Spit (Azov Sea, Ukraine) are discussed. Two new syntaxa, the *Artemisio santonicae-Juncetum maritimi* and the *Tripolio pannonici-Caricetum extensae,* have been described from the area, together with two previously described syntaxa, the *Plantagini salsae-Juncetum maritimi* and *Tripolio vulgaris-Bolboschoenetum maritimi.*

Key words: *Juncetea maritimi, Bolboschoenetea maritimi,* phytosociology, plant ecology, Ukraine

Introduction

The results of phytosociological investigations into wet or waterlogged salt meadows belonging to the classes *Juncetea maritimi* and *Bolboschoenetea maritimi* are summarized in this paper. This vegetation was studied by Ukrainian and Czech geobotanists in 1991 and completed during recent Ukrainian research.

The area analyzed was a narrow spit in the NW part of the Azov Sea (Fig. 1), occasionally isolated from the mainland by high floods (for a description of the general characteristics of this area see DUBYNA et al. 1994). It was the centre of several botanical expeditions and intensive vegetation research in the 1980s and the beginning of the 1990s. The results of these investigations have been gradually published. In the foregoing studies attention was paid to coastal vegetation, sand steppes (DUBYNA et al. 1994, 1995) and salt meadows of the class *Festuco-Puccinellietea* (DUBYNA and NEUHÄUSLOVÁ 2000).

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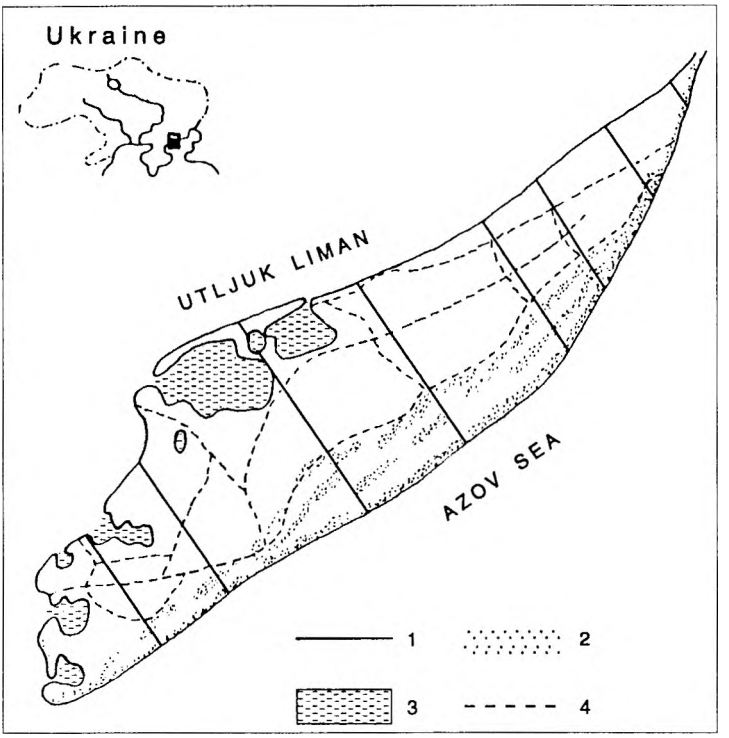

Fig. 1. Birjučij Island Spit. 1-Transects analyzed (from SW to NE), 2-Dunes, 3-Inlets, 4- Paths

Methods

The investigations were performed on transects running from NW to SE across the Spit. Relevés were analyzed and synthesized according to the principles of the Braun-Blanquet School (BRAUN-BLANQUET 1964).

Taxonomic nomenclature follows DOBROČAEVA et al. (1987). Names of syntaxa follow the Code of Phytosociological Nomenclature (BARKMAN et al. 1986). Vegetation units distinguished in this area have been compared with analogous syntaxa from adjoining or other European states (see References).

Location of the relevés

Artemisio santonicae-Juncetum maritimi - Birjučij Island Spit, profiles 1, 4–8, 20–30 m from the Utljuk Liman (Tab. 1).

Plantagini salsae-Juncetum maritimi - Birjučij Island Spit, profiles 4–8, 10–20 cm from the Utljuk Liman (Tab. 2).

Tripolio pannonici-Caricetum extensae - Birjučij Island Spit, profiles 3–6, depressions of the plains close to the Utljuk Liman (Tab. 3).

Tripolio vulgaris-Bolboschoenetum maritimi - Birjučij Island Spit, profiles 1–8, N part of the area near the Utljuk Liman (Tab. 4).

Results

Characteristics of the syntaxonomical units

Class: ***Juncetea maritimi*** Braun-Blanquet et al. 1952 em. Beefting 1965. South European moist to wet coastal meadows on weakly to moderately salinized soils

Order: ***Juncetalia maritimi*** Braun-Blanquet 1931 em. Beefting 1965. Salt meadows with a dominance of hemicryptophytes on periodically wet soils

Alliance: ***Limonio gmelinii-Juncion maritimi*** Golub et V. Solomacha ex Dubyna et Neuhäuslová all. nova hoc loco.

Nomenclatural type: *Plantagini salsae-Juncetum maritimi* Šeljag-Sosonko et V. Solomacha 1987.

Note: Since the alliance mentioned above was based on the invalidly described association *Juncetum maritimi* V. (Solomacha and Šeljag 1984), it was necessary to validate it here.

Association: ***Artemisio santonicae-Juncetum maritimi*** Šeljag-Sosonko, Neuhäuslová et Dubyna ass. nova hoc loco (Tab. 1, rels. 1–15).

Tab. 1. The *Artemisio santonicae-Juncetum maritimi* association

Relevé Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	%
Orientation	–	–	–	NW	NW	NW	NW	NW	NW	NW	NW	–	–	NW	NW	
Inclination	–	–	–	2	1	1	1	1	1	2	1	–	–	1	1	
Area analyzed (m^2)	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	
Total cover (%)	100	100	100	95	75	100	75	75	75	80	85	75	75	70	75	
Number of species	19	19	19	15	15	14	13	13	13	13	13	13	10	10	10	
D *Juncetea maritimi* and lower syntaxa																
Juncus maritimus Lam.	5	5	5	4	4	4	4	4	4	4	4	3	3	3	3	100
Agrostis maeotica Klokov	1	+	.	.	.	+	.	.	.	+	+	.	.	.	+	40
Carex distans L.	+	.	1	+	.	.	+	.	.	+	.	+	.	.	.	40
Carex extensa Good.	.	1	1	.	.	.	2	.	.	2	.	.	.	.	.	27
D *Festuco–Puccinellietea* and lower syntaxa																
Artemisia santonica L.	+	1	+	+	+	2	+	+	.	+	+	+	.	+	1	87
Aeluropus littoralis (Gouan) Parl.	1	+	+	+	1	+	+	+	+	1	1	.	+	.	.	80
Puccinellia gigantea (Grossh.) Grossh.	1	1	1	.	+	+	1	+	.	.	+	+	+	+	+	80
Juncus gerardii Loisel.	+	+	+	+	.	+	.	+	+	.	.	2	2	2	+	73
Limonium meyeri (Boiss.) O.Kuntze	+	+	+	.	.	.	+	.	.	+	.	1	+	+	.	53
Tripolium vulgare Nees.	2	.	.	+	2	+	.	1	+	.	2	+	.	.	.	53
Triglochin maritimum L.	.	+	.	+	.	.	.	+	+	+	+	.	.	.	.	40
Apera maritima Klokov	.	.	+	.	.	.	+	.	.	+	.	.	.	.	.	20
Taraxacum bessarabicum (Hornem.) Hand.-Mazz.	+	.	.	.	r	+	.	.	.	.	.	.	.	.	.	20
Plantago salsa Pall.	.	+	r	.	.	.	.	.	.	.	.	.	r	r	.	20

D *Bolboschoenetea* maritimi and lower syntaxa																	
Bolboschoenus maritimus (L.) Palla	+	+	.	+	+	2	.	+	+	.	+	.	.	.	.		53
Other accompanying species																	
Halimione pedunculata (L.) Aell.	+	+	.	+	+	+	.	2	+	+	+	+	+	+	+		87
Suaeda prostrata Pall.	+	+	+	.	+	+	.	1	+	.	.	+	+	+	+		73
Spergularia marina (L.) Griseb.	+	1	+	.	+	+	+	.	.	+	+	.	.	.	.		53
Salicornia perennans Willd.	+	.	+	2	2	.	.	3	2	.	2	1	.	.	.		53
Atriplex littoralis L.	.	.	.	.	+	.	1	+	+	+	.	.	+	+	.		47
Limonium caspium (Willd.) Gams	+	+	+	+	.	.	.	.	.	+	+	.	.	.	.		40
Atriplex prostrata Boucher	.	+	1	+	+	.	+	.	.	.	.	.	.	.	.		40
Elytrigia repens L.	.	+	.	+	.	+	.	.	+	.	.	+	.	.	+		40
Lepidium ruderale L.	.	+	+	.	.	.	+	.	.	.	.	+	.	.	+		33
Lepidium latifolium L.	.	.	.	+	+	.	.	+	+	.	+	.	.	.	.		33
Halimione verrucifera (Bieb.) All.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.		20
Salsola soda L.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.		20
Phragmites australis (Cav.) Trin.	1	.	1	+	.	.	.	.	.	.	.	.	.	.	.		20
Schoenoplectus lacustris (L.) Palla	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.		20
Cynanchum acutum L.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	.		20

In one relevé only: *Calystegia sepium* (L.) R.Br. (rel. 9: +), *Lactuca tatarica* (L.) C.A.Mey. (15: +).

Nomenclatural type: Tab. 1, rel. 6 (holotypus). Location: Birjučij Island Spit, transect 5, 30 m from the Utljuk Liman. Dubyna, September 1991.

Diagnostic species combination: *Juncus maritimus, Aeluropus littoralis, Agrostis maeotica, Artemisia santonica, Atriplex littoralis, Halimione pedunculata, Juncus gerardii, Puccinellia gigantea, Suaeda prostrata.*

Structure and floristic composition

This association is represented by dense stands dominated by *Juncus maritimus* together with a number of species characteristic of salt meadow and solonchak vegetation. Individual relevés contain 10–19 species. The total number of species in the stands analyzed was 32. Some stands are poor in species, a number are almost monospecific.

Habitat, distribution

Stands dominated by *Juncus maritimus* are quite typical of the investigated area. They are confined to depressions in level plains that are flooded for medium or long periods of time. The salinized soils are shelly-clay. Frequently, these phytocenoses represent ecological relics in areas flooded for a short time. The stands are relatively resistant to mowing, but become degraded under regimes of repeated harvesting. Where this takes place, the regradation of solonchaks and penetration of solonchak elements can be observed.

Economic importance

This association plays an important part in soil-fixing and coastal protection. In its early stage of development, the dominant species serves as wildlife fodder. The dense tussocks of *Juncus maritimus* are relatively impervious to the negative influence of trampling that is so obvious in other salt meadow communities, such as stands dominated by *Puccinellia gigantea* or *Bolboschoenus maritimus*. These dense *Juncus* stands provide habitat and/or shelter of numerous invertebrate colonies, and of small mammals. Drier sites serve as nesting areas for birds.

Association: *Plantagini salsae-Juncetum maritimi* Šeljag-Sosonko et V. Solomacha 1987 (Tab. 2, rel. 16–25)

Tab. 2. The *Plantagini salsae-Juncetum maritimi* association

Relevé Nr.	16	17	18	19	20	21	22	23	24	25	%
Orientation	W	W	W	W	W	NW	NW	NW	NW	W	
Inclination	1	1	1	1	1	1	1	1	1	1	
Area analyzed (m²)	80	80	80	80	80	80	80	80	80	80	
Total cover (%)	100	100	100	95	95	75	75	70	70	70	
Number of species	15	12	13	11	10	10	8	8	8	8	
D ass.											
Juncus maritimus Lam.	4	4	4	4	4	4	4	4	3	3	100
Plantago salsa Pall.	2	1	2	3	2	2	2	2	3	3	100
Suaeda prostrata Pall.	+	1	1	2	+	+	+	+	1	r	100
Carex extensa Good.	.	.	+	.	+	2	2	+	2	1	70
Agrostis maeotica Klokov	2	.	.	2	+	.	.	.	.	.	30
D *Festuco-Puccinellietea* and lower syntaxa											
Puccinellia gigantea (Grossh.) Grossh.	1	+	2	+	+	.	.	r	.	+	70
Tripolium vulgare Nees	.	1	+	+	.	.	+	+	.	+	60
Limonium meyeri (Boiss.) Kuntze	+	.	.	+	.	.	.	.	+	1	40
Aeluropus littoralis (Gouan) Parl.	+	.	.	+	.	.	.	.	+	+	40
Glaux maritima L.	.	+	+	.	.	.	+	.	.	.	30
D *Bolboschoenetea maritimi* and lower syntaxa											
Bolboschoenus maritimus (L.) Palla	.	1	1	.	1	+	.	.	.	.	40
Other accompanying species											
Salicornia perennans Willd.	.	2	+	1	+	+	1	.	.	.	60
Phragmites australis (Cav.) Trin. et Steudel	.	1	1	.	1	+	+	+	.	.	60
Limonium caspium (Willd.) Gams	.	2	+	+	.	+	.	.	.	.	40
Agrostis stolonifera L.	.	+	+	.	+	.	.	.	.	.	30
Atriplex prostrata Boucher	.	.	.	.	.	.	+	+	+	.	30
Spergularia marina (L.) Griseb.	+	.	.	.	.	+	.	.	.	.	20
Halimione verrucifera (Bieb.) Aell.	1	.	.	.	.	.	.	.	1	.	20
Halimione pedunculata (L.) Aell.	.	.	.	+	.	+	.	.	.	.	20

In one relevé only: *Artemisia santonica* L. (rel. 16:+), *Carex distans* L. (17:+), *Cirsium alatum* (S. G. Gmel.) Bobr. (16:+), *Cynanchum acutum* L. (16:+), *Elytrigia elongata* (Host) P. Beauv. (16:+), *Odontites salina* (Kotov) Kotov (18:+), *Salsola laricina* Pall. (16:+), *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz. (16:+).

Nomenclatural type: G.I. Bilyk in ŠELJAG-SOSONKO and V. SOLOMACHA (1987).

Diagnostic species combination: *Juncus maritimus, Agrostis maeotica, Carex extensa, Plantago salsa, Puccinellia gigantea, Suaeda prostrata*

Structure and species composition

Well-developed stands of this association are dominated by dense tussocks of *Juncus maritimus*. Stands are poor in species (8–15 species in the individual relevés). The total number of species in ten stands was 27. In comparison with the foregoing association, the species *Plantago salsa, Carex extensa* and *Phragmites australis* are frequent here, while *Aeluropus littoralis, Artemisia santonica, Juncus gerardii, Triglochin maritimum* and *Halimione pedunculata* are missing or relatively rare.

Habitat, distribution

Although the ecology of these stands is rather similar to that of the foregoing unit, the stands are frequently flooded for long periods. Such stands are relatively frequent in the area investigated.

Association: *Tripolio pannonici-Caricetum extensae* ass. nova hoc loco (Tab. 3, rels. 26–35)

Nomenclatural type: Tab. 3, rel. 29 (holotypus). Location: Birjučij Island Spit, transect 4. Dubyna and Neuhäuslová, September 1991.

Diagnostic species combination: *Carex extensa, Atriplex littoralis, Bolboschoenus maritimus, Limonium meyeri, Tripolium pannonicum.*

Structure and species composition

This association is dominated by *Carex extensa*, which forms dense populations of up to 1m in diameter. In these stands, species of wet salt meadows and those of other moist or wet sites, such as *Agrostis stolonifera, Atriplex littoralis, Bolboschoenus maritimus, Tripolium pannonicum* and *Juncus maritimus*, occur in abundance. The total number of species recorded in these stands was 26. Species numbers in individual stands varied from 9 to 14. In some places the stands are monospecific and formed solely by *Carex extensa*. Phytocoenoses occuring in depressions among dunes represent the ecological limits of this unit, and differ from typical stands in having denser cover and richness in species of typical and salt meadows.

Habitat, distribution

While the stands of this association are relatively common on the Spit, they are confined to relatively restricted areas (depressions in the plains) in the environs of Liman, where prolonged flooding is a feature. Less frequently, they occur in depressions between the dunes. They are confined to shelly-sandy soils with clay layers. The groundwater level fluctuates between 20 and 50 cm. The species *Carex extensa* is a good indicator of brackish water.

Tab. 3. The *Tripolio pannonici-Caricetum extensae* association

Relevé Nr.	26	27	28	29	30	31	32	33	34	35	%
Orientation	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	
Inclination	2	2	1	1	2	2	1	2	2	2	
Area analyzed (m^2)	80	80	80	80	80	80	80	80	80	80	
Total cover (%)	65	80	70	80	80	70	60	60	65	65	
Number of species	14	14	11	11	9	10	9	8	11	11	
D *Juncetea maritimi* and lower syntaxa											
Carex extensa Good.	3	3	3	3	3	3	3	3	2	2	100
Tripolium pannonicum (Jacq.) Dobroc.	3	3	3	3	.	.	.	.	+	+	60
Juncus maritimus Lam.	+	+	+	.	.	.	.	.	.	.	30
D *Bolboschoenetea maritimi*											
Bolboschoenus maritimus (L.) Palla	+	.	+	+	2	.	+	+	+	+	80
D *Festuco-Puccinellietea* and lower syntaxa											
Limonium meyeri (Baiss.) O.Kuntze	+	1	+	.	2	2	.	.	+	+	70
Puccinellia gigantea (Grossh.) Grossh.	+	+	+	+	.	.	.	.	+	+	60
Tripolium vulgare Nees.	.	+	.	.	1	1	.	.	2	2	50
Artemisia santonica L.	.	.	.	+	1	1	+	+	.	.	50
Glaux maritima L.	+	+	+	+	.	.	.	.	.	.	40
Elytrigia elongata (Host) Nevski	.	.	.	.	+	+	.	.	+	+	40
Apera maritima Klokov	+	+	.	.	.	+	.	.	.	.	30
Aeluropus littoralis (Gouan) Parl.	.	+	.	.	.	.	.	.	1	.	20
Plantago salsa Pall.	.	.	.	.	.	.	.	.	2	2	20
Other accompanying species											
Atriplex littoralis L.	+	+	+	.	+	+	+	.	.	+	70
Agrostis stolonifera L.	.	.	+	3	+	.	+	3	.	+	60
Salicornia perennans Willd.	+	+	.	.	+	+	.	.	+	+	60
Lactucata tatarica (L.) C.A.Mey.	+	+	+	.	.	.	.	.	.	.	30
Althaea officinalis L.	+	.	+	+	.	.	.	.	.	.	30
Lepidium latifolium L.	.	.	.	+	.	.	+	2	.	.	30
Poa angustifolia L.	.	.	.	+	.	.	+	+	.	.	30
Suaeda prostrata Pall.	1	+	.	.	.	.	.	.	.	.	20
Spergularia marina (L.) Griseb.	+	+	.	.	.	.	.	.	.	.	20
Althaea officinalis L.	+	.	.	+	.	.	.	.	.	.	20
Cynanchum acutum L.	.	.	.	.	.	+	+	.	.	.	20
Limonium caspium (Willd.) Gams	.	.	.	.	.	+	.	+	.	.	20

In one relevé only: *Juncus gerardii* Loisel. (rel.33: +), *Phragmites australis* (Cav.) Trin. ex Steud. (32: 1).

Economic importance

The stands of *Carex extensa* play an important part in the economy of the Spit. In addition to their shore- and soil-protecting functions they are of great importance in providing wildlife fodder. In the early stage of development, *Carex extensa* serves as food for domestic animals (BILYK 1963). Under intensive graz-

ing this species disappears. The stands of *Carex extensa* harbour many small invertebrates, birds and mammals.

Class: ***Bolboschoenetea maritimi*** Vicherek et R. TX. 1969 ex R. TX. et Hülbusch 1971. Meadow communities of periodically flooded, moderately nutrient-rich soils

Order: ***Bolboschoenetalia maritimi*** Hejný in Holub et al. 1967. Reed communities of brackish and alkaline waters

Alliance: ***Scirpion maritimi*** Dahl et Hadač 1941. Reed communities of brackish and alkaline waters in sites with fluctuating water level

Association: ***Tripolio vulgaris-Bolboschoenetum maritimi*** Šeljag-Sosonko et V. Solomacha 1987

Original diagnosis: ŠELJAG-SOSONKO and V. SOLOMACHA (1987: 16)

Nomenclatural type: V. SOLOMACHA in ŠELJAG-SOSONKO and V. SOLOMACHA (1987: 16).

Diagnostic species combination: *Bolboschoenus maritimus, Aeluropus littoralis, Halimione pedunculata, Salicornia perennans, Spergularia marina, Suaeda prostrata, Tripolium vulgare.*

Structure and species composition

The stands of this association are formed by a well-developed herb layer differentiated in three sub-layers. The upper sub-layer determining the physiognomy of the stands is dominated by *Bolboschoenus maritimus*, which grows to heights ranging from 100 cm to 120 cm. Cover of *B. maritimus* is usually moderately dense. Stands are relatively poor in species (9 to 15 species per relevé). Species of the family *Cyperaceae*, the grasses *Elytrigia elongata, E. repens, Phragmites australis* and *Puccinellia gigantea,* together with *Juncus maritimus* are frequent in this sub-layer. In the middle sub-layer (c. 40 cm to 60 [70] cm high) species of the *Chenopodiaceae (Atriplex littoralis, Suaeda prostrata, Salicornia perennans, Salsola soda)* together with *Tripolium vulgare,* which is occasionally sub-dominant, the grasses *Agrostis stolonifera, Aeluropus littoralis,* and *Lepidium latifolium* determine the physiognomy. The lowermost sub-layer, which does not exceed 30 cm, is only weakly developed and formed mainly by *Spergularia marina* or *Ambrosia artemisifolia.* Since *Bolboschoenus maritimus* is regularly grazed by deer or horned cattle, phytocoenoses of this association are often markedly disturbed and frequently represented by species-poor stands where the dominant *B. maritimus* is associated with sporadic occurrences of *Calamagrostis epigeios, Aeluropus littoralis, Agrostis stolonifera, Elytrigia repens* and *Phragmites australis.* Some stands are formed only by the dominant species.

Habitat, distribution

This association belongs to the rare syntaxa on the Spit. It is mainly found on clay-sandy sediments in the coastal zone that is permanently flooded by 30 cm to 40 cm of water. It occurs more frequently on plains that are flooded for prolonged periods and sporadically on sites that are flooded for short periods.

Tab. 4. The *Tripolio vulgaris-Bolboschoenetum maritimi* association

Relevé Nr.	36	37	38	39	40	41	42	43	44	45	46	%
Orientation	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	
Inclination	1	1	1	1	1	1	1	1	1	1	1	
Area analyzed (m^2)	80	80	80	80	80	80	80	80	80	80	80	
Total cover (%)	70	60	60	50	50	45	55	80	45	55	45	
Number of species	15	13	13	12	12	11	11	10	10	9	9	
D ass.												
Bolboschoenus maritimus (L.) Palla	3	2	3	2	3	2	2	4	2	3	2	100
Tripolium vulgare Nees	+	+	+	+	.	+	2	+	2	+	2	91
D *Festuco-Puccinellietea* and lower syntaxa												
Aeluropus littoralis (Gouan) Parl.	+	1	+	2	+	+	+	2	+	+	+	100
Puccinellia gigantea (Grossh.) Grossh.	+	.	+	1	.	.	.	1	.	.	.	36
Elytrigia elongata (Host) Nevski	+	.	+	.	.		+	.	+	.	.	36
Triglochin maritimum L.	3	.	3	.	.	.		1	.	.	.	27
Juncus gerardii Loisel.	+	.	+	.	.	+	+	.	.	.	.	18
Apera maritima Klokov	.	.	.	.	.	.	+	.	.	.	+	18
D *Juncetea maritimi*												
Juncus maritimus Lam.	.	.	.	.	.	+	.	.	.	+	+	27
Other accompanying species												
Suaeda prostrata Pall.	+	2	1	1	2	2	+	+	+	2	+	100
Salicornia perennans Willd.	1	1	1	+	1	+	+	+	+	+	+	100
Spergularia marina (L.) Griseb.	+	+	.	+	+	+	+	+	+	+	+	91
Halimione pedunculata (L.) Aell.	+	+	+	+	+	+	.	.	+	.	.	64
Lepidium latifolium L.	+	+	+	+	+	.	+	.	.	.	.	55
Agrostis stolonifera L.	.	+	.	.	+	+	2	+	+	+	+	55
Elytrigia repens (L.) Nevski	+	+	+	.	.	.	+	.	+	.	.	46
Calamagrostis epigeios (L.) Roth	+	.	+	.	.	.	.	+	.	.	.	27
Atriplex littoralis L.	.	+	.	+	.	+	.	.	.	.	.	27
Phragmites australis (Cav.) Trin.	.	.	.	+	.	+	.	.	.	+	.	27
Cynanchum acutum L.	+	+	+	.	.	.	.	.	.	.	.	18
Ambrosia artemisiifolia L.	.	+	.	.	+	.	.	.	.	.	.	18

In one relevé only: Halimione verrucifera (Bieb.) Aell. (rel. 40: +), Halocnemum strobilaceum (Pall.) Bieb. (39: +), Plantago cornuti Gouan (40: +), P. salsa Pall. (43. +), Salsola soda L. (40: +).

Economic importance

Phytocoenoses of this association play an important role on the Spit: *Bolboschoenus maritimus* contributes to shore and soil protection, colonizing newly forming sites in the shallow waters of the coastal zone. In addition to this protecting function, stands of *Bolboschoenus maritimus* are of considerable importance as a fodder source for deer and cattle and as a refuge for many small animals (rodents, birds and invertebrates). In sites that are sheltered from strong winds these stands provide nesting sites for some water birds.

Discussion

Although communities of the *Juncetea maritimi* and *Bolboschoenetea maritimi* have been relatively frequently studied both in the (sub)Atlantic area of Europe (cf. TÜXEN 1971, 1973, SCHAMINÉE et al. 1998) and in (sub)continental SE Europe (cf. BILYK 1937, 1963, GOLUB et SOLOMACHA 1988, SOLOMEŠČ et. al. 1988, SOLOMACHA et al. 1995, SOLOMACHA 1996, SOÓ 1968, VICHEREK 1971), there are still many places where new syntaxa of these classes can be found, for example on geographically isolated islands and spits.

Some eponymous species forming wet or waterlogged salt meadows in the Birjučij Island Spit, also occur frequently in vegetation units of W Central, W and SW Europe, for example *Bolboschoenus maritimus, Carex extensa* and *Juncus maritimus*. However, the total floristic composition of these mostly (sub)Atlantic communities is markedly different. So for example, *Carex extensa* is a diagnostic species of the *Junco-Caricetum extensae* Braun-Blanquet et De Leeuw 1936 or the *Juncus maritimus-Carex extensa* community Bolos et al. 1970 (cf. TÜXEN 1973). The Pontic-Pannonian species typical of the Ukrainian *Tripolio pannonici-Caricetum extensae* are missing there. On the contrary, many elements of W European communities do not occur in the Ukrainian stands (e.g. *Carex punctata, Parapholis strigosa, Armeria maritima, Blysmus rufus,* etc.).

SOÓ (1957), in his survey of Pannonian vegetation, described the *Bolboschoenetum maritimi continentale* (invalid name!) from SE Europe as a unit analogous to W European communities dominated by *Bolboschoenus maritimus*. VICHEREK (1973) has analyzed the differences from analogous W European stands: occurrence of species of Irano-Turanian salt steppes and semi-deserts, such as *Halimione verrucifera* and *Limonium caspium*, and the presence of many, mostly E Mediterranean halophytes, such as *Aeluropus littoralis, Salicornia perennans* and *Suaeda prostrata* typifying the SE European stands. In the area investigated, these species occur in salt communities of several classes, for example the *Bolboschoenetea, Juncetea maritimi, Festuco-Puccinellietea* and *Salicornietea fruticosae*. The floristic and ecological differences between the Ukrainian and W European *Bolboschoenus* communities show, that the inclusion of all these communities in the single alliance *Scirpion maritimi* Dahl et Hadač 1941 is very problematic. However, the classification of higher syntaxa should await a large pan-European synthesis.

Summary

Salt meadows from the classes *Juncetea maritimi* and *Bolboschoenetea maritimi* have been described from the Birjučij Island Spit, South Ukraine. Four associations have been distinguished:

1. *Artemisio santonicae-Juncetum maritimi* Šeljag-Sosonko, Neuhäuslová et Dubyna in Dubyna et Neuhäuslová, covering plain depressions near the Utljuk Liman, which are flooded for medium to long periods.

2. *Plantagini salsae-Juncetum maritimi* V. Solomacha in Šeljag-Sosonko et V. Solomacha 1987 on relatively similar habitats, which are flooded for long periods.
3. *Tripolio pannonici-Caricetum extensae* Dubyna et Neuhäuslová, dominated by *Carex extensa,* with a frequent occurrence of *Tripolium pannonicum* on shelly-sandy soils with prolonged floods.
4. *Tripolio vulgaris-Bolboschoenetum maritimi* Šeljag-Sosonko et V. Solomacha 1987, dominated by *Bolboschoenus maritimus,* on clay-sandy sediments in the coastal zone that are permanently flooded.

The classification of higher syntaxa (alliances to classes) needs revision on the basis of a pan-European synthesis.

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