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A Mediterranean element of the vegetation: *Junco maritimi-Cladietum marisci* – a new association for Ukraine

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Key words: *Cladium mariscus* communities, associations, marshland, swamp, Europe, *Junco maritimi-Cladietum marisci*.

Ključne besede: združbe z vrsto *Cladium mariscus*, asociacije, mokrišče, močvirje, Evropa, *Junco maritimi-Cladietum marisci*.

Abstract

Cladium mariscus (L.) Pohl (Cyperaceae) is a rare species in Europe considered by several authors to be a relict of the early Holocene period. It is listed in the Red Data Book of Ukraine, Annexes of the Habitat Directive and the Bern Convention. Communities with domination of this species are included in the Green Data Book of Ukraine. Substantial differences in major ecological factors for *Cladium mariscus* communities in the western (carbonate bogs) and the southern (marshes and floating swamps of the northern Black Sea) regions of Ukraine were shown. The author carried out comparisons of relevés characterizing different communities with *Cladium mariscus* within Europe. Based on the results of TWINSPAN analysis, four associations were identified, confirmed by floristic indices and ecological data: *Cladietum marisci* Allorge 1921, *Soncho maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Cirujano 1980, *Dorycnio recti-Cladietum marisci* Gradstein & Smittenberg 1977 and *Junco maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Géhu & Biondi 1988. Thus, in addition to the association *Cladietum marisci*, a new one was indicated for Ukraine, *Junco maritimi-Cladietum marisci*.

Izvleček

Cladium mariscus (L.) Pohl (Cyperaceae) je v Evropi redka vrsta in številni avtorji jo uvrščajo med relikte iz zgodnjega holocena. Uvrščena je na rdeči seznam Ukrajine, Habitatno direktivo in Bernsko konvencijo. Združbe, v katerih je vrsta dominantna, so uvrščene na zeleni seznam Ukrajine. Med združbami z vrsto *Cladium mariscus* v Ukrajini obstajajo znatne razlike v rastiščnih dejavnikih med zahodnimi (karbonatna barja) in južnimi (mokrišča in plavajoča močvirja ob severnih obalah Črnega morja) regijami. Avtorica je naredila primerjavo vegetacijskih popisov različnih združb s to vrsto v Evropi. Na osnovi rezultatov TWINSPAN analize je ugotovila štiri asociacije, ki jih je potrdila s florističnimi indeksi in ekološkimi podatki: *Cladietum marisci* Allorge 1921, *Soncho maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Cirujano 1980, *Dorycnio recti-Cladietum marisci* Gradstein & Smittenberg 1977 in *Junco maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Géhu & Biondi 1988. Ugotovila je tudi, da v Ukrajini poleg asociacije *Cladietum marisci* obstaja tudi asociacija *Junco maritimi-Cladietum marisci*.

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Introduction

The genus *Cladium* P. Browne comprises 3 species which are typical for temperate, subtropical and partly tropical regions (Plants of world…, 2020). One of them is *C. mariscus* (L.) Pohl, distributed in Eurasia and accepted in the wide sense to consist of an uncertain number of infraspecific taxa. In Ukraine, two species from this genus (*C. mariscus* (L.) Pohl and *C. martii* (Roem. et Schult.) K. Richt.) are indicated by I. M. Danylyk (Danylyk 2011, 2012). The key for their determination proposed by Danylyk was compiled from T. V. Egorova`s paper (1976), who accepted these taxa at subspecies level as *C. mariscus* subsp. *mariscus* and *C. mariscus* (L.) Pohl subsp. *martii* (Roem & Schult.) T.V. Egorova.

The latter subspecies has actually been described from Spain as *Isolepis martii* Roem. et Schult. (Egorova 1976). Tzvelev (1966) advanced the idea of a divided area of the genus *Cladium* in view of the evolutionarily younger *C. mariscus* represented in Europe. The areas of distribution of two older close species, *C. grossheimii* Pobed. and *C. medwedewii* (Meinsh.) Grossh., are situated along the Black Sea (Ukraine, Abkhazia) and near the Caspian Sea (Azerbaijan, Iran), respectively. Both these species are confined to coastal areas (Tzvelev 1966), but now they are mainly synonymized with *C. mariscus* subsp. *martii* which some other authors have considered to be a synonym of *C. mariscus* subsp. *mariscus* (Castroviejo et al. 2007, Verloove 2012).

According to the Red Data Book of Ukraine, *C. mariscus* is protected on the territory of Shatsk National Nature Park in the Volyn region and *C. mariscus* ssp. *martii* – in "Dzharylhatskyi" National Nature Park in the Kherson region (Andrienko et. al. 2009). In the Green Data Book of Ukraine, the communities of "*Cladieta marisci*" (association *Cladietum* (*marisci*) *phragmitosum* (*australis*), *Cladietum marisci* purum, *Cladietum* (*marisci*) *caricosum* (*acutiformis*), *Cladietum* (*marisci*) *schoenosum* (*ferruginei*) (Andrienko-Malyuk & Dubyna 2009) are indicated. *Cladium mariscus* has had the status of a relict species confirmed by various palaeoecological studies (Pokorný et al. 2010, Gałka & Tobolski 2012, Hájková et al. 2013).

In addition to the inconsistency of taxonomical status of *Cladium mariscus*, there are several problems with the syntaxonomy of its communities in Ukraine. This species is diagnostic for the association *Cladietum marisci* Allorge 1921 (Allorge 1921, Dengler et al. 2004). Currently, two isolated fragments of this species distribution are known from the territory of Ukraine – in western regions on calcareous fens and in southern regions on salt depressions between dune slacks. I therefore decided to compare the existing relevés from different locations in Ukraine with a protologue to discover significant differences based on ecological factors. There have previously been suggestions for classifying variants based on various ecological factors (Buczek 2005, Borsukevych 2008). However, these data concern only western Ukrainian communities on calcareous fens and peatlands.

The main objective was to conduct syntaxonomic analysis of Ukrainian plant communities dominated by *Cladium mariscus* and compare them with similar ones from other European regions. In addition, the author attempted to study the features of ecological differentiation for these communities and to find differences in their floristic composition.

Material and methods

The studied area

The research territory was "Dzharylhatskyi" National Nature Park located in the southern part of Ukraine. This area includes the island of Dzharylhach in the Black Sea and continental areas, which are mainly represented by forest cultures and ruderal plant communities. The island of Dzharylhach is 42 km long, 4.6 km at its widest (Ardamatskaya et al. 2000). This island is an elevated sand-shell spit formed at the beginning of the Quaternary period by the accumulation of bottom sediments (Ardamatskaya et al. 2000). Between 700 and 1700 years ago, it was the eastern part of a single spit Dzharylhach-Tendra (Pravotorov 1967). The most represented soil types are sands and salt soils. The main climatic features are a predominance of eastern and north-eastern winds, relatively low humidity of the air, low cloudiness, slight precipitation and relatively large daily and annual amplitudes of air temperature fluctuations. The territory is located in the zone of hot-summer humid continental climate (Peel et. al. 2007). The average annual air temperature is + 10 °C. The lowest temperatures are observed in January (average monthly temperature -2.6 °C) and the highest values are recorded in July (+22.9 °C). Usually 270–345 mm of precipitation falls annually (Ardamatskaya et al. 2000, Shaposhnikova 2017).

There is only one type of vegetation in the studied area according to the Map of the Natural Vegetation of Europe – western and central Pontic desert steppes (Bohn et al. 2004).

Dataset

We used 172 relevés made by different authors according to the Braun-Blanquet approach (Braun-Blanquet 1964, Westoff & van der Maarel 1973) for critical analysis and

Figure 1: Map of the research area: A – general location in eastern Europe, B – location within the southern part of Ukraine (green points – localities of *Cladium mariscus*).
Slika 1: Zemljevid raziskovanega območja: A – splošna lokacija v vzhodni Evropi, B – lokacija v južnem delu Ukrajine (zelene točke – lokacije vrste *Cladium mariscus*).

construction of the classification scheme. Six of them were made by the author on the research territory and five of them are unpublished relevés from Dzharylhach island by D. V. Dubyna. Other relevés were published in various papers and were carried out in other regions: 12 – in the western region of Ukraine (Datsyuk & Andrienko 2013, Chorna 2013) and 151 – in other countries of Europe: Great Britain (Wheeler 1980: 1 relevé), Greece (Theocharopoulos et al. 2006: 18), Croatia (Stančić et al. 2010: 15), Crete (Gradstein & Smittenberg, 1977: 14), France (Allorge 1921: 1), Hungary (Lájer 2006: 6), Ireland (Mooney & O'Connell 1990: 14), Italy (Biondi et al. 2006: 11, Taffetani 2011: 2, Lastrucci et al. 2017: 8, eVeg (Géhu & Biondi 1988): 5, eVeg (Géhu & Biondi 1994): 1), Netherlands (Verhoeven 1992: 19), Poland (Buczek 2005: 18), Spain (Braun-Blanquet & de Bolos 1957: 5, Cirujano 1980: 5, Rivas-Martínez et al. 1980: 5, Conesa 1991: 2), Switzerland (Dengler et al. 2004: 1) (Table 3, 4).

Data analysis

The classification of the vegetation was conducted by Modified TWINSPAN (Roleček et al. 2009), implemented in the software package JUICE 7.0.102 (Tichý 2002).

To clarify the limiting ecological factors, statistical analysis in the STATISTICA 7.0 software package and JUICE was used. In order to assess the impact of ecofactors and relationship of communities to the main ecological factors, a method of synphytoindication was used with the calculation for each species of vascular plants in all communities (Didukh 2011). Ellenberg indicator values were used for this purpose (Ellenberg et al. 1991). For each species in the relevés, quantitative (point) indicators are calculated for the six most important environmental factors.

The world map of Köppen-Geiger climate classification (Peel et. al. 2007) was used for the confirmation of the association distribution depending on temperature.

The combined synoptic table shows the combination of percentage frequency and modified fidelity index phi coefficient (Tichý 2002). The table shows species with phi values of frequency over 10. The phi fidelity index was used for diagnostic species identification. Non-essential values of fidelity (less than 0.001) were removed on the basis of Fischer's exact test. The fidelity threshold for the allocation of diagnostic species is at least 25%, for highly diagnostic species – 50%.

The Czekanowski-Sørensen coefficient was used for the calculation of floristic similarity:

$$Ksc = \frac{2c}{a+b},$$

where a – number of species in first community; b – number of species in second community; c – number of species common to the two communities. The limit values of

this factor are from 0 to 1, Ksc = 1 absolute coincidence of floristic lists, Ksc = 0 they have no common species.

The Stugren-Radulescu coefficient of species composition similarity is calculated by the formula

$$Ksr = \frac{a+b-3c}{a+b+c}.$$

This coefficient ranges from -1 to +1, the range from 1 to 0 indicates a similarity, the range from 0 to +1 – shows a difference of floristic lists (Kostina 2013).

For comparison, I analyzed floristic lists (only the species composition) from the relevés and identified clusters based on floristic composition.

The names of syntaxa were used in accordance with the International Code of Phytosociological Nomenclature (Weber et al. 2000). The higher syntaxonomic units are given in the latest prodromes of Europe (Mucina et al. 2016) and Ukraine (Dubyna & Dziuba 2019). Names of vascular plant species are used in accordance with the recent Ukrainian nomenclatural checklist (Mosyakin & Fedoronchuk 1999). Only some plant names with doubtful taxonomical status are cited with reference to the relevant sources (e.g. Mavrodiev et al. 2015). The names of the species in the synoptic table are given in accordance with the authors of the original works.

Results and Discussion

Cladium in Europe: two species or one?

Cladium mariscus and *C. martii* are morphologically very similar species. Their main features are: *C. martii* – broad panicle with diffused strongly branched lateral inflorescences, up to 20 cm in length with numerous elongated twigs, diffused clusters with 3–7(10) spikelets; *C. mariscus* – narrow and compact inflorescence with 5–20(30) spikelets aggregated into dense clusters (Egorova 1976, Danylyk 2011, 2012) (Figure 2).

Both *C. mariscus* and *C. martii* are geographically isolated so they may be treated as subspecies of *C. mariscus*. However, our field studies did not confirm a clear geographical correlation with morphological features in *Cladium mariscus* populations. For example, photographs 1 and 2 were taken on Dzharylhach Island (Ukraine) in different locations about 1200 m apart. Photo 3 was taken in the Lviv region at the same time. According to the current determination keys (Egorova 1976, Danylyk 2011, 2012), plants from photographs 2 and 3 should be treated as *C. mariscus* subsp. *mariscus* and the plant from photograph 1 – as *C. martii* or *C. mariscus* subsp. *martii*.

Figure 2: Morphological differences between *Cladium mariscus* and *C. martii* (from Egorova 1976, modified by the author): 1 – *C. mariscus*: 1a – spikelet, 1b – fruit, 2 – *C. martii.*

Slika 2: Morfološke razlike med vrstama *Cladium mariscus* in *C. martii* (iz Egorova 1976, spremenjeno): 1 – *C. mariscus*: 1a – klasek, 1b – plod, 2 – *C. martii.*

In addition, herbarium specimens in KW, KWHA and MW from Germany, Italy, Poland, Czech Republic, Latvia, Estonia, Lithuania, Ukraine, Russian Federation, Belarus, Kazakhstan, Kyrgyzstan, Turkey, Azerbaijan and Georgia were analyzed and a similar situation was found: in many different locations both morphotypes ("southern" with diffused inflorescences – *Cladium martii*-morphotype – and "western" with compact inflorescences – *Cladium mariscus*-morphotype) were identified. Based on these data, I treat *Cladium mariscus* as one polymorphic species and accept it in the wide sense to include *C. martii* as a heterotypic synonym of *C. mariscus*. This solution has also been confirmed by several other authors (Castroviejo et al. 2007, Verloove 2012).

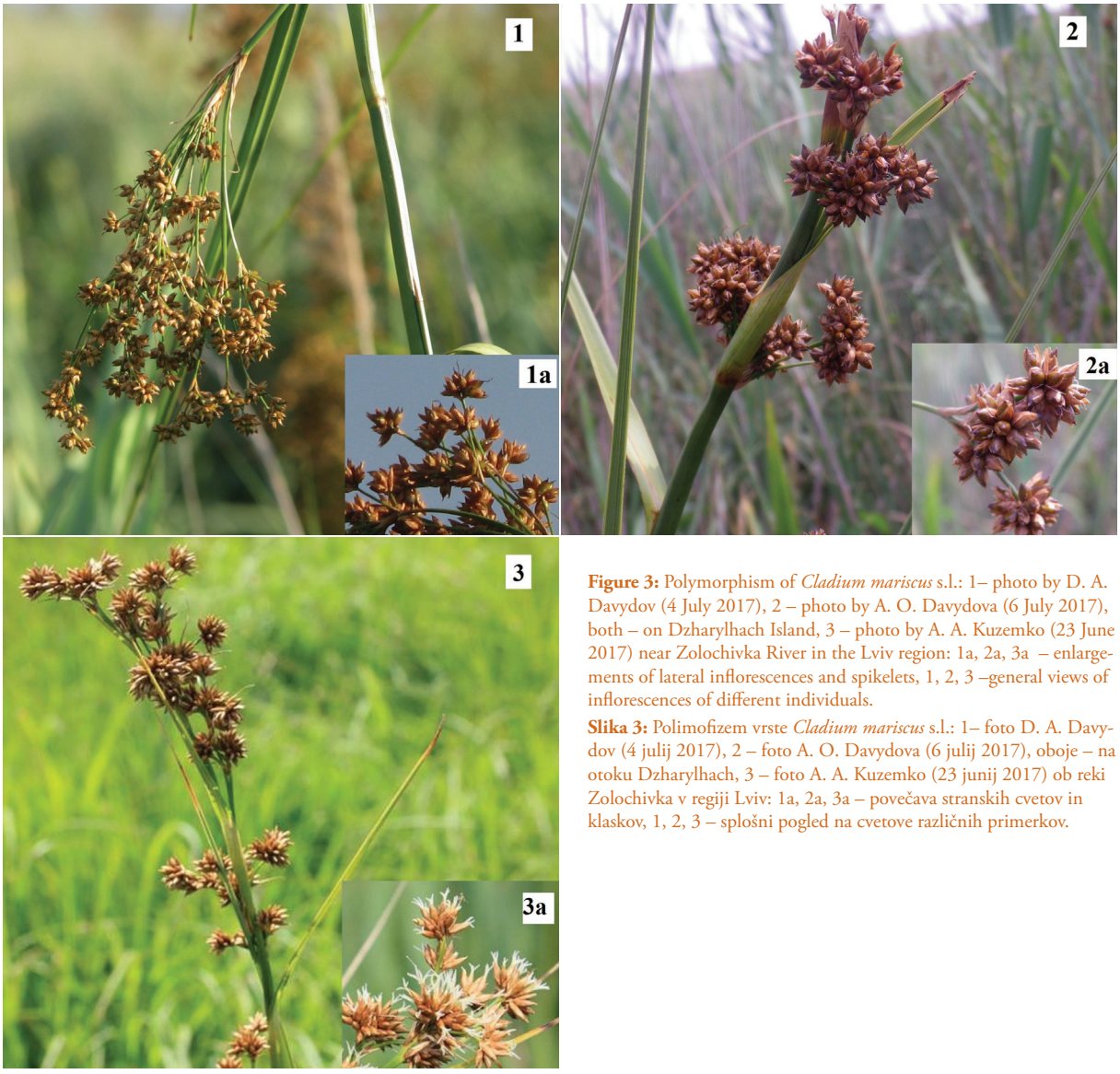

Figure 3: Polymorphism of *Cladium mariscus* s.l.: 1– photo by D. A. Davydov (4 July 2017), 2 – photo by A. O. Davydova (6 July 2017), both – on Dzharylhach Island, 3 – photo by A. A. Kuzemko (23 June 2017) near Zolochivka River in the Lviv region: 1a, 2a, 3a – enlargements of lateral inflorescences and spikelets, 1, 2, 3 –general views of inflorescences of different individuals.

Slika 3: Polimofizem vrste *Cladium mariscus* s.l.: 1– foto D. A. Davydov (4 julij 2017), 2 – foto A. O. Davydova (6 julij 2017), oboje – na otoku Dzharylhach, 3 – foto A. A. Kuzemko (23 junij 2017) ob reki Zolochivka v regiji Lviv: 1a, 2a, 3a – povečava stranskih cvetov in klaskov, 1, 2, 3 – splošni pogled na cvetove različnih primerkov.

Communities with Cladium mariscus in Ukraine

Cladium mariscus is distributed on calcareous wetlands in western Ukraine and on the banks of freshwater and salty reservoirs of the northern Black Sea Coast (Andrienko-Malyuk & Dubyna 2009). Based on the differences in ecological conditions of these communities, it would be logical to ensure that it is correct to merge relevés into the same association.

Figure 4: A general view of *Cladium mariscus* communities on Dzharylhach Island (photo by A. O. D avydova).
Slika 4: Videz združbe z vrsto *Cladium mariscus* na otoku Dzharylhach (foto A. O. Davydova).

Cladium mariscus was found by the author in 6 locations (Figure 1) in the central part of Dzharylhach Island. The relevés were made mainly in dune slack habitats, with only a few locations being situated near lakes.

At the first stage, the author analyzed published data devoted to the syntaxonomy of *Cladium mariscus* communities in Ukraine (Dubyna et al. 2004, Yaschenko & Turich 2007, Borsukevych 2008, Kuzyarin & Zhizhin 2008, Datsyuk & Andrienko 2013, Chorna 2013) and compared the floristic composition with the data of the original relevé of the association *Cladietum marisci* (Allorge 1921). The floristic composition was identified for all relevés (from western to southern regions) (species occurring in >50% of relevés): *Cladium mariscus*, *Phragmites australis*, *Lycopus europaeus*, *Lythrum salicaria*, *Mentha aquatica*. So-called "vikarians" were established for the western and southern locations: *Schoenus ferrugineus* and *S. nigricans*, a group of freshwater sedges (*Carex acutiformis*, *C. nigra*, *C. spicata*) and a group of sedges on salt areas (*C. extensa* and *C. distans*). The common species from the original relevés (Allorge 1921) and the data from Ukraine are *Eupatorium cannabinum*, *Molinia caerulea*, *Ranunculus lingua*, *Schoenoplectus tabemaemontani*.

Comparison of Ukrainian and European communities

The authentic *Cladietum marisci* relevés were carried out in the north-western part of France, on the limestone plateau on the right bank of the Seine (Allorge 1921). Accordingly, the protologue of this syntaxon refers to continental freshwater habitats, not coastal areas, which differ in both ecological conditions and floristic composition. The group of coastal *Cladietum marisci* relevés is characterized by poor species composition, lacking a moss layer and the presence of halophytic species.

The next step was therefore to create a database of vegetation relevés with *Cladium mariscus*. It included selected relevés from various publications and represented by various associations, subassociations and variants with domination of *Cladium mariscus*. Twenty-two floristic lists from Europaean communities with *C. mariscus* were analysed in STATISTICA and three large clusters were identified combining similar floristic lists: cluster A (freshwater and mostly flooded communities with a large number of aquatic species and mosses, *Cladietum marisci* sensu stricto); cluster B (communities with low salinization, *Soncho maritimi-Cladietum marisci*) and cluster C (more salinized communities, *Junco maritimi-Cladietum marisci*) (Figure 5).

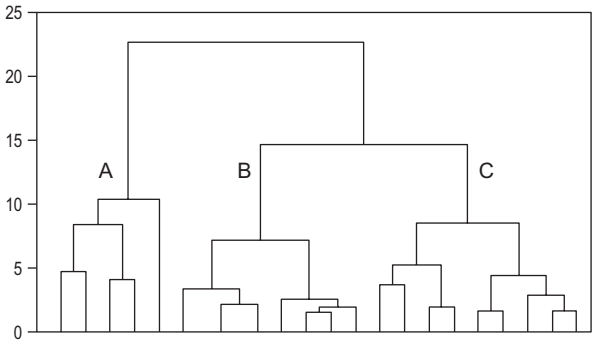

Figure 5: Dendrogram based on floristic lists of communities with *Cladium mariscus* as dominant species: A – communities with a large number of aquatic species and mosses; B – communities with low salinization, C – more salinized communities.

Slika 5: Dendrogram na osnovi florističnih popisov združb z dominantno vrsto *Cladium mariscus*: A – združbe z velikim številom vodnih vrst; B – združbe z manjšo slanostjo, C – združbe na bolj slanih rastiščih.

At the lower levels, the clusters were distributed with an aberration: each of three large clusters has uncharacteristic inclusions of untypical communities, since the distribution of the floristic lists was calculated by Euclidean distances, Ward's method, which provides an accurate distribution at the highest levels. However, since the main task was to re-distribute the array of floristic data, the author focused on the allocation of three main clusters.

The next step was to apply the modified TWINSPAN algorithm for the allocation of individual clusters of relevés (Roleček et al. 2009). At this stage, 162 relevés were used for analysis. I selected the most ecologically appropriate distribution of communities to six clusters at the association level (Figure 6). Clusters 1 and 2 represent the association *Dorycnio recti-Cladietum marisci* Gradstein & Smittenberg 1977 (Gradstein & Smittenberg 1977). The distribution into two clusters is due to the presence of two clearly separated variants of the association – for Crete (typical) and for continental Europe. Based on the last critical revisions, the typical *Dorycnio recti-Cladietum marisci* association belongs to Central and Eastern Mediterranean tall-herb vegetation of *Dorycnio recti-Rumicion conglomerati*, *Convolvuletalia sepium* and *Epilobietea angustifolii* (Gradstein & Smittenberg 1977, Mucina et al. 2016).

The third cluster is *Junco maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Géhu & Biondi 1988 described from Italy (eVeg database); the fourth one – *Soncho maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Cirujano 1980 described from Spain. There are now two opinions about the classification of associations: various authors have synonymized them using the priority name *Soncho maritimi-Cladietum marisci* (eVeg database,

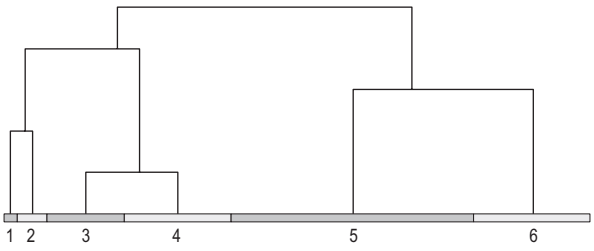

Figure 6: Dendrogram of "similarity-difference" between plant communities with *Cladium mariscus* as dominant species in Europe: 1, 2 – *Dorycnio recti-Cladietum marisci*; 3 – *Junco maritimi-Cladietum marisci*; 4 – *Cladio marisci-Schoenetum nigricantis*, *Soncho maritimi-Cladietum marisci*; 5 – *Cladietum marisci* (terrestrial variant); 6 – *Cladietum marisci* (water variant).

Slika 6: Dendrogram podobnosti med rastlinskimi združbami na osnovi "razlike v podobnosti" z dominantno vrsto *Cladium mariscus* v Evropi: 1, 2 – *Dorycnio recti-Cladietum marisci*; 3 – *Junco maritimi-Cladietum marisci*; 4 – *Cladio marisci-Schoenetum nigricantis*, *Soncho maritimi-Cladietum marisci*; 5 – *Cladietum marisci* (kopenska varianta); 6 – *Cladietum marisci* (vodna varianta).

Landucci et al. 2020) or recognize both associations in parallel (Taffetani 2011, Pirone 2014, Pirone et al. 2014, Lastrucci et al. 2017, Pedrotti 2018, Habitats Naturels supports de la biodiversité 2018, Habitat Italia 2018). Both of these associations are present on saline soils but *Junco maritimi-Cladietum marisci* is characterized by the presence of numerous subhalophytic diagnostic species: *Bolboschoenus maritimus*, *Juncus maritimus* and *Carex extensa*. The relevés from Dzharylhach Island are also in cluster 3. Two associations from this cluster also belong to different syntaxa of the higher ranks. The association *Junco maritimi-Cladietum marisci* belongs to the alliance *Scirpion maritimi* from the order *Bolboschoenetalia maritimi* (Biondi et al. 2014, Mucina et al. 2016, Habitat Italia 2018) and the association *Soncho maritimi-Cladietum marisci* belongs to the alliance *Magnocaricion elatae* from the order *Magnocaricetalia* (Rivas-Martínez et al. 2001, Mucina et al. 2016).

Two clusters (5 and 6) are distinguished as separate groups: 5 – *Cladietum marisci* (terrestrial variant) and 6 – *Cladietum marisci* (water variant). Cluster 5 includes relevés from western Ukraine. The problem of the separation of these relevés into two variants is based on the flooding degree, but also depends on the technique of plot selection. For example, relevés of the typical *Cladietum marisci* by H. A. Chorna (Chorna 2013; Borysova & Chorna 2011) were originally indicated as the association *Charetum tenuispinae* Dąmbska 1966 ex Tomaszewicz 1979 from the class *Charetea intermediae* F. Fukarek 1961 and included *Schoenus ferrugineus* and *Cladium mariscus* as common species. At the same time, European relevés combine water and coastal-water species in the association *Utriculario-Cladietum* (Jeschke 1963) Succow in Knapp et al. 1985 (Verhoeven 1992, Zscheile & Schubert 2010). There is also a view of the classification of *C. mariscus* communities into successional stages based on paleoecological research in Poland: lake phase, lower peatland phase, upper peatland phase (Gałka & Tobolski 2012). It is possible that all flooded communities of *C. mariscus* with aquatic plants are the starting point of successional development of a "typical community". It is obvious, though, that these plant communities do not fit the original diagnosis in terms of floristic composition and ecological conditions (Allorge 1921; Dengler et al. 2004).

It was interesting to calculate the floristic similarity between selected clusters, so floristic lists for these clusters were prepared. Cluster analysis was conducted by STATISTICA combining the *Dorycnio recti-Cladietum marisci* group into a joint cluster (Figure 7).

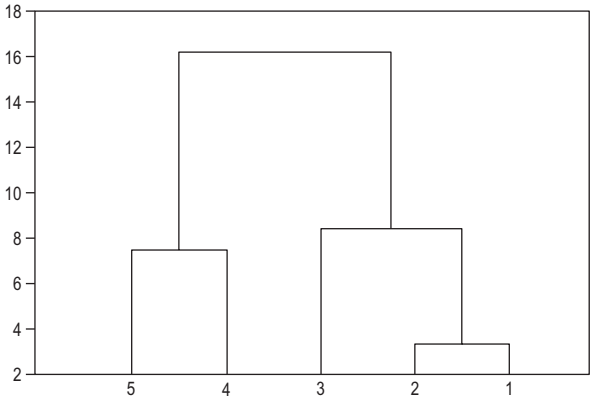

Figure 7: Dendrogram of "similarity-difference" between the plant communities based on floristic composition: 1 – *Dorycnio recti-Cladietum marisci*; 2 – *Junco maritimi-Cladietum marisci*; 3 – *Soncho maritimi-Cladietum marisci*; 4 – *Cladietum marisci* (terrestrial variant); 5 – *Cladietum marisci* (water variant).

Slika 7: Dendrogram podobnosti med rastlinskimi združbami na osnovi "razlike v podobnosti" z dominantno vrsto *Cladium mariscus*: 1 – *Dorycnio recti-Cladietum marisci*; 2 – *Junco maritimi-Cladietum marisci*; 3 – *Soncho maritimi-Cladietum marisci*; 4 – *Cladietum marisci* (kopenska varianta); 5 – *Cladietum marisci* (vodna varianta).

According to the Czekanowski-Sørensen coefficient (Ksc), the most significant differences were found between the clusters *Junco maritimi-Cladietum marisci* and terrestrial and water variants of *Cladietum marisci* and this supports the author's opinion about the difference between communities from western and southern Ukraine. Based on the Stugren-Radulescu coefficient of species composition similarity (Ksr,) clusters *Junco maritimi-Cladietum marisci*, *Dorycnio recti-Cladietum marisci* and typical *Cladietum marisci* have the lowest similarity, too. The two groups that are closest according to floristic composition are: the Mediterranean *Junco maritimi-Cladietum marisci* and *Soncho maritimi-Cladietum marisci*, and the Central

and Eastern European water and terrestrial variants of *Cladietum marisci* (Table 1).

Table 1: Indices of coefficients of species composition similarity (1 – *Dorycnio recti-Cladietum marisci*; 2 – *Junco maritimi-Cladietum marisci*; 3 – *Soncho maritimi-Cladietum marisci*; 4 – *Cladietum marisci* (terrestrial variant); 5 – *Cladietum marisci* (water variant).

Tabela 1: Indeksi podobnosti vrstne sestave (1 – *Dorycnio recti-Cladietum marisci*; 2 – *Junco maritimi-Cladietum marisci*; 3 – *Soncho maritimi-Cladietum marisci*; 4 – *Cladietum marisci* (kopenska varianta); 5 – *Cladietum marisci* (vodna varianta).

	Ksc				
Ksr	1	2	3	4	5
1	-	0.1	0.14	0.12	0.07
2	0.78	-	0.22	0.05	0.09
3	0.64	0.49	-	0,14	0.1
4	0.73	0.88	0.69	-	0.22
5	0.84	0.82	0.77	0.2	-

The floristic composition similarity between the associations *Junco maritimi-Cladietum marisci* and *Soncho maritimi-Cladietum marisci* was 0.49 for the Stugren-Radulescu and 0.22 for the Czekanowski-Sørensen coefficients. The overall floristic similarity of these two clusters is therefore about 25%. In the author`s opinion, these coefficients for two associations from the same climatic region cannot indicate their identity.

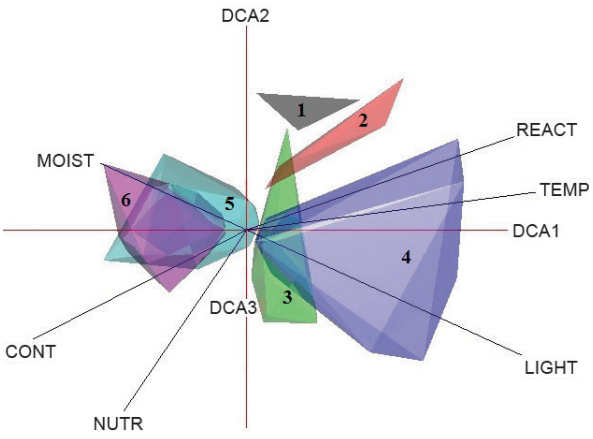

Figure 8: Results of DCA ordination of the studied communities: 1, 2 – *Dorycnio recti-Cladietum marisci*; 3 – *Junco maritimi-Cladietum marisci*; 4 – *Soncho maritimi-Cladietum marisci*; 5 – *Cladietum marisci* (terrestrial variant); 6 – *Cladietum marisci* (water variant). Values: MOIST – moisture; NUTR – nutrients; REACT – soil reaction; LIGHT – light; TEMP – temperature; CONT – continentality.

Slika 8: Rezultati DCA ordinacije obravnavanih združb: 1, 2 – *Dorycnio recti-Cladietum marisci*; 3 – *Junco maritimi-Cladietum marisci*; 4 – *Soncho maritimi-Cladietum marisci*; 5 – *Cladietum marisci* (kopna varianta); 6 – *Cladietum marisci* (vodna varianta). Values: MOIST – vlažnost; NUTR – hranila; REACT – reakcija tal; LIGHT – svetloba; TEMP – toplota; CONT – kontinentalnost.

In order to find the differentiation of the most important ecological factors, DCA-analysis was applied using ecological indicator values (Ellenberg et al. 1991). These results show that the most ecologically isolated is the *Dorycnio recti-Cladietum marisci* association. The most important factors for *Junco maritimi-Cladietum marisci* and *Soncho maritimi-Cladietum marisci* are soil reaction, light and temperature values. The ecological amplitude of the terrestrial variant of *Cladietum marisci* almost completely overlaps with the amplitude of the water variant. This ecological differentiation is determined by the level of soil moisture and the continentality of the climate.

The differentiation of the associations in relation to the level of light showed that the highest values for this indicator value are observed in *Dorycnio recti-Cladietum marisci* and *Junco maritimi-Cladietum marisci*. Water and terrestrial variants of *Cladietum marisci* are represented by lower values of light, which can be explained by the division of association habitats into coastal territories and continental ones (Figure 9).

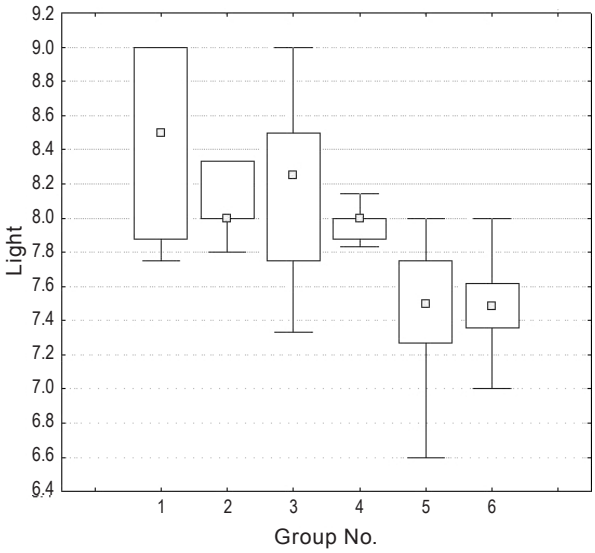

Figure 9: Differentiation of the associations based on light values. Numbers along the abscissa axis correspond to the number of associations in Figure 8.

Slika 9: Razlike med asociacijami na osnovi vrednosti indeksa svetlobe. Številke ob abscisi odgovarjajo številkam asociacij na Sliki 8.

Differentiation of the associations based on temperature regime is presented by three groups according to the World Map of Köppen-Geiger Climate Classification (Peel et. al. 2007): *Dorycnio recti-Cladietum marisci* in the typical hot-summer mediterranean climate type (Csa), *Junco maritimi-Cladietum marisci* and *Soncho maritimi-Cladietum marisci* partially represented in the hot-summer mediterranean climate, the warm-summer mediterranean climate and in the hot-summer humid continental cli-

mate types (Csa, Csb, Dfa). The water and terrestrial variants of *Cladietum marisci* are mostly found in the temperate oceanic and warm-summer humid continental climate types (Cfb, Dfb) (Figure 10). This pattern is also observed in the graph with continentality values: *Dorycnio recti-Cladietum marisci* tends to the oceanic type, *Junco maritimi-Cladietum marisci* and *Soncho maritimi-Cladietum marisci* tend to the suboceanic types, the terrestrial variant of *Cladietum marisci* has fairly wide amplitude from the oceanic to the suboceanic type, the water variant of *Cladietum marisci* tends to the suboceanic type. The amplitude of the typical *Cladietum marisci* can be explained by the wide distribution of this syntaxon (Figure 11).

The moisture factor demonstrates a great difference between hydrophilous and more xerophytic associations of *Dorycnio recti-Cladietum marisci*. *Junco maritimi-Cladietum marisci* is the most xerophytic of all the studied syntaxa. Other associations tend to temporarily flooded places (Figure 12).

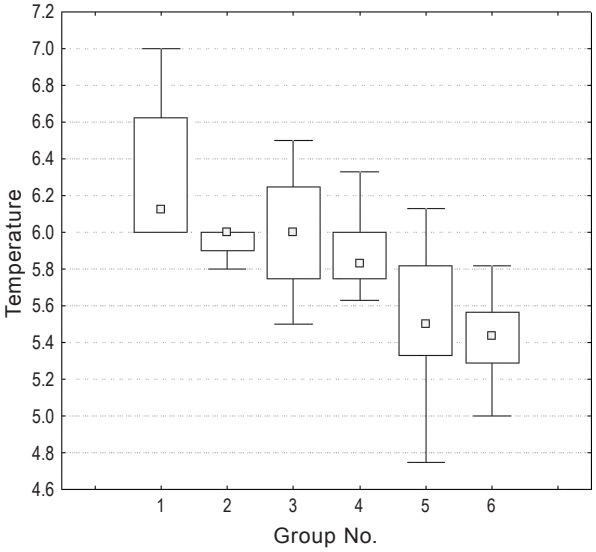

Figure 10: Differentiation of the associations based on temperature values.
Figure 10: Razlike med asociacijami na osnovi vrednosti indeksa toplote.

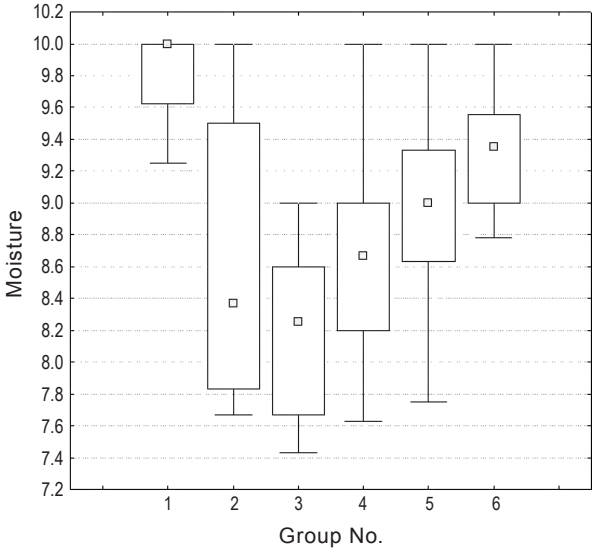

Figure 12: Differentiation of the associations based on moisture values.
Figure 12: Razlike med asociacijami na osnovi vrednosti indeksa vlažnosti.

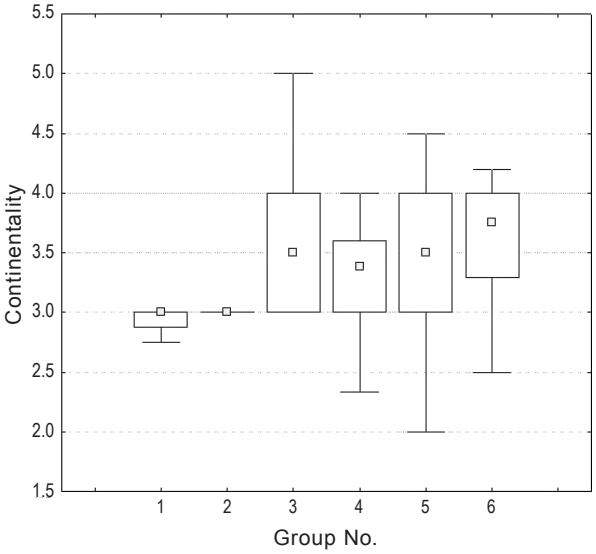

Figure 11: Differentiation of the associations based on continentality values.
Figure 11: Razlike med asociacijami na osnovi vrednosti indeksa kontinentalnosti.

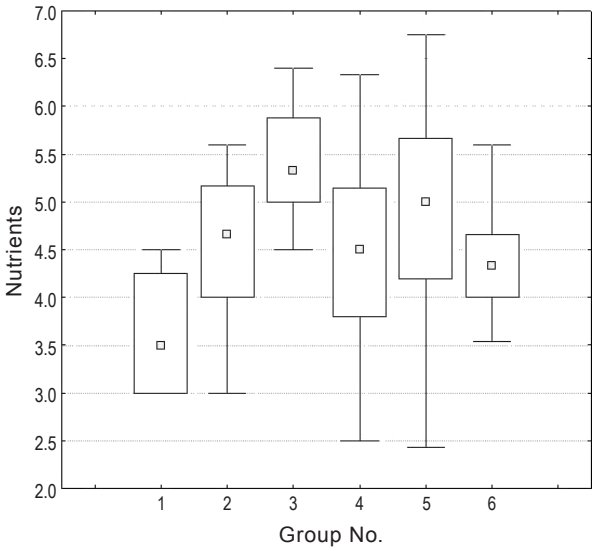

Figure 13: Differentiation of the associations based on nutrient values.
Figure 13: Razlike med asociacijami na osnovi vrednosti indeksa hranil.

Differentiation of the associations based on the nutrient content in soils indicates a significant differentiation: water *Dorycnio recti-Cladietum marisci* is marked by the lowest trophic level and the typical by a moderate level. The broadest amplitude is observed in typical (terrestrial) *Cladietum marisci* and in *Soncho maritimi-Cladietum marisci*. *Junco maritimi-Cladietum marisci* tends to soils that are moderately rich in nutrients (Figure 13).

Differentiation of the associations based on soil reaction showed that the highest alkaline reaction is observed in *Dorycnio recti-Cladietum marisci* associations. The communities of *Junco maritimi-Cladietum marisci* grow on slightly alkaline soils. Values of the typical *Cladietum marisci* range from neutral to carbonate soils. Water *Cladietum marisci* is closer to neutral soils. Values for *Soncho maritimi-Cladietum marisci* also indicate the predominance of carbonates in soils (Figure 14).

As a result of this analysis, I propose recognition of these syntaxa dominated by *Cladium mariscus*: *Cladietum marisci* Allorge 1921, *Soncho maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Cirujano 1980, *Dorycnio recti-Cladietum marisci* Gradstein & Smittenberg 1977 and *Junco maritimi-Cladietum marisci* (Br.-Bl. & O. de Bolòs 1957) Géhu & Biondi 1988. I believe that *Cladio marisci-Schoenetum nigricantis* sensu Lájer 2006 non Soó 1930 is a synonym of *Soncho maritimi-Cladietum marisci*. The most controversial associations *Soncho maritimi-Cladietum marisci* and *Junco maritimi-Cladietum marisci* are recognized as separate, based on floristic comparison and ecological analysis. The merging of these syntaxa into one was proposed recently by Landucci et al. (2020), but this was probably due to the small number of relevés with *Juncus maritimus* used in that study. The association *Junco maritimi-Cladietum marisci* is new for Ukraine from the Dzharylhach Island. Its special feature is the presence of *Poacynum russanovii* (Mavrodiev et al. 2015) (Table 2), an endemic species for this island. The following syntaxonomic scheme for communities with *Cladium mariscus* for "Dzharylhatskyi" National Nature Park is proposed:

Phragmito-Magnocaricetea Klika in Klika & Novák 1941
Bolboschoenetalia maritimi Hejný in Holub et al. 1967
Scirpion maritimi Dahl & Hadač 1941
Junco maritimi-Cladietum marisci (Br.-Bl. & O. de Bolòs 1957) Géhu & Biondi 1988

Diagnostic species of this association: *Carex distans*, *Cladium mariscus*, *Juncus maritimus*, *Mentha aquatica*, *Phragmites australis*, *Poacynum russanovii*, *Pulicaria dysenterica*.

Constant species: *Elytrigia elongata*.

Dominant species: *Cladium mariscus*, *Phragmites australis*.

In relation to the order *Bolboschoenetalia maritimi* as part of *Phragmito-Magnocaricetea* (Biondi et al. 2014, Mucina et al. 2016), the author does not agree with the separation of the class *Bolboschoenetea maritimi* Tx. & Vicherek in Tx. & Hülbusch 1971 that is widely accepted in many Ukrainian papers (Dubyna et al. 2007, Dziuba 2008).

As a result of the studied communities, a distribution map of the syntaxa and their types (holotype and neotype) is proposed (Figure 15). Two syntaxa – *Cladietum marisci* and *Junco maritimi-Cladietum marisci* - are thus distributed in Ukraine. In the southern part of Ukraine *Cladium mariscus* grows on the territory of the "Danube Biosphere Reserve" in the Odesa region and also on the "Chornomorsky Biosphere Reserve". Based on the floristic composition of relevés in the synoptic table from the Danube delta (Dubyna et al. 2004), the author considers them to be *Cladietum marisci,* although these communities need further investigation. The map shows the essential distance (1 358 km) between the locus typicus of *Junco maritimi-Cladietum marisci* and the location of the syntaxon indicated by the author. The Mediterranean climate partly explains the closeness of *Junco maritimi-Cladietum marisci* and *Soncho maritimi-Cladietum marisci* areas, but what is the explanation in this case? Based on floristic studies, Illichevskyi (1941) put forward a hypothesis about the origin of Dzharylhach Island as "a kind of relic of the former land" and extrapolated the results of geological surveys, observing that the flora of the island partly consists of rare species with Mediterranean and disjunctive areal characteristics typical of the Crimean Peninsula, the Balkans, the Caucasus and Asia Minor. Il-

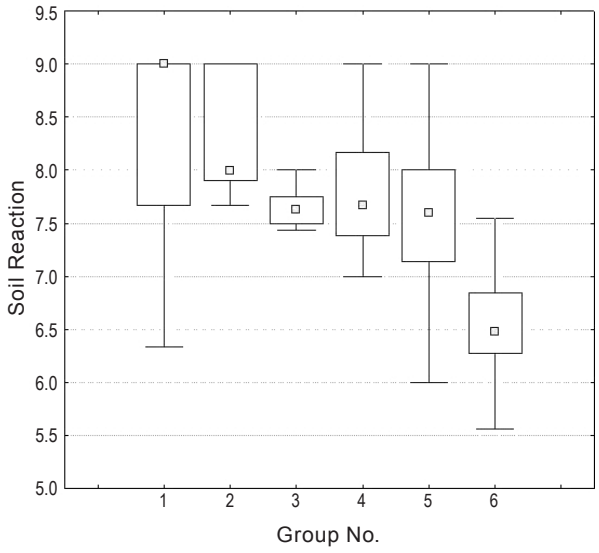

Figure 14: Differentiation of the associations based on soil reaction values.
Figure 14: Razlike med asociacijami na osnovi vrednosti indeksa reakcije tal.

Table 2: Phytocoenological table of assotiation *Junco maritimi-Cladietum marisci*.
Tabela 2: Fitocenološka tabela acociacije *Junco maritmi-Cladietum marisci*.

Releve's №	1	2	3	4	5	6	7	8	9	10	Constancy	Phi coeff.
Releve's area (m²)	25	25	50	50	30	50	50	70	15	50		
Number of species	9	7	9	9	8	8	9	4	7	8		
Total cover (%)	80	90	90	80	90	100	100	90	90	100		
D. s. for the ass. *Junco maritimi-Cladietum marisci*												
Cladium mariscus	3	3	2	2	5	5	5	5	2	5	V	100
Juncus maritimus	2	+	+	.	2	2	2	.	3	.	IV	78.2
Carex distans	+	.	+	2	2	r	.	.	.	+	III	72.1
Poacynum russanovii	.	.	r	2	.	r	r	.	+	.	III	65.5
D. s. for the cl. *Phragmito-Magnocaricetea*												
Mentha aquatica	+	2	2	.	+	.	.	+	.	2	III	78.2
Phragmites australis	2	2	3	+	2	3	2	2	2	1	V	50.8
Pulicaria dysenterica	+	.	+	.	2	.	.	+	.	.	III	58.3
Althaea officinalis	.	+	.	.	.	.	.	.	.	.	I	28.7
Calystegia sepium	.	.	.	.	.	.	r	.	.	+	I	40.8
Other species												
Apera maritima	.	.	.	.	.	.	.	.	+	.	I	-
Calamagrostis epigejos	.	+	+	.	+	.	.	.	.	.	II	-
Carex extensa	.	.	.	+	.	.	.	.	.	.	I	28.7
Cirsium alatum	+	.	.	r	.	.	r	.	.	.	III	45.1
Cynanchum acutum	2	.	.	.	.	.	.	.	.	.	I	-
Elytrigia elongata	+	2	.	+	.	r	r	.	2	.	IV	45.4
Festuca pratensis	.	.	.	.	+	.	.	.	.	.	I	28.7
Heracleum sibiricum	.	.	.	.	.	.	r	.	.	.	I	28.7
Inula salicina subsp. *aspera*	.	.	.	+	.	.	r	.	.	2	II	-
Limonium gmelinii	.	.	.	.	.	r	.	.	+	.	II	-
Lythrum virgatum	.	.	.	.	.	.	.	.	.	+	I	-
Plantago cornuti	.	.	.	r	.	.	.	.	.	.	I	-
Plantago maxima	.	.	.	.	.	+	.	.	.	.	I	28.7
Schoenus nigricans	.	.	.	.	.	.	.	.	.	+	I	
Thalictrum minus	.	.	+	.	.	.	.	.	.	+	I	-

Localities:

1 – N 46° 01' 543", E 32° 94' 92" (09. 07. 2017);
2 – N 46° 01' 578", E 32° 93' 535" (09. 07. 2017);
3 – N 46° 01' 517", E 32° 94' 677" (09. 07. 2017);
4 – Island Dzharylhach, D. Dubyna (05. 2002);
5 – N 46° 01' 472", E 32° 93' 683" (09. 07. 2017);
6 – Island Dzharylhach, D. Dubyna (09. 2000);
7 – Island Dzharylhach, D. Dubyna (09. 2000);
8 – N 46° 01' 217", E 33° 02' 627" (09. 07. 2017);
9 – N 46° 01' 543", E 32° 94' 92" (09. 07. 2017);
10 – Island Dzharylhach, D. Dubyna (05. 2001).

lichevskyi concludes that Dzharylhach was originally part of a larger territory connected with the Crimea, Balkans and Asia Minor (Illichevskyi 1941). This idea was also confirmed by later research by geologists (Ryan et al. 1997). Barbarych (1962) believed that the distribution of the genus *Cladium* in the past tended to the sea coasts, so its growth in the Eastern and Central Europe is also due to the presence of sea basins. The age of origin of southern Ukrainian localites is Pleistocene and western Ukrainian – Miocene (Barbarych 1962).

Cladium mariscus therefore has a disjunct habitat. The existence of individual localities of *C. mariscus* with halophilic elements is due to regional features – soil type, salinization and flooding.

Cladium mariscus s.l. is a key species in the habitats from Habitat Directive "7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*" (Interpretation Manual of European Union Habitats 2013) and in "D 5.2 Large thickets without free standing water" of Resolution No. 4 of the Bern Convention (2016)

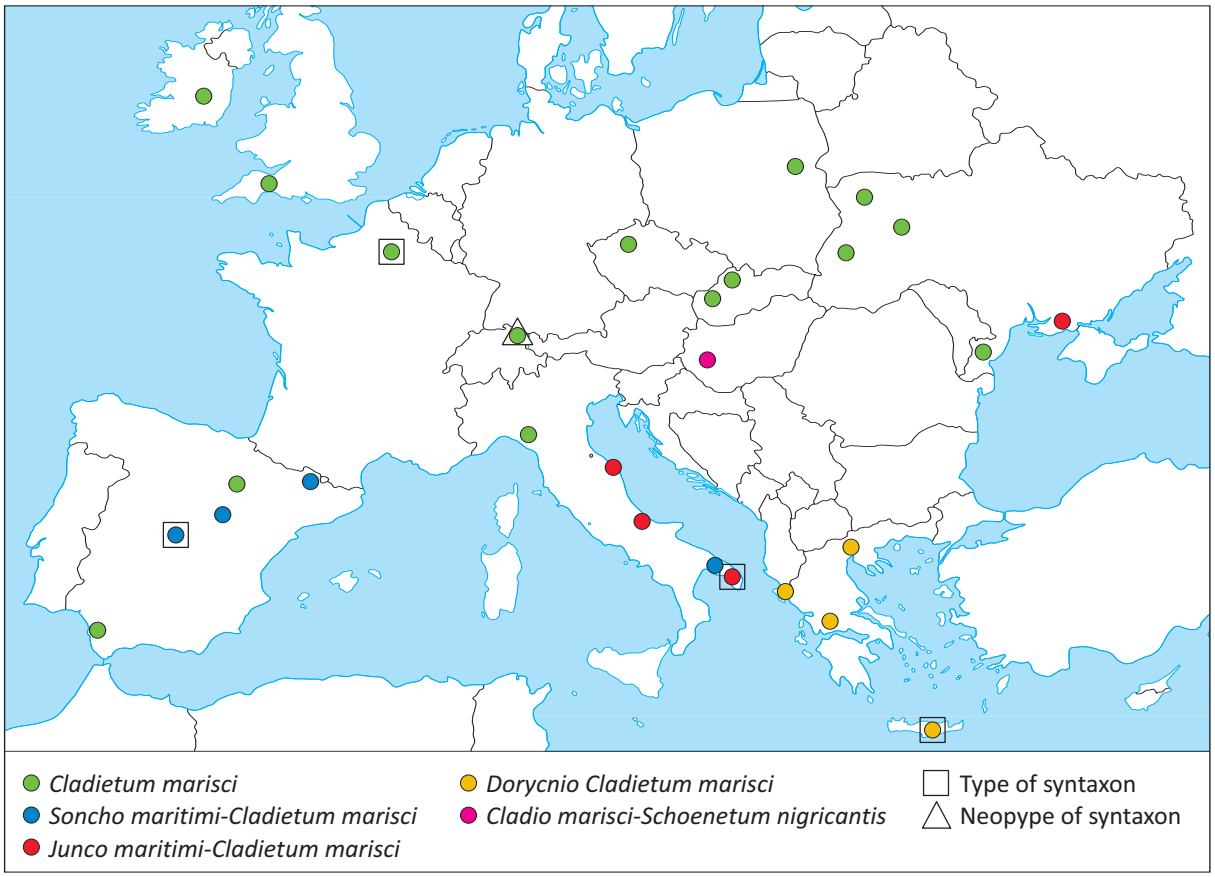

Figure 15: Map of syntaxa based on the results of this study.
Slika 15: Zemljevid sintaksonov na osnovi rezultatov te raziskave.

(Perrino et al. 2013, Detailed final conclusions … 2016, Habitats Naturels supports de la biodiversité 2018, Habitat Italia 2018). We propose distinguishing a new sub-type of habitat D 5.2 "Large thickets without free standing water" ("D 5.2.1. Halophytic wetlands and wet depressions with *Cladium mariscus*").

Conclusions

The isolated position of plant communities with *Cladium mariscus* s.l. on Dzharylhach Island was thus confirmed on the basis of the results of the analysis of geobotanical relevés. A new subtype of habitat ("D 5.2.1. Halophytic wetlands and wet depressions with *Cladium mariscus*") is proposed. The name "*Cladio marisci-Schoenetum nigricantis* sensu Lájer 2006 non Soó 1930" is a synonym of *Soncho maritimi-Cladietum marisci*. The floristic and ecological independence of *Soncho maritimi-Cladietum marisci* (Br.-Bl. & Bolòs 1957) Cirujano 1980 is substantiated. A new association *Junco maritimi-Cladietum marisci* (Br.-Bl. & Bolòs 1957) Géhu & Biondi 1988 for vegetation of Ukraine was confirmed. Further research of *Cladium mariscus* communities is needed, particularly a comparison with data from the Caucasus and Western Asia.

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The autor are very grateful to editor in chief Urban Šilc and two anonymous reviewers for comments and recommendations that greatly improved the manuscript. Special thanks are due to Denis Davydov and Martin Cregeen for English proofreading, to Dmytro Dubyna for providing the relevés and to Anna Kuzemko for providing images.

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Table 3: Data about the geobotanical relevés included in the database.
Tabela 3: Podatki o vegetacijskh popisih vključenih v podatkovno bazo.

Syntaxa	Country	Year	№ of table/releve
Cladietum marisci	Spain	1957	tab. 15, rel. 1–5
	Great Britain	1980	tab. 3, rel. 2
	Ireland	1990	tab. 2, rels. 16–29
	Netherlands	1992	tab. 4, rels. 1–19
	Poland	2005	tab. 1, rels. 10–18
	Croatia	2010	tab. 3, rels. 24–34
	Ukraine	2013	tab. 31, rels. 1–10
	Ukraine	2013	p. 10–11
	Italy	2017	tab. 8, rels.1–8
Cladietum marisci var. *Carex elata*	Poland	2005	tab. 1, rels. 1–9
Soncho maritimi-Cladietum marisci	Italy	1980	tab. 4, rels. 1–3
	Spain	1980	tab. 7, rels. 1–5
	Italy	1991	tab. 7, rels. 1–2
Soncho maritimi-Cladietum marisci myrtetosum communis	Italy	2006	tab. 4, rels. 4–6
Soncho maritimi-Cladietum marisci schoenetosum nigricantis	Spain	1980	tab. 7, rels. 10, 12, 14, 17, 19
Junco maritimi-Cladietum marisci	Italy	1988	rels. 1–5
	Italy	1994	tab. 70 p. 120
	Italy	2011	tab. 15, rels. 3–4
	Ukraine	2000–2018	in abstract
Dorycnio-Cladietum marisci typicum	Crete	1977	tab. 6, rels. 12–17
	Greece	2006	tab. 2, rels. 16–27
Dorycnio-Cladietum marisci inops	Crete	1977	tab. 6, rels. 18–25
Cladio marisci-Schoenetum nigricantis	Hungary	2006	tab. 2, rels. 16–19
Schoeno nigricantis-Erianthetum ravennae cladietosum marisci	Italy	2006	tab. 7, rels.1–4

Table 4: Synoptic table with percentage frequency and modified fidelity index phi coefficient.
Table 4: Sinoptična tabela s frekvencami v odstotkih in modificiranim fi koeficientom navezanosti.

Group Number	**1**	**2**	**3**	**4**	**5**	**6**
Number of relevés	**4**	**8**	**21**	**29**	**66**	**32**
Phragmites australis	.	.	67	39	62	91$^{39.7}$
Cladium mariscus	100	100	100	100	100	100
Carex lasiocarpa	.	.	.	.	2	62$^{73.1}$
Lythrum salicaria	.	.	5	28	26	59$^{44.8}$
Carex elata	.	.	.	.	2	53$^{68.4}$
Galium palustre	.	.	5	.	5	50$^{60.1}$
Lysimachia vulgaris	.	.	.	3	33$^{27.3}$	41^{37}
Peucedanum palustre	.	.	.	.	3	41$^{57.4}$
Comarum palustre	.	.	.	.	2	38$^{56.2}$
Utricularia vulgaris	.	.	.	24$^{20.4}$	.	38$^{40.1}$
Calliergonella cuspidata	.	.	.	.	2	34$^{53.5}$
Scorpidium scorpioides	.	.	.	.	.	34
Utricularia minor	.	.	.	.	2	31$^{50.8}$
Menyanthes trifoliata	.	.	.	.	.	28$^{49.6}$
Mentha aquatica		50	38	28	35	25
Juncus subnodulosus	.	.	.	21	5	25$^{26.8}$
Nymphaea alba	.	.	.	.	.	25$^{46.6}$
Equisetum fluviatile	.	.	.	.	9	25$^{37.3}$
Calliergon cuspidatus	.	.	.	.	2	25$^{44.8}$

Group Number	1	2	3	4	5	6
Number of relevés	4	8	21	29	66	32
Carex buxbaumii	.	.	.	.	2	22[41.5]
Campylium stellatum	.	.	.	.	.	19[40.2]
Lycopus europaeus	.	.	.	10	14	19
Lemna minor	.	.	.	.	2	19[38.1]
Salix cinerea	.	.	.	.	3	19[36.2]
Lysimachia thyrsiflora	.	.	.	.	3	16[32.2]
Potentilla palustris	.	.	.	.	2	16[34.3]
Epilobium palustre	.	.	.	.	6	16[28.8]
Drepanocladus revolvens	.	.	.	.	.	16[36.6]
Stachys palustris	.	.	.	.	2	16[34.3]
Lemna gibba	.	.	.	.	.	12[32.6]
Thelocarpon pallidum	.	.	.	.	3	12[27.9]
Chara species	.	.	.	.	3	12[27.9]
Lathyrus palustris	.	.	.	.	.	12[32.6]
Galium uliginosum	.	.	.	.	.	12[32.6]
Spirodela polyrhiza	.	.	.	.	.	12[32.6]
Poa palustris	.	.	.	.	.	12[32.6]
Carex rostrata	.	.	.	.	2	12[30.1]
Eupatorium cannabinum	.	.	.	.	23[37.3]	6
Solanum dulcamara	.	.	.	.	15[27.9]	6
Typha angustifolia	.	.	5	.	18[27.7]	6
Schoenus nigricans	.	.	14	72[69.6]	2	6
Agrostis stolonifera	.	.	.	17[27.9]	3	6
Typha angustata	25	.	.	.	2	3
Hydrocotyle vulgaris	25	.	.	.	3	3
Iris pseudacorus	.	50[62.4]	.	.	3	3
Carex panicea	.	.	.	.	11[24.9]	3
Holoschoenus romanus	.	12	.	3	.	.
Carex hispida	25	25	.	21[12.4]	.	.
Linum maritimum	.	.	.	14[34.3]	.	.
Saccharum ravennae	.	.	.	17[38.5]	.	.
Equisetum ramosissimum	.	12	.	3	.	.
Rubus ulmifolius	.	.	.	17[38.5]	.	.
Carex distans	.	25	29[29.1]	3	.	.
Pulmonaria dacica	25[46.6]	.	.	.	.	.
Arundo donax	75[84.5]	.	.	.	.	.
Polypogon monspeliensis	25[46.6]	.	.	.	.	.
Galium constrictum	25	12	5	.	.	.
Nerium oleander	.	12	.	.	.	.
Anagallis tenella	.	12	.	.	.	.
Sonchus glaucescens	.	12	.	.	.	.
Panicum repens	.	25[46.6]	.	.	.	.
Rubus sanctus	.	38[57.7]	.	.	.	.
Oenanthe pimpinelloides	25	62[60.]	.	.	.	.
Poa trivialis s. sylvicola	.	25[46.6]	.	.	.	.
Juncus heldreichianus	25	38[39.6]	.	.	.	.
Rumex conglomeratus	.	25[46.6]	.	.	.	.
Agrostis semiverticillata	25[34.6]	12	.	.	.	.
Lythrum junceum	50	25[16.9]	.	.	.	.
Imperata cylindrica	25[50.7]	25[27.0]	.	.	.	.
Cynodon dactylon	.	12	.	.	.	.

Group Number	1	2	3	4	5	6
Number of relevés	4	8	21	29	66	32
Inula viscosa	.	25	.	28[29.8]	.	.
Ipomoea sagittata	.	.	5	31[47.3]	.	.
Myrtus communis	.	.	.	24[45.8]	.	.
Phillyrea media	.	.	.	14[34.3]	.	.
Sonchus maritimus	.	.	10	45[55.7]	.	.
Oenanthe lachenalii	.	.	5	34[50.5]	.	.
Juncus acutus	.	.	14[26.1]	7	.	.
Juncus articulatus	.	12	.	.	.	.
Gaudinia fragilis	.	12	.	.	.	.
Rubia peregrina	.	.	.	10[29.6]	.	.
Juncus maritimus	.	.	76[80.7]	7	.	.
Orchis laxiflora subsp. *palustris*	25	25[22.2]	.	10	.	.
Cirsium creticum	.	38[46.6]	.	10	3	.
Samolus valerandi	25	12	.	48[42.8]	2	.
Apium nodiflorum	50[59.1]	.	5	.	6	.
Dorycnium rectum	25	75[66.4]	.	3	5	.
Calamagrostis epigejos	.	.	14[28.6]	.	5	.
Calystegia sepium	.	.	38[32.7]	31[23.4]	11	.
Carex flava	.	.	.	.	11[30.0]	.
Sparganium erectum	.	.	.	.	11[30.0]	.
Pulicaria dysenterica		25	29[24.7]	10	3	.
Cirsium alatum	.	.	14[34.9]	.	.	.
Inula salicina subsp. *aspera*	.	.	14[34.9]	.	.	.
Poacynum russanovii	.	.	24[45.5]	.	.	.
Elytrigia elongata	.	.	29[50.0]	.	.	.
Carex extensa	.	.	19[40.5]	.	.	.
Inula crithmoides	.	.	14[34.9]	.	.	.
Festuca arundinacea	.	12	.	.	2	.

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