DUNE VEGETATION OF THE BULGARIAN BLACK SEA COAST

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Izvleček
Med terensko raziskavo psamofitne vegetacije (brez gozdne in grmiščne vegetacije) ob obali Črnega morja, od meje z Romunijo do mednarodnega mladinskega tabora Primorsko, smo leta 2003 naredili 166 popisov in jih uvrstili v 7 asociacij. Šest izmed njih je endemičnih za bolgarsko obalo Črnega morja, najbolj specifična je *Aurinio-Artemisietum campestris*. Asociacija *Cakilo euxinae-Salsoletum ruthenicae* je razširjena ob bolgarski in turški obali. Obalna vegetacija Dobrudže se zelo razlikuje od tiste južno od letovišča Golden Sands. Splošno sprejeta fitogeografska meja med severno in južno obalo Črnega morja pri rtu Emine je vprašljiva. Vpliv človeka na psamofitno vegetacijo se povečuje in ogroža njeno ohranitev.

Abstract
During a field research study on the psammophytic (without forests and bushes) vegetation in 2003 along the coast of the Black Sea, from the Romanian border south to the International Youth Camp "Primorsko", 166 relevés from 7 associations were differentiated. Six of them are endemic to the Bulgarian Black Sea coast (most specific is *Aurinio-Artemisietum campestris*) and one – *Cakilo euxinae-Salsoletum ruthenicae* – have a distribution on the Bulgarian and Turkish coasts. The coastal vegetation of the Dobrudzha coast is considerably different to that which lies south of the "Golden Sands" resort. The accepted phytogeographical border between the Northern and Southern Black Sea coast – Cape Emine – is very arguable. The human impact on the psammophytic vegetation is strongly increasing and threatening its preservation.

Ključne besede: psamofitna vegetacija, Črno morje, endemitske asociacije, geosinvikariante, ohranitev habitatov
Key words: psammophytic vegetation, Black Sea coast, endemic associations, geosynvicariants, habitat conservation

1. INTRODUCTION

The Black Sea coast is characterized by well-developed dune systems. Publications by Davidov (1905, 1909, 1912), Petkov (1908), Yordanov (1928, 1932, 1936 a, b), Stefanov (1943), Stoyanov (1941), Bondev & Radenkova (1969) contain information about the flora and the vegetation of separate regions or bigger territories. Some later studies have concentrated primarily on the biological and ecological characteristics of the psammophytic species, the problems with their distribution, their ecology, the human influence and protection of rare and endangered species (Meshinev, Vasilev & Indzheyan 1982, Velchev & Bondev 1982, Bondev & Velchev 1984, Bondev & al. 1985, Koeva-Todorovska 1985, Meshinev & al. 1994, Kozhuharov & al. 1992). Vicherek (1971) used the method of the Zürich–Montpellier school to classify the coastal vegetation along beaches, embryonic and shifting dunes for a

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substantial part of the Black Sea coast, while Meshinev & al. (1994), Ivanov & al. (1997), Filipova-Marinova & al. (1997) have used the dominance method for their research on the vegetation of single dune complexes. The proposed syntaxa in the last two works are without relevés.

These publications are a substantial contribution towards clarifying the floristic species composition and the structure of the psammophytic vegetation along the Bulgarian Black Sea coast, but do not present its complete and contemporary state. Only the publications of Vicherek (1971) are based on the floristic-sociological method, widely accepted in Europe and elsewhere in the world. However, his research did not cover the entire Bulgarian coast and the fixed dunes vegetation. The data used in his study were collected during 1965, when the human impact on the coastal vegetation was still weak. During the last decades the human impact on the psammophytic vegetation has been continuously increasing.

Already obliterated are many of the dunes described by Vicherek (1971) in the "Golden Sands" resort. Despite the protection status of part of the area, resort hotels are continuously being built over the dunes of "Sunny Beach". Plans for hotel construction on the south Bulgarian Black Sea coast are due to be realized. In the present situation, the protection of the dune complexes, some of which are comparatively well preserved, is an extremely difficult task. Compromises are made by institutions with jurisdictional rights over environmental protection. This determines the increasing need for urgent studies of the vegetation along the Bulgarian Sea coast, including collecting new data and imposing new protection measures for its conservation.

The present publication presents the results from 2003 research work on psammophytic vegetation (without bushes and forests) of the West Black Sea coast. The range of the field investigations of beach dunes and dune complexes is from the north Bulgarian border southwards to the International Youth Camp "Primorsko". The dunes south of this region were described by Vicherek, and with the given particular circumstances, continue to be slightly altered. The presented information provides reasons for accepting the comparative availability of full factual data about the composition and succession stages of the psammophytic vegetation of the entire Bulgarian Black Sea coast. This provides an opportunity to classify it in a contemporary classification scheme.

2. METHODS

The field research studies were carried out in August 2003; the analysis and the syntaxonomical decisions follow the classical prescriptions of the Zürich–Montpellier school (Braun-Blanquet 1964, Mueller-Dombois & Ellenberg 1971, Westhoff & Maarel 1978).

The relevés of 166 phytocoenoses were prepared and part of them is presented in the diagnostic tables. The Barkman's (Barkman & al. 1964) 9-rate scale of abundance is attached, which for further mathematical calculations and classification of the relevés has been transformed according to Maarel (1979). The professional program, SYNTAXA (Podani 1993) was used. The cluster dendrogram was obtained by the method of group-average sorting (UPGMA), and for calculation of the floristic similarity Horn's index (Krebs 1999) was used. The index also reflectes the abundance.

The completed dendrogram illustrates the degree of irrelevance entered on the ordinate. Syntaxa with different rank are presented with the help of phytocoenological tables. Presented in the synoptic tables are similar syntaxa described by different authors. The taxonomical nomenclature is conformable with Flora of Bulgaria (Yordanov (ed.) 1963–1989, Kozhuharov (ed.) 1995), the identification book for higher plants in Bulgaria (Kozhuharov 1992), Bryophyta Bulgarica Clavis Diagnostica (Petrov 1975), and Flora Europaea (Tutin & al. 1964–1980, Tutin & al. 1993). The adapted syntaxonomical nomenclature is in correspondence with the International Code of Phytosociological Nomenclature (Weber & al., 2000) and the reference literature.

3. DESCRIPTION OF THE STUDY AREA

The Black Sea coast relief is a complicated system of successive steep cliffs and lowering, in which the dune systems are formed (from north to south: Dourankulak, Cape Shabla, near Balchik and Kavarna, Varna Bay, Kamchia River near to the village of Shkorpilovtsi, Bourgas lowland, Alepu, Ropotamo River, Dyavolska River, Ahtopol bay). Cape Emine (the most eastern part of the Balkan Mountains) is a physic-geographical barrier dividing the Bulgarian Black Sea coast into southern and northern (Galabov 1956). It is arguable matter that this is also phytogeographical border be-

tween the northern and southern parts of the coast, as claimed by Bondev (1997) and others. The second opinion is: the flora and vegetation of the large dune complex near Kamchia River mouth, located south of Cape Emine, should be assigned to the southern group of phytocoenoces. Somehow or other the northern and southern complexes have their own specific flora and vegetation. The basic reason is the difference in climatic factors.

The Black Sea influence creates a milder climate on the shoreline than the corresponding inland climatic zones. The Black Sea coast is differenciated in a subzone of the Continental-Mediterranean climatic zone pertaining to the Euxinian vegetation province, which includes four climatic regions: 1. Strandzha Black Sea coast, 2. Bourgas lowland, 3. Varna Black Sea coast, and 4. Dobrudzha Black Sea coast. The main climate difference between these regions is the increased average annual rainfall from north to south: Balchik 480 mm, Rezovo – 820 mm (Velev 1997).

As is known, an important factor for the dune formation is the wind action. The main part of the shoreline is low and flat, and the lack of a mountain barrier is the reason for the strong winds. In the cold months, the western winds predominate in the south, while in the Dobrudzha Black Seacoast – the northern. In summer the east onshore wind rises (Galabov 1956).

The Western Black Sea coastal region is divided into two phytogeographical regions: southern and northern with the dividing border being the East Balkan Mountains, and for the coast its eastern point – Cape Emine (Bondev 1997). The precision of this separation is debatable.

The structure of the Black Sea coast dunes as a whole, and as an object of the present study, can be divided with reasonable conventionality into two main groups:

- the first group includes dune systems, which are not very wide towards the inland and consist of beach and shifting dunes with unstabilized sand. Such dune regions are near Dourankulak, Shabla, Krapets and other places (Fig. 1),
- the second group includes also regions with fixed dunes, found beside shifting dunes. Such areas are Anna Maria (on the Romanian border), near the Kamchia River mouth, Ropotamo, Dyavolska (Primorsko), near the town of Nesebur, the "Sunny Beach" resort and other places (Fig. 1).

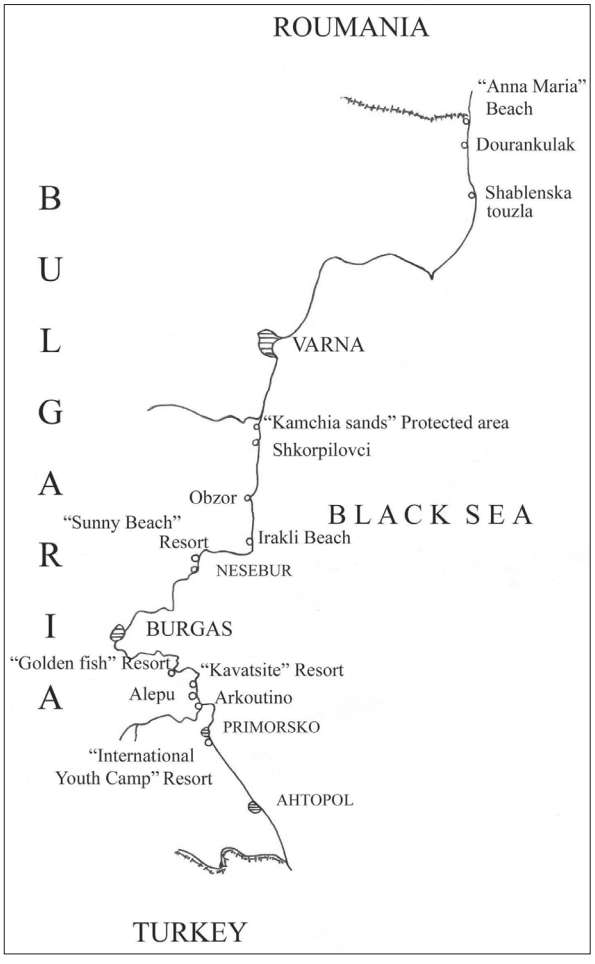

Figure 1: Study area.
Slika 1: Raziskovano območje.

4. RESULTS

4.1 Flora

The floristic complex of the Bulgarian Black Sea dunes includes more than 200 taxa of higher plants. Part of these are typical psammophytes (*Eryngium maritimum* L., *Euphorbia peplis* L., *Leymus racemosus* (Lam.) Tzvel. subsp. *sabulosus* (Bieb.) Tzvel., *Ammophila arenaria* (L.) Link., *Crambe maritima* L. and others). They form almost the entire vegetation of the beaches and the shifting dunes. A predominant part of the taxons has a higher ecological amplitude and wider distribution. Most frequently, they are related with fixed dunes. Mesophytes and xerophytes, with their ecological characteristic have similar shares in the primal formation of phytocoenoses. The hygrophytes grow in the lower parts of the dunes and compose a small frac-

tion of their vegetation. Perennial plants as a biological type dominate in floristic complexes, though in some cases (mainly on the beaches) the dominants are pioneer annual plants (*Cakile maritima* Scop., *Euphorbia peplis* L. and others).

The results of pollen analysis in Ropotamo River mouth and Lake Arkutino for the last 6000 years (Bozilova & Beug 1992) show, that the "longos" forests neighboring the sand dune complexes appeared 3000 years ago – at the beginning of the subatlantic period of the Holocene. It could be presumed that, the vegetation of the dune complexes in these regions of the country has the same age. The dune vegetation possesses the following geographical elements (Dimitrov (ed.) 2002): Eurasian (*Poa bulbosa* L., *Secale sylvestre* Host., *Calamagrostis epigejos* (L.) Rothm.), cosmopolites (*Calystegia soldanella* (L.) R. Br., *Phragmites australis* (Cav.) Trin ex Steud.), central and south European (*Peucedanum arenarium* Walds. et Kit., *Ammophila arenaria* (L.) Link., *Euphorbia paralias* L., *Crambe maritima* L., *Elymus farctus* (Vis.) Runem. ex Meld., *Corispermum nitidum* Kit. in Schult., *Eryngium maritimum* L., *Carex ligerica* J. Gay), Mediterranean (*Stachys maritima* Gouan., *Pancratium maritimum* L., *Galilea mucronata* (L.) Parl., *Erianthus ravenae* (L.) Beauv., *Elymus pycnanthus* (Godr.) Meld.). The pontic elements (*Centaurea areanria* Bieb subsp. *borysthenica, Medicago falcata* L. subsp. *tenderiensis* (Operm.) Vas., *Silene euxina* (Rupr.) Hand.-Maz., *Jurinea albicaulis* Bunge subsp. *kilaea* (Azn.) Koz., *Festuca arenicola* (Prod.) Soo, *Leymus racemosus* (Lam.) Tzvel. *subsp. sabulosus* (Bieb.) Tzvel.) are of special interest, since they reveal the relations between the psammophytic vegetation of the west with that of the south and southeast Black Sea coasts. These relations are completed by the occurrence of Turanian-central Asian geographical elements *Aurinia uechtritziana* (Bornm.) Cullen et Dudley, *Stachys atherocalyx* C. Koch., *Cionura erecta* (L.) Grizeb.). The number of endemic taxa (according to Velchev, Kozhuharov & Anchev (eds.) 1992) include Balkan (*Silene thymifolia* Sibth. et Sm., *Verbascum purpureum* (Janka) Hub.-Mos., *Alyssum borzaeanum* E. I. Nyar., *Astragalus onobrychis* L. subsp. *scorpili* Velen.) and Bulgarian taxa (*Linum tauricum* Willd. subsp. *bulgaricum* (Podp.) Petrova). They are limited, but with the pontical species they define the specific coastal psammophytic vegetation of Bulgaria.

About 20 of the discussed taxa in the present work are included in the lists of the Bulgarian Red Book (Velchev (ed.) 1984), Biodiversity Law (2002), and in the annexes of the convention on the conservation of European wildlife and natural habitats (Bern Convention, Directive 92/43 EEC). Some of them are with limited distribution and abundance (*Calystegia soldanella* (L.) R. Br., *Convolvulus persicus* L., *Argusia sibirica* (L.) Dandy, *Merendera sobolifera* C. A. Mey, *Otanthus maritimus* (L.) Hoffm. et Link., *Silene frivaldskyana* Hampe, *Hypecoum ponticum* Velen.) and do not play a major role in the phytocoenoses formation. Others, such as *Centaurea arenaria* Bieb., *Eryngium maritimum* L., *Lactuca tatarica* (L.) C. A. Mey., *Silene thymifolia* Sibth. et Sm., *Silene euxina* (Rupr.) Hand.-Maz., *Aurinia uechtritziana* (Bornm.) Cullen et Dudley, are included in the composition of many phytocoenoses, in some places with a relatively high abundance.

The range of distribution of species primarily forming the phytocoenoses in different parts of the coastline is of particular interest. Most of the species are present everywhere, but there are some which are distributed predominantly or only on the southern half of the Black Sea coast: *Pancratium maritimum* L., *Cionura erecta* (L.) Grizeb., *Jurinea albicaulis* Bunge subsp. *kilaea* (Azn.) Koz., *Galilea mucronata* (L.) Parl., *Osyris alba* L., *Jasione heldreichii* Boiss. et Orph., *Artemisia campestris* L., *Silene euxina* (Rupr.) Hand.-Maz., *Erianthus ravenae* (L.) Beauv., *Aurinia uechtritziana* (Bornm.) Cullen et Dudley, *Elymus pycnanthus* (Godr.) Meld.; while *Medicago falcata* L. subsp. *tenderiensis* (Operm.) Vas., *Astragalus onobrychis* L. subsp. *scorpili* Velen., *Crambe maritima* L., *Stachys atherocalyx* (L.) C. Koch. can be found mainly or entirely in the northern part. On this basis, a separation of the northern and southern littoral psammophytic vegetation was made. The present analysis and some previous researches provide reasons for the comments made in the "Discussion" section and the Conclusions on this issue.

4.2 Vegetation

In accordance with the specified definition of psammophytic vegetation succession dynamics and stages of dune formation, the following parts of the dune complexes have been researched:

- the higher parts of the beaches with pioneer vegetation from class *Cakiletea maritimae* R. Tx. et Prs. 1950;
- embryonic dunes with phytocoenoses from class *Ammophiletea* Br.-Bl. et R. Tx. 1943;
- shifting dunes with phytocoenoses from class *Ammophiletea* Br.-Bl. et R. Tx. 1943;

- fixed dunes with phytocoenoses, which include characteristic taxa from classes *Ammophiletea* Br.-Bl. et R. Tx. 1943 and *Koelerio-Corynephoretea* Klika in Klika et Novak 1941.

On the basis of phytosociological study, the vegetation along the Bulgarian Black Sea coast could be shown in terms of syntaxonomy in the following way:

Cakiletea maritimae R. Tx. et Prsg. ex Br.-Bl. et R. Tx. R. Tx. 1952
Cakiletalia maritimae R. Tx. 1950
Euphorbion peplis R. Tx. 1950
Cakilo euxinae-Salsoletum ruthenicae Vicherek 1971

Ammophiletea Br.-Bl. et R. Tx. ex Westhoff et al. 1946
Ammophiletalia arudinaceae Br.-Bl. 1933
Elymion gigantei Morariu 1957
Xanthio italici-Leymetum sabulosi ass. nova
Medicago tenderiensis-Ammophiletum arundinaceae ass. nova
Scabiosion ucrainicae Boscaiu 1975
Alysso borzaeani-Ephedretum distachyae ass. nova
Stachyo atherocalici-Caricetum ligericae ass. nova
Festuca arenicola community

Helichryso-Crucianelletalia maritimae Géhu, Riv.-Mart. et R. Tx. in Géhu 1975
Sileno thymifolae-Jurinion kilaeae Géhu et al. 1989
Aurinio uechtritziani-Artemisietum campestris typicum ass. nova
var. *Alyssum borzaeanum*
var. *Secale sylvestre*
var. *Syntrichia ruralis*
Aurinio uechtritziani-Artemisietum campestris pancratietosum maritimi subass. nova

4.2.1 Pioneer vegetation on the higher parts of the beaches

Association *Cakilo euxinae-Salsoletum rutenicae* Vicherek 1971

This association represents the first stages of development of littoral psammophytic vegetation in the higher beach places. Vicherek (1971) described it on the basis of 30 relevés from the Bulgarian Sea coast. The total abundance of the species is often very low. Despite the poor floristic composition (a total of 12 species, 4–6 different phytocoenoses), the author of the association defines a typical subassociation with a variant *Xanthium strumarium* subsp. *italicum* and subassociation *crambetosum maritimae*. The latter is localized in the dunes of one of the biggest Bulgarian Black Sea resorts – "Golden Sands". The discussed vegetation, in most of the cases, is under human impact determined by the developing tourism, intensive usage and cleaning of the beaches. A considerable part of this group of

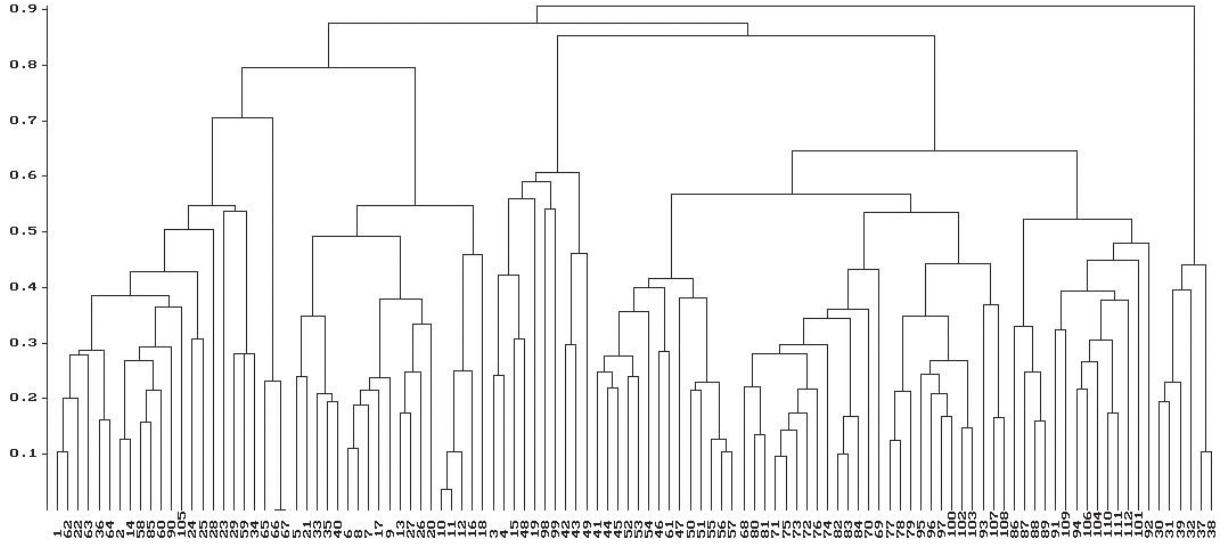

Figure 2: Classification of all relevés. Average linkage method and Horn`s index of similarity.
Slika 2: Klasifikacija vseh popisov. Kopičenje na osnovi povezovanja srednjih razdalj s indeksom podobnosti po Hornu.

phytocoenoses *Cakile maritima* subsp. *euxina* has been obliterated in the last decades. In the phytocoenoses described (Table 1) it was rarely found, possibly due to the seasonal rhythm of these annual species.

All species primarily forming the coenoses of the association indisputably place it in Class *Cakiletea maritimae*, Order *Cakiletalia maritimae,* and Alliance *Euphorbion peplis.*

Described as an association from the Bulgarian Sea coast, *Cakilo euxinae-Salsoletum rutenicae* has a pontic character. It is distributed on the Turkish Black Sea coast as well as on the Sea of Marmara coast and the beaches of the northeastern part of the Aegean Sea (Géhu & Uslu 1989).

Described by the dominant method for the "Kamchia sands" protected area, the association E*ryngium maritimum* + *Salsola ruthenica* (Ivanov & al. 1997) is published without relevés, and for *Eryngium maritimum* + *Salsola soda* (Filipova-Marinova 1997) near Lake Shabla it is indicated that *Cakile maritima* and *Salsola rutenica* also occur.

4.2.2 Embryonic dune vegetation

Association *Xanthio italici-Leymetum sabulosi* ass. nova

The association is formed on embryonic dunes in the higher beach places (Table 2). *Leymus racemosus* subsp. *sabulosus* dominates in many phytocoenoses along the beaches. *Xanthium strumarium* subsp. *italicum* and *Eryngium maritimum* occur almost everywhere. Highly abundant are also *Lactuca tatarica* and *Salsola ruthenica,* while *Ammophila arenaria, Elymus farctus, Crambe maritima* and others, are of limited presence. The association features transitional characteristics between the classes *Ammophiletea* and *Cakiletea maritimae* with little superiority to the latter. This illustrates a more evident relation with the embryonic dunes than with the higher beach places.

An obvious result of human impact is the expansive distribution of *Xanthium strumarium* subsp. *italicum* in the phytocoenoses of the highest beach places and the embryonic dunes. The species was introduced from America and is perfectly adapted in East, Central and South Europe. This taxon is not present in *Ammophilo-Elymetum gigantei* (Vicherek 1971). While species such as *Centaurea arenaria* and *Silene thymifolia*, diagnostic and with maximum constancy for this association, are now very rare. Indicative is the absence of the highly abundant, and diagnostic for Vicherek's association, perennial species *Euphorbia paralias, Stachys maritima* and *Medicago marina. Cynanchum acutum*, a diagnostic species to the order *Ammophiletalia* Br.-Bl. 1933 (syn. *Elymetalia gigantei* Vicherek 1971), is also absent. Many species from the two subassociations of *Ammophilo-Elymetum gigantei – cakiletosum euxinae* and *festucetosum vaginatae* are not present. In addition to the human influence, succession and fluctuation processes are also possible reasons for the changes taking place in the phytocoenoses, described by Vicherek 40 years ago.

The discussed association is distributed along the entire Bulgarian coastline. There is a similar association *Leymo sabulosi-Elymetum farcti* Géhu et al. 1986 (Géhu & Uslu 1989) distributed along the most southerly parts of the west Black Sea coast (Turkey), the northern Sea of Marmara coast, the northernmost shoreline of the Aegean Sea. It is characterized by high constancy of the typical *Elymus farctus* and *Leymus racemosus* subsp. *sabulosus,* and *Eryngium maritimum.* Relevés with emphasized presence in the cited species are also present on the Bulgarian Black Sea coast, but the floristic composition is considerably richer, as shown in Table 2. The two associations are geographic vicariants.

The described Bulgarian Black Sea coast association possesses an endemic element, its Romanian vicariant *Elymetum gigantei* Morariu 1957 being similar to the Bulgarian mainly by the dominant *Leymus racemosus* subsp. *sabulosus.* The Romanian vicariant includes species not present in the Bulgarian association: *Alyssum alyssoides, Artemisia arenaria,* but at the same time it lacks important species forming the coenoses of the Bulgarian association: *Ammophila arenaria, Lactuca tatarica, Salsola ruthenica* and others.

4.2.3 Shifting dune vegetation

Association *Medicago tenderiensis-Ammophiletum arundinaceae* ass. nova

The relevés of *Ammophila arenaria* subsp. *arundinacea* and *Leymus racemosus* subsp. *sabulosus* are included in Table 3 and are a clearly expressed fraction in the dendrogram (Fig. 2) with a similarity of 51 %.

Analysis of the floristic structure shows closest proximity of the association with that established by Vicherek (1971), the association *Ammophilo-Elymetum gigantei.* The expressed differences reveal, in our opinion, the consequences of an intensive hu-

man impact: almost complete absence of basic obligatory psammophytes (*Euphorbia peplis, Medicago marina, Stachys maritima*) and the introduction in the phytocoenoses composition of other, ecologically more adaptable species, with high constancy and in some places with high abundance (*Medicago falcata* subsp. *tenderiensis, Euphorbia seguierana, Linaria genistifolia* subsp. *genistifolia, Secale sylvestre* and others). Instead of *Leymus racemosus* subsp. *sabulosus* in many phytocoenoses *Ammophila arenaria* dominates. The two association groups have distinctively different ranges of distribution: those presented in Table 3 group are distributed along the Dobrudzha Black Sea coast, while the associations of *Ammophilo-Elymetum gigantei* Vicherek 1971 occur on the coast south of this territory. All this gives us reason to describe the phytocoenoses discussed here as a new association *Medicago tenderiensis-Ammophiletum arundinaceae.* To larger extent it is related with the shifting (white) dunes rather than with the embryonic. The basic species in this association are rooty cereal plants, more often with considerable abundance. The floristic structure of the association is comparatively rich and entirely belongs to *Ammophiletea,* without expressed relevance to *Cakiletea.*

The association has a western-pontic character, defined by a considerable occurrence of *Centaurea arenaria* subsp. *borysthenica* and *Silene thymifolia.* It has a certain floristic relevance with *Othantho-Leymetum sabulosi* Géhu et Uslu 1989, described in Turkey. This association includes thermophytic species with Mediterranean affinity: *Pancratium maritimum, Othanthus maritimus, Polygonum maritimum, Cyperus capitatus* and others, which are missing in *Medicago tenderiensis-Ammophiletum arundinaceae.* Even though *Othanthus maritimus* is an element of the Bulgarian flora, it is not found in our country's coastal psammophytic vegetation relevés. The phytocoenoses with higher abundance of *Pancratium maritimum* reach northwards to the camping "Kavatsite", south of the town of Sozopol, while *Polygonum maritimum* is distributed along the northern beaches as well, but in another syntaxon (Table 1).

Festuca arenicola community

The habitats of some phytocoenoses dominated by *Festuca arenicola* (Table 4) cover a range of 25 square metres of flat areas or slight inclinations in the inner part of the Lake Dourankulak dune complex. They are established on unstable sand, have poor floristic structure and show similarity to the association *Medicago tenderiensis-Ammophiletum arundinaceae* (Fig. 2). With more limited abundance there occur: *Silene thymifolia, Medicago falcata* subsp. *tenderiensis, Astragalus onobrychis* subsp. *skorpili, Secale sylvestre, Euphorbia seguierana* and others.

4.2.4 Fixed dune vegetation

Association *Aurinio uechtritzianae-Artemisietum campestris* ass. nova

A larger part of the fixed dunes' phytocoenoses, from the north of Kamchia River mouth to the last described – south of Primorsko – is included in this association.

The entire group of relevés is clearly separated from the above discussed beach and shifting dune syntaxa. The similarity between the two groups of relevés is under 15 % (Fig. 2). So far the floristic-sociological method has not been used for classification of fixed dune vegetation along the Bulgarian Black Sea coast. The existing information for dominant method researches is scarce. In their article about the Kamchia sands (Ivanov & al. 1997) did not distinguish relevés, whereas in his work Meshinev & al. (1994) has one relevé described by specific methodology.

The described association (Table 5) has two characteristic species: the core in most phytocoenoses is *Artemisia campestris* together with East Balkan-Anatolian endemic *Aurinia* (*Lepidotrichum*) *uechtritziana.* The presence of East Balkan endemic species *(Verbascum purpurem* and *Silene thymifolia),* of some pontic elements with high constancy and the abundance of *Silene euxina, Cionura erecta, Jurinea albicaulis* subsp. *kilaea* in some places, makes it an endemic association for the west Black Sea coast. Additionally, the occurrence of the south European species *Scabiosa argentea* and *Carex ligerica* (though with more limited distribution) is a reason to refer to the association as alliance *Sileno thymifoliae-Jurinion kilaea,* order *Hellichryso-Crucianelletalia,* and class *Ammophiletea.* Due to the relief varieties, generally the association's composition includes a considerable number of species, but with more limited presence.

The fixed dunes are characterized by complicated nano- and micro-relief. The undulating topography of rising slopes from a few to tens of metres, take alternates with different inclinations, creating conditions for climatic variations, changes in sand density and (im) mobility, etc. All this reflects the taxons' distribution. Four groups of relevés are clearly defined (Fig. 2, Table 5). In each of them

the similarity is about 50 %. Three of the groups have closer relativeness (similarity 44 %). These relevés are united in a typical subassociation. The fourth group of relevés has a more different floristic composition and is separated as a subassociation.

On the basis of different species from subassociation *Aurinio uechtritzianae-Artemisietum campestris* typicum, three habitat variants with defined edaphic and climatic conditions are distinguished. Besides the primal for the association's species, a variant develops with *Alyssum borzaeanum* on the denser sand of the flattened areas, or on the steep south or west slopes. It is characterized by the presence of *Alyssum borzaeanum, Stachys atherocalyx, Linum tauricum* subsp. *bulgaricum*, as well as *Peucedanum arenarium*. In some phytocoenoses with high abundance there occurs *Galilea mucronata*.

Because of strong winds the ridge parts of the fixed dunes are much drier and with unstable sand. This defines a lower vegetation cover and development of annual species such as S*ecale sylvestre, Coryspermum nitidum*, as well as an endemic Balkan taxon *Astragalus onobrychis* subsp. *scorpili*. On other species with high constancy is *Cionura erecta*. Differentiated is a variant with *Secale sylvestre*. Communities of a variant with differential species *Syntrichia ruralis, Cladonia foliacea, Poa bulbosa* and *Arenaria serpilifolia* utilize the north shadowy humidified slopes with stable sand. Suitable conditions for this group of phytocoenoses are the more humidified flattened regions adjacent to the Kamchia River mouth.

The aspect of the phytocoenoses of this subassociation is defined mainly by *Artemisia campestris*.

In subassociation *pancratietosum maritimae* the presence of primal species, which form the phytocoenosis of the association, is decreased because of the increased presence of – characteristic for embryonic and shifting dunes – the taxa *Ammophila arenaria, Pancratium maritimum*. Some of these phytocoenoses also include *Leymus racemosus* subsp. *sabulosus, Eryngium maritimum* and *Medicago marina*. This is a result of the specific habitats, on the border between the embryonic and shifting (white) dunes occupied by this group of phytocoenoses. The sand is loose, not only on the steep sunny slopes, but also on the flatter areas, bordering the embryonic or shifting dunes. With high abundance are *Festuca vaginata, Peucedanum arenarium, Silene euxina, Cionura erecta* and *Galilea mucronata*. On account of its floristic composition the discussed phytocoenoses group possesses a distinct identity. And while the relations between the typical subassociation with *Crucianelletalia* dominate, in *pancratietosum maritimae* apparent are those with *Ammophiletalia*. The subassociation has an expressed Mediterranean-pontic character.

For the Turkish Black Sea coast geosynvicariantic association, *Stachio subcrenatae-Centauretum kilaeae* (Géhu & Uslu 1989) is differentiated from the subassociation here disscused. It is referred to the same higher syntaxa, as *Aurinio uechtritzianae-Artemisietum campestris,* and is distinguished by the high abundance of Euxinian species which, according to the authors have an optimum development here. The analysis of the associations from the described group differentiated by the dominant method is hampered by limited published information. It can be accepted that most of them are parts of the association discussed. For example: *Centaurea arenaria + Silene thymifolia, Centaurea arenaria + Lepidotrichum uechtritzianum + Silene thimifolia, Peucedanum arenarium + Jurinea albicaulis* subsp. *kilaea* (Ivanov & al. 1997), *Peucedanum arenarium, Jurinea albicaulis* subsp. *kilaea* and others (Meshinev & al. 1994).

Association *Stachyo atherocalici-Caricetum ligericae* ass. nova

Carex ligerica is a comparatively widely distributed species among the fixed dune vegetation cover and occurs in the composition and structure of different phytocoenoses. The sand in some mainly flattened areas or with slight inclination, as well as in areas with several to hundreds of square metres of inclining relief, is slightly more compact and better humidified from the sand of neighboring areas.

In such conditions *Carex ligerica* is often well presented as dominant. Associations of this type are described in different dune systems along the entire Bulgarian coast, but most of them are northwards from Kamchiiski dunes. In Romania (Ivan (ed.) 1992, Ivan & al. 1993), a vicariantic association of the one discussed here is *Scabioso ucrainice-Caricetum ligericae* (Simon 1960) Krausch 1965 (Table 8). For the Turkish Black Sea shorelines such an association is not documented.

The floristic composition of the association includes more than 30 taxa, but most of them express no adherence to it (Table 6). Above one-half of the species occur only in one or two relevés. Distinctive phytocoenoses have poor floristic compostion – about (4) 6 – 8–9 (14) taxa. More frequently encountered is *Stachys atherocalyx,* with a range of distribution spreading from the Balkan Peninsula to

the Ukrainian and Crimean Black sea coast, and reaching Iran. Other more often occurring species are also *Centaurea arenaria, Linaria genistifolia* subsp. *genistifolia, Chondrilla juncea* and *Jasione heldreichii.* The presence of *Artemisia campestris* and *Aurinia uechtritziana* was very limited. It is obvious that this group of phytocoenoses, whith a floristic similarity of about 43 % (Fig. 2), can not be referred to the main fixed dune association – that of *Artemisia campestris.* It has a distinctive floristic compostion and differs from association *Scabioso ucrainicae-Caricetum ligericae* (Simon 1960) Krausch 1965. In the latter, highly abundant are many taxa, which – almost or entirely – are not encountered in the phytocoenoses of *Carex ligerica* from the Bulgarian dunes: *Scabiosa argentea, Polygonum arenarium, Syrenia montana, Euphorbia seguieriana, Kochia laniflora* and others.

Species from the discussed association are with limited occurrence in *Ammophiletea.*

Ivanov & al. (1997) describe the association with poor floristic composition and high abundance of Carex ligerica. Meshinev & al. (1994) published the association *Ammophila arenaria + Carex ligerica* with a relevé on a limited area.

Association *Alysso borzaeani-Ephedretum distachyae* ass. nova

The association is described within the borders of the dune complex "Anna Maria" on the Bulgarian-Romanian border. A number of clearly defined floristic and – spatially differentiated from one another – phytocoenoses of *Ephedra distachya* are found in the inner parts of the fixed dunes, until the complex reaches a steep cliff. The floristic composition is considerably different from the other earlier described psammophytic phytocoenoses, hence the relevance between them is around 10 % (Fig. 2). The edificator species of the phytocoenoses is *Ephedra distachya* (Table 7). The presence of Balkan endemic *Verbascum purpureum*, as well as xerotherm *Syntrichia ruralis,* emphasizes the specificity of the association discussed. With high presence are *Xanthoria parietina* and *Erysimum diffusum.* The phytocoenoses of *Alysso borzaeani-Ephedretum distachyae* are composed by a few species (7–10–12). The presence of anthropophytes and ruderals (*Echium vulgare, Marrubium peregrinum, Prunus spinosa* etc.) is a sign of certain ruderalisation of the association.

The composition of the association consists of some characteristic species for *Ammophiletea* and *Koelerio-Corynephoretea* species.

The presence of *Ephedra distachya, Alyssum borzaeanum, Cynanchum acutum, Silene thymifolia, Festuca vaginata* and *Scabiosa argentea,* diagnostic for the relevés in the Romanian's alliance *Scabiosion ucrainicae* Boscaju 1975, shows the connection between the vegetation of the northern Bulgarian coast with the vegetation in the Danube delta (Popescu & al. 1981). However the described on Romanian territory *Ephedro-Caricetum colchicae* (Morariu 1959) Krausch 1965, has a different floristic composition. Phytocoenoses' relevés of *Ephedra distachya* in other dune complexes on the Bulgarian western Black Sea association were unknown until now.

Outside the differentiated syntaxa there remain several relevés of the phytocoenoses dominated by *Clamagrostis epigeios.* As a rule they are monodominants; in the composition with limited species richness are included: *Plantago lanceolata, Pycreus serotinus, Juncus littoralis, Allium guttatum* subsp. *sardoum, Sanguisorba minor, Daucus carota* and others.

In some dune complexes, mainly on the southern coastline, for example in the region of Arkutino, the psammophytic vegetation succession processes end up with the formation of phytocoenoses dominated by *Chrysopogon gryllus, Paliurus spina-christis;* as well as the development of tree species, particularly on the slopes facing the sea from the highest dune (50m) in Bulgaria. Mainly *Carpinus orientalis, Fraxinus ornus, Quercus pubescens* and others dominate these fragmented forests.

5. DISCUSSION

From the Romanian border south to the International Youth Camp "Primorsko", 166 relevés from 7 associations were differentiated by the floristic-sociological method. Six of them are endemic to the Bulgarian Black Sea coast – two localized only in the Dobrudza Black Sea region, 3 distributed south of it, one on the entire Bulgarian shoreline and another on the Bulgarian and Turkish coasts. A smooth transition is established from the pioneer coastal vegetation to that of the embryological and shifting (white) dunes and further on to the fixed (grey) dunes vegetation. The described associations are connected to classes *Cakiletea maritimae, Ammophiletea* and *Koelerio-Corynephoretea.*

Davidov (1905, 1912), one of the first scientists to explore the Bulgarian coastal psammophytic flora, emphasized the next conclusions. While the vegetation of the northern part of the Bulgarian Black Sea coast is diverse, and the associations in-

clude more species, the vegetation growing on the southern Bulgarian sandy coast is less diversified and "grows in simple communities" (Davidov 1912). Indeed, on the southern dunes a clearer, irregular and group species distribution is established. This is one of the reasons why each of the three variants of the typical *Aurinio uechtritzianae-Artemisietum campestris* subassociation is limited in its own range of distribution within the area of one or several neighboring dune systems. The use of the dominant method has led to separation of many associations in the south dune complexes (Meshinev & al. 1994–32 associations for Sunny beach dune).

Another specific feature of the Bulgarian dunes is the influence of inland tercieric dunes on the psammophytic vegetation (Davidov 1912). This is a reason for the formation of some endemic taxa (*Aurinia uechtritziana)*, which add to the unique character of the Bulgarian coastal psammophytic vegetation.

The western Black Sea coastal Euxinian province is divided into two regions: Southern coastline and Northern coastline (Bondev 1997) or into northern and southern dunes (Davidov 1905, 1912) with a separating border – the Balkan Mountains' Cape Emine. This separation places the Kamchiiski sands (including those near the village of Shkorpilovtsi) in the group of the southern dunes. In our opinion, such division is incorrect. Hence, according to the climatic features of this territory, the geographers consider it as an independent Kamchian-Balkan climatic region (Tishkov 1982). Another interpretation included it in the boundaries of the Varna Black Sea coast climatic region (Velev 1997). From the geobotanical point of view, the Kamchiiski sands have a rather transitional character, but closer to the southern sands. Bondev (1997) defined as characteristic of the Southern coast psammophytic taxa: *Ammophila arenaria, Leymus racemosus, Centaurea arenaria, Festuca vaginata, Festuca arenicola, Peucedanum arenarium, Silene euxina, Silene thymifolia, Pancratium maritimum, Otanhus maritimus, Cionura erecta* (no typical species for the Northern coast are published in the article). The cited species, without the last three, are basic formers of the coenosis vegetation cover in the Kamchiiski sands. *Ammophila arenaria, Leymus racemosus, Centaurea arenaria, Fesutca vaginata, Festuca arenicola* form psammophytic vegetation in the Northern coast, including up to the Romanian border.

In Bulgaria, *Pancratium maritimum* is distributed mainly south of Sozopol, i.e. the "Kavatsite" camp. The distribution of this species could be a prerequisite for differentiation of the southern subregion in the range of one southern geobotanical region. Its northern border, though, should be specified in more detailed studies, but in every case it will include the Kamchiiski sands.

The syntaxa discussed in the recent work are differentiated, and outline certain differences in Dobrudzha coastal vegetation to that of "Golden sands" in the south.

The synoptic table (Table 8) allows for comparison of the constancy of species presence in separate syntaxa (only psammophytic vegetation) along the western Black Sea coast. It precisely defines their relativeness and differences, for the Bulgarian as well as for the geosynvicariantic associations of neighboring countries (Romania and Turkey), and partly on the coasts of neighboring seas (Sea of Marmara and Aegean Sea).

The pioneer psammophytic vegetation of the Bulgarian coast is poorer than that of neighboring territories. The only pioneer coastal psammophytic association on our territory *Cakilo euxinae-Salsoletum rutenicae* (*Cakiletea maritimae*) has a Pontic-mediterranean character and range of distribution. As far is presently known, this is the only association that spreads beyond the borders of the Bulgarian Black Sea coast. This syntaxon is of southern nature and occurs along the Bulgarian coast and the south Black sea coast, the shorelines of the Sea of Maramara and the eastern part of the Aegean Sea (Géhu & Uslu 1989). On the higher Bulgarian beach places, embryonic and shifting dunes (*Ammophiletea, Ammophiletalia*) form associations *Xanthio italici-Leymetum sabulosi, Ammophilo-Elymetum gigantei* and *Medicago tenderiensi-Ammophiletum arundinaceae.*

In the south geosynvicariantic associations are *Otantho-Leymetum sabulosi* and *Leymo sabulosi-Elymetum farcti,* while in the north – *Elymetum gigantei.*

All of them are from one alliance – *Elymyion gigantei* of *Ammophiletalia*, which is an evidence of considerable floristic and syntaxonomic vegetation relevance of the shifting sands of the Western Black Sea coast. The vegetation of dunes with more or less stable sand, situated beside the shifting dunes, is presented in the southern regions of the West Black Sea coast by *Stachyo subcrenatae-Centauretum kilaeae* association, in which *Polygonum maritimum, Salsola kali* subsp. *ruthenica, Eryngium maritimum, Elymus farctus, Ammophila arenaria* take part. To a certain degree, this association is closer to the shifting dunes in comparison with *Aurinio uechtritzianae-Artemisietum campestris,* distributed along the boundaries of the Bulgarian Black Sea coast, in which the

cited taxa are almost missing. Compared with *Stachyo subcrenatae-Centauretum kilaeae,* the southern association is poorer in species. However, the two syntaxons include species from the same alliance from *Helichryso-Crucianelletalia* of *Ammophiletea,* although the Bulgarian association also contains elements of *Koelerio-Corynephoretea.*

The clear connection between *Aurinio uechtritzianae-Artemisietum campestris* and syntaxa of shifting dunes appears to be a variant with *Secale sylvestre* from a typical subassociation and subassociation *pancratietosum maritimae.* The two subassociations and the represented variants of typical subassociation of the association *Aurinio uechtritzianae-Artemisietum campestris* reveal a complex structure of the vegetation cover of the fixed dunes. Additionally, it is complemented by two new associations: *Stachyo atherocalici-Caricetum ligericae* and *Alysso borzaeani-Ephedretum distachyae.* The composition of the last association marks the advancing northward of even more essential changes, which lead to a more steppe appearance of the fixed dune vegetation. It is similar to the associations known (Ivan (ed.) 1992, Ivan & al. 1993) for the Romanian territory, addressed to order *Festucetalia vaginatae* (Table 8).

It can be concluded from the above description that: the development of the succession processes of the vegetation cover of the coastal dunes increases differentiation of the floristic composition and structure of phytocoenoses of Pontic-mediterranean to steppe and foresteppe vegetation, as well as the connection with the neighboring dry land territories. In the framework of these tendencies, the vegetation of coastal dunes within the boundaries of Bulgaria is distinguished by a transitional character between typical Pontic-Meditarrenean syntaxa from the west parts of the West Black Sea coastal dunes and those in its northern parts connected with steppe and broadleaved forest vegetation. As a result, the Bulgarian Black Sea coast has one common association with the South Black Sea coast and 6 endemic associations.

6. CONCLUSIONS

The discussed syntaxa are of particular bio-geographical interest as part of the western Pontic-meditarrenean vegetation cover. Part of them appear to be geosynvicariants of associations from Southern Black Sea coast, some also Mediterranean, while others are from the northern Black sea coast. The predominant associations are endemic.

Particularly distinctive is the floristic combination of the Bulgarian fixed dune compared with the one described on the southern and northern territories of the West Black Sea coast.

The above analysis confirms the Pontic-Mediterranean character of the coastal psammophytic vegetation on Bulgarian territory.

On the Bulgarian Black Sea coast the preserved dune complexes require that, in these times of dynamically developing tourism, special measures and actions be taken for their conservation.

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Table 1: Pioneer vegetation on the higher parts of sand beaches.
Association *Cakilo euxinae-Salsoletum ruthenicae* Vich. 1971

Tabela 1: Pionirska vegetacija na višjih delih peščenih sipin.
Asociacija *Cakilo euxinae-Salsoletum ruthenicae* Vich. 1971

Rel. number	28	23	29	59	34	65	66	67	C
Area (m²)	25	200	200	200	200	200	200	100	
Cover (%)	70	1	3	5	3	1	1	1	
Exposition	–	–	–	–	E	–	–	E	
Slope (in degrees)	0	0	0	0	2	0	0	10	
Number of taxa	10	5	6	6	8	6	3	3	
Diagnostic taxa of association									
Salsola ruthenica Iljin	2	+	1	1	+	+	.	.	IV
Cakile maritima Scop. subsp. *euxina* (Pobed.) E. I. Nyar.	.	.	.	.	.	1	1	1	II
Diagnostic taxa of higher units									
***Cakiletea maritimae* R.Tx. et Prsg.ex Br.-Bl. et R.Tx. R.Tx. 1952, *Cakiletalia maritimae* R.Tx. 1950 and *Euphorbion peplis* R.Tx. 1950**									
Polygonum maritimum L.	+	+	+	1	+	+	+	+	V
Eryngium maritimum L.	.	.	+	.	+	+	+	+	IV
Crambe maritima L.	3	.	+	+	+	.	.	.	III
Euphorbia peplis L.	.	+	.	+	+	+	.	.	III
Xanthium italicum Moretti	.	.	1	+	+	.	.	.	II
Glaucium flavum Crantz.	.	.	.	.	+	.	.	.	I
***Ammophiletea* Br.-Bl. et R. Tx. 1943**									
Elymus farctus (Vis.) Runem. ex Meld.	1	.	.	.	+	+	.	.	II
Leymus racemosus (Lam.) Tzvel. subsp. *sabulosus* (Bieb) Tzvel.	+	+	.	.	.	.	.	.	II
Lactuca tatarica (L.) C.A. Mey.	1	r	.	.	.	.	.	.	II
Centaurea arenaria Bieb.	2	.	.	.	.	.	.	.	I
***Accompanying* taxa**									
Corispermum nitidum Kit. in Schult.	1	.	+	.	.	.	.	.	II
Linaria genistifolia (L.) Mill. subsp. genistifolia	+	.	.	.	.	.	.	.	I
Cichorium inthybus L.	+	.	.	.	.	.	.	.	I
Convolvulus arvensis L.	.	+	.	.	.	.	.	.	I
Suaeda altissima (L.) Pall.	.	.	.	+	.	.	.	.	I

Localities: 23 – Lake Dourankulak; 28, 29 – Lake Shablenska touzla; 34 – "Anna Maria" Beach; 59 – village of Shkorpilovci; 65, 66 and 67 – Irakli Beach.
Dates: 23, 28, 29 and 34 – 26. 08. 03; 59 – 27. 08. 03; 65–67 – 28.08.03.

Table 2: Vegetation of the embryonic dunes. Association *Xanthio italici-Leymetum sabulosi* ass. nova, type nom. rel. 85 holotype

Tabela 2: Vegetacija novonastalih sipin. Asociacija *Xanthio italici-Leymetum sabulosi* ass. nova, type nom. rel. 85 holotype

Rel. number	1	62	22	63	36	64	2	14	58	85	60	90	105	24	25	C
Area (m^2)	25	100	25	200	200	100	25	25	100	100	100	100	200	25	25	
Cover (%)	50	60	60	1	10	30	30	50	30	30	20	20	10	70	80	
Exsposition	–	–	–	–	–	–	–	E	–	–	–	–	E	N	–	
Slope (in degrees)	0	0	0	0	0	0	0	10	0	0	0	0	3	3	0	
Number of taxa	8	6	6	7	10	7	7	7	5	10	10	10	14	10	10	
Diagnostic taxa of association																
Leymus racemosus (Lam.) Tzvel. subsp. *sabulosus* (Bieb) Tzvel.	4	2	4	1	+	1	3	3	2	3	1	2	2	4	4	V
Xanthium strumarium L. subsp. *italicum* (Moretti) D. Loeve	2	2	1	+	1	+	+	+	.	1	+	+	+	1	+	V
Diagnostic taxa of higher units																
Ammophiletea **Br.-Bl. et R. Tx. ex Westhoff et al. 1946,** *Ammophiletalia arudinaceae* **Br.-Bl. 1933 and** *Elymion gigantei* **Morariu 1957**																
Eryngium maritimum L.	+	1	2	+	+	+	.	+	+	1	+	1	+	+	+	V
Lactuca tatarica (L.) C.A. Mey.	2	2	+	1	1	+	1	2	.	+	.	+	.	2	+	IV
Ammophila arenaria (L.) Link.	.	.	1	.	.	.	+	+	2	2	1	1	1	.	.	III
Elymus farctus (Vis.) Runem. ex Meld.	.	.	.	.	+	.	1	1	1	3	2	2	1	.	2	III
Centaurea arenaria Bieb.	+	1	1	.	.	.	.	.	.	.	.	1	1	+	.	II
Silene thymifolia Sibth. et Sm.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	I
Pancratium maritimum L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Euphorbia paralias L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Cakiletea maritimae **R.Tx. et Preising. in R.Tx. 1950**																
Salsola ruthenica Iljin	1	+	.	+	+	+	1	.	1	2	+	1	+	.	.	IV
Crambe maritima L.	+	.	.	+	+	.	1	+	.	.	+	.	.	1	+	III
Polygonum maritimum L.	+	.	.	.	+	+	.	.	.	+	+	.	+	.	.	II
Euphorbia peplis L.	.	.	.	.	+	+	.	.	.	.	+	.	+	.	.	II
Cakile maritima Scop. subsp. *euxina* (Pobed.) E. I. Nyar.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	I
Glaucium flavum Crantz.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
Accompanying taxa																
Chondrilla juncea L.	.	.	.	.	.	.	.	.	.	1	.	.	.	+	+	I
Medicago falcata L. subsp. *tenderiensis* (Operm.) Vas.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	I
Sonchus arvensis L. subsp. *uliginosus* (Bieb.) Nym.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Phragmites australis (Cav.) Trin. ex Steud.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
Plantago scabra Moench.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	I
Corispermum nitidum Kit. in Schult.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
Galilea mucronata (L.) Parl.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Jurinea albicaulis Bunge subsp. *kilaea* (Azn.) Koz.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Alyssum hirsutum Bieb. subsp. *caespitosum* (Dudl.) Ancev	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
Leontodon crispus Vill.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
Conyza canadensis (L.) Cronq.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Crepis foetida L ssp. *foetida*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Tragopogon dubius Scop.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I

Localities: 1, 2, 14 and 22 – Lake Dourankulak; 24 and 25 – Lake Shablenska touzla; 36 – "Anna Maria" Beach; 58 and 60 – village of Shkorpilovci; 62 – north from Obzor; 63 and 64 – Irakli Beach; 85 and 90 – "Golden fish" Resort; 105 – Arkoutino.

Dates: 1, 2, 14, 22, 24, 25, 36 – 26. 08. 03; 58, 60 – 27. 08. 03; 62, 63, 64 – 28. 08. 03; 85, 90 – 29. 08. 03; 105 – 30. 08. 03.

Table 3: Vegetation of the shifting (white) dunes
Association *Medicago tenderiensis-Ammophiletum arundinaceae* ass. nova, type nom. rel. 7 holotype

Tabela 3: Vegetacija premikajočih (belih) sipin
Asociacija *Medicago tenderiensis-Ammophiletum arundinaceae* ass. nova, type nom. rel. 7 holotype

Rel. number	5	21	33	35	40	6	8	7	17	9	13	27	26	20	C
Area (m^2)	25	25	25	25	25	25	25	25	25	25	25	25	25	25	
Cover (%)	60	60	60	60	80	50	50	60	70	80	80	80	80	60	
Number of taxa	7	9	9	11	11	11	10	9	10	7	9	8	7	10	
Diagnostic taxa of association															
Medicago falcata L. subsp. *tenderiensis* (Operm.) Vas.	2	1	1	1	+	1	2	2	+	.	1	1	.	+	V
Ammophila arenaria (L.) Link.	.	+	.	.	.	1	3	3	4	4	5	4	4	4	IV
Diagnostic taxa of higher units															
Ammophiletea **Br.-Bl. et R. Tx. ex Westhoff et al. 1946,** *Ammophiletalia arudinaceae* **Br.-Bl. 1933 and**															
Elymion gigantei **Morariu 1957**															
Centaurea arenaria Bieb.	1	+	+	3	2	3	1	2	+	1	1	1	2	1	V
Leymus racemosus (Lam.) Tzvel.															
subsp. *sabulosus* (Bieb) Tzvel.	3	4	1	+	+	1	+	+	+	.	+	1	.	.	IV
Silene thymifolia Sibth. et Sm.	3	+	2	2	2	3	2	1	1	1	1	.	.	.	IV
Eryngium maritimum L.	+	+	.	+	+	+	.	.	+	+	+	+	1	+	IV
Elymus farctus (Vis.) Runem. ex Meld.	2	.	3	2	+	.	.	.	.	.	.	.	.	.	II
Lactuca tatarica (L.) C.A. Mey.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
Accompanying taxa															
Euphorbia seguierana Neck.	.	+	1	+	2	2	+	.	.	.	+	1	1	1	IV
Linaria genistifolia (L.) Mill. subsp. *genistifolia*	+	+	.	+	.	+	+	+	+	+	.	.	.	+	IV
Secale sylvestre Host.	.	.	.	.	.	+	+	+	+	+	.	.	+	.	III
Chondrilla juncea L.	.	.	+	.	.	.	.	.	.	.	.	+	+	2	II
Silene conica L.															
subsp. conomaritima D. Jord. et P. Pan.	.	.	.	.	.	+	+	.	+	.	.	.	.	+	II
Alyssum borzaeanum E. I. Nyar.	.	.	2	3	3	.	.	.	.	.	.	.	.	.	II
Alyssum minutum Schlecht. ex DC	.	.	.	.	.	.	+	+	.	+	.	.	.	.	II
Alyssum hirsutum Bieb.															
subsp. *caespitosum* (Dudl.) Ancev	.	.	.	.	.	.	.	.	.	.	+	+	+	.	II
Astragalus onobrychis L. subsp. *scorpili* Vel.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	I
Erysimum diffusum Ehrh.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
Glaucium flavum Crantz.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Marrubium peregrinum L.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Verbascum purpureum (Janka) Hub.-Mor.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Xanthoria parietina (L.) Th. Fr.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Scabiosa argentea L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Stachys maritima Gouan	.	.	.	.	.	+	.	.	.	.	.	.	.	.	I
Festuca arenicola (Prod.) Soo	.	.	.	.	.	.	.	.	1	.	.	.	.	.	I
Crambe maritima L.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	I
Stachys atherocalyx C. Koch.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	I
Convolvulus persicus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	I

Localities: 5–9, 13, 17, 20 and 21 – Lake Dourankulak; 26 and 27 – Lake Shablenska touzla; 33, 35 and 40 – "Anna Maria" Beach.

Dates: 5-9, 13, 17, 20, 21, 26, 27, 33, 35 and 40 – 26. 08. 03

Table 4: Vegetation of the shifting (white) dunes *Festuca arenicola* community

Tabela 4: Vegetacija premikajočih (belih) sipin Združba z vrsto *Festuca arenicola*

Rel. number	10	11	12	16	18	C
Area (m²)	25	25	25	25	25	
Cover (%)	50	50	40	40	60	
Exposition	W	W	W	SW	–	
Slope (in degrees)	5	5	3	5	0	
Number of taxa	11	10	7	7	8	
Dominant species						
Festuca arenicola (Prod.) Soo	4	4	4	3	+	V
Diagnostic taxa of higher units						
***Ammophiletea* Br.-Bl. et R. Tx. 1943**						
Silene thymifolia Sibth. et Sm.	1	2	2	2	1	V
Centaurea arenaria Bieb. subsp. *borysthenica* (Gruner) Dostal	1	1	2	.	.	III
Eryngium maritimum L.	+	+	.	.	.	II
Carex ligerica J. Gay.	.	.	.	.	4	I
Ammophila arenaria (L.) Link.	.	.	.	.	+	I
Accompanying taxa						
Medicago falcata L. subsp. *tenderiensis* (Operm.) Vas.	1	+	+	+	+	V
Silene conica L. subsp. *conomaritima* D. Jord. et P. Pan.	1	+	+	1	.	IV
Astragalus onobrychis L. subsp. *scorpili* Vel.	2	1	1	1	.	IV
Euphorbia seguierana Neck.	1	2	2	.	+	IV
Secale sylvestre Host.	+	+	.	+	+	IV
Linaria genistifolia (L.) Mill. subsp. *genistifolia*	+	+	.	.	+	III
Xanthoria parietina (L.) Th. Fr.	+	.	.	.	.	I
Alyssum hirsutum Bieb. subsp. *caespitosum* (Dudl.) Ancev	.	.	.	1	.	I

Localities: 10–12, 16 and 18 – Lake Dourankulak
Dates: 10–12, 16 and 18–26. 08. 03

Table 5: Vegetation of the dry fixed (grey) dunes
Association *Aurinio uechtritziani-Artemisietum campestris* ass. nova, type nom. rel. 93 holotype

Tabela 5: Vegetacija suhih stabilnih (sivih) sipin
Asociacija *Aurinio uechtritziani-Artemisietum campestris* ass. nova, type nom. rel. 93 holotype

Rel. number	41	44	45	52	53	54	46	61	47	50	51	55	56	57	C1	68	80	81	71	75	73	72	76	74	82
Area (m²)	25															25									
Cover X 10 (%)	5	5	7	5	6	8	8	7	6	8	8	9	9	8		7	7	6	5	7	7	6	5	6	4
Exposition	W	E	W	S	S	E	E	–	E	–	–	SW	–	–		E	–	–	–	–	–	E	E	W	E
Slope (in degrees)	6	5	3	10	10	10	10	0	10	0	0	5	0	0		20	0	0	0	0	0	10	20	10	15
Number of taxa	17	16	14	9	14	11	12	10	12	11	11	8	9	8		14	12	11	12	12	8	10	10	9	12
Diagnostic taxa of association, subassociation and variant																									
Aurinia uechtritziana Cullen&Dudl.	+	2	1	+	2	3	3	1	3	.	1	.	+	.	IV	1	2	1	1	2	1	1	3	1	1
var. *Alyssum borzaeanum*																									
Alyssum borzaeanum E. I. Nyar.	3	2	2	3	3	2	2	3		2	2	2	2	2	V	.	.	.	.	.	.	.	.	.	.
Stachys atherocalyx C. Koch.	.	+	3	.	+	.	2	1	2	+	.	.	.	+	III	1	1	.	.	.	.	.	.	1	.
Linum tauricum Wills.																									
subsp. *bulgaricum* (Podp.)Petrova	+	1	+	+	1	.	.	.	.	+	1	.	.	.	III	.	.	.	.	.	.	.	.	.	.
var. *Secale sylvestre*																									
Secale sylvestre Host.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		+	1	+	1	1	+	1	+	1	+
Astragalus onobrychis L.																									
subsp. *scorpili* Vel.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		+	1	1	+	1	.	2	.	1	.
Corispermum nitidum Kit.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		+	1	+	2	+	.	.	.	.	+
var. *Syntrichia ruralis*																									
Syntrichia ruralis Brid.	2	1	.	.	.	2	.	.	.	.	.	.	.	.	II	.	2	2	.	.	.	.	2	.	.
Cladonia foliacea (Huds.)Schaer.	2	.	.	.	.	2	3	2	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Poa bulbosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Arenaria serpilifolia L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
***pancratietosum maritimi* subass. nova, type nom. rel. 87 holotype**																									
Ammophila arenaria (L.) Link.	.	1	.	.	.	.	.	.	+	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Pancratium maritimum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Festuca vaginata Waldst.&Kit.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Diagnostic taxa of higher units																									
***Sileno thymifolae-Jurinion kilaeae* Gehu et al.1989, *Helichryso-Crucianelletalia maritimae* Gehu, Riv.-Mart. et R.Tx. in Gehu 1975**																									
Jurinea albicaulis Bunge																									
subsp. *kilaea* (Azn.) Koz.	+	1	1	2	2	.	2	1	+	1	2	.	+	+	V	3	3	3	2	1	2	2	1	2	3
Silene thymifolia Sibth. et Sm.	1	2	1	.	1	1	1	+	2	.	1	+	1	+	V	2	2	2	1	2	3	1	2	.	+
Scabiosa argentea L.	+	2	1	+	.	.	1	.	+	+	+	+	+	+	IV	.	+	1	1	+	+	.	.	+	.
Carex ligerica J. Gay.	.	.	.	.	2	+	.	.	+	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Cladonia subrangiformis Sandst.	.	.	1	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium semidecandrum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Erysimum diffusum Ehrh.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

83	84	70	69	C2	77	78	79	95	96	97	100	102	103	93	107	108	C3	86	87	88	89	91	109	94	106	104	110	111	112	101	92	C4	C
										25															25								
5	6	9	7		7	8	9	9	1	3	9	9	9	8	8	8		2	7	3	2	7	3	6	7	4	3	5	3	4	3		
–	–	E	E		N	N	–	E	W	W	E	E	E	–	–	–		E	E	–	–	S	–	S	S	E	E	N	E	–	–		
5	0	5	20		20	20	0	5	5	10	5	2	2	0	0	0		5	3	0	0	10	0	30	25	55	10	20	5	0	0		
13	13	15	10		12	12	15	14	16	19	17	11	15	8	13	13		9	15	13	14	12	13	15	11	8	10	11	15	15	11		
1	+	1	2	V	3	2	2	1	2	2	1	+	1	2	.	+	V	.	2	1	.	1	.	.	.	.	.	+	2	2	3	III	**IV**
.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.		**II**
.	.	+	.	II	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.		**II**
.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	1	3	.	.	.	.	.	.	.	I	**I**
+	1	+	.	V	.	.	.	.	+	1	+	.	+	.	.	+	III	.	+	+	.	.	.	.	+	.	.	.	+	.	.	II	**III**
.	.	.	1	III	2	+	1	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.		**II**
+	1	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.		.	1	.	.	.	.	.	.	.	.	.	.	.	.	I	**I**
.	3	.	.	II	3	4	3	4	4	4	2	3	3	3	4	4	V	.	3	1	.	.	.	.	.	.	.	.	.	.	.	I	**II**
.	.	.	.		+	1	4	2	2	2	2	3	2	.	+	2	V	.	.	.	.	.	.	.	.	.	.	.	+	2	+	II	**II**
.	.	.	.		2	2	2	1	2	2	2	2	2	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.		**I**
.	.	.	.		.	.	.	+	+	1	+	1	+	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		**I**
+	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.		2	2	2	3	2	1	2	1	2	2	2	2	2	1	V	**II**
.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.			2	3	1	+	1	3	3	3	3					IV	**I**
.	.	.	.		.	.	.	.	.	1	.	.	.	.	.	.	I		2		2		1	2	2			3	2	3	2	IV	**II**
2	2	1	3	V	2	+	.	2	2	1	2	2	2	1	+	1	V	.	2	.	2	3	1	2	2	.	+	1	+	2	3	IV	**V**
2	2	.	2	V	.	.	.	.	1	.	.	.	.	.	2	.	I	1	.	2	3	2	3	.	.	+	.	.	.	.	.	III	**III**
.	.	.	.	III	1	+	1	1	.	.	1	.	+	.	+	+	IV	.	.	.	.	.	.	+	.	.	.	.	.	.	.	I	**III**
.	.	.	1	I	.	.	1	.	.	.	.	.	.	.	.	.	I	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I	**I**
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Rel. number	41	44	45	52	53	54	46	61	47	50	51	55	56	57	C1	68	80	81	71	75	73	72	76	74	82
Accompanying taxa																									
Peucedanum arenarium W.&Kit.	1	1	2	1	2	2	.	.	2	2	2	+	.	.	IV	.	.	.	.	.	.	.	.	.	1
Silene euxina (Rupr.)Hand.-Mazz.	+	1	.	1	+	.	1	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	+
Linaria genistifolia (L.) Mill.																									
subsp. genistifolia	+	+	1	.	+	+	.	.	.	+	+	+	+	+	IV	+	.	+	.	+	.	1	.	.	+
Cionura erecta (L.) Grsb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		1	3	.	1	3	3	1	2	3	2
Galilea mucronata (L.) Parl.	.	.	.	.	.	.	1	.	2	4	4	4	4	4	III	.	.	.	.	.	.	.	.	.	.
Teucrium polium L.																									
subsp. *vincentinum* (Rouy) Wood.	+	+	.	.	2	+	.	.	+	.	2	.	.	.	III	.	.	.	.	.	.	.	.	.	.
Verbascum purpureum (Janka) Hub.-Mor.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	+	1
Jasione heldreichii Boiss.&Orph.	2	+	1	.	.	.	+	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Medicago falcata L.																									
subsp. *tenderiensis* (Operm.)Vas.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	I	+	1	+	.	.	.	.	.	.	.
Kochia laniflora (S. G. Gmel.) Borb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		+	.	.	.	.	.	.	.	.	.
Anchusa leptophylla Roem.&Schult.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	I	1	.	.	1	.	.	.	.	.	.
Chondrilla juncea L.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Alyssum hirsutum Bieb.																									
subsp. *caespitosum* (Dudl.) Ancev	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Rumex tenuifolis (Wallr.) A. Love.	.	.	.	.	+	+	+	.	+	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Melilotus alba Medic.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		+	.	.	.	.	.	+	.	.	.
Salsola ruthenica Iljin	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Alyssum minutum Schlecht.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Trachomytum venetum (L.)Woods.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Crataegus monogyna Jacq.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	I	.	.	.	.	.	.	.	.	.	.
Amorpha fruticosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	+
Phleum graecum Boiss.&Heldr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	+	.	.
Vitis vinifera L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Chrysopogon gryllus (L.) Trin.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Grimmia sp.(pulvinata)	.	.	.	.	.	.	.	2	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Orobanche arenaria Borkh.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Xanthoria parietina (L.) Th. Fr.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Echium vulgare L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Elymus pycnanthus (Godr.) Meld.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Erianthus ravennae (L.) Beauv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Morus alba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Osyris alba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Papaver hybridum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Xanthium italicum Moretti	.	.	.	.	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.

Localities: 41, 44–47, 50–57 – village of Shkorpilovci; 61 – "Kamchia sands" Protected area; 68-74 – Nesebur – the southern beach; 75-81 – Nesebur – the new town; 82-84 – "Sunny beach" Resort; 86, 95–97, 100, 102, 103 – town of Primorsko; 87, 89, 93 and 110 – "Kavatsite" Resort ; 88, 91, 94, 104, 106–109 – Arkoutino; 92, 101, 111 and 112 – "Golden fish" Resort

Dates: 41, 44–47, 50–57 – 27. 08. 03; 61, 68–74 – 28. 08. 03; 75–84, 87, 89, 92, 93, 101, 111–112 – 29. 08. 03; 86, 88, 91, 94–97, 100, 102–104, 106–109 – 30. 08. 03.

83	84	70	69	C2	77	78	79	95	96	97	100	102	103	93	107	108	C3	86	87	88	89	91	109	94	106	104	110	111	112	101	92	C4	C
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+	+	.	.	II	.	.	.	+	.	+	1	.	+	.	+	1	III	+	3	1	1	1	1	1	1	.	1	+	+	+	V	**III**
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Table 6: Vegetation of the wet fixed (grey) dunes.
Association *Stachyo atherocalici-Caricetum ligericae* ass. nova, type nom. rel. 42 holotype

Tabela 6: Vegetacija mokrih stabilnih (sivih) sipin.
Asociacija *Stachyo atherocalici-Caricetum ligericae* ass. nova, type nom. rel. 42 holotype

Rel. number	3	4	15	48	19	98	99	42	43	49	C
Area (m²)	9	9	10	9	9	10	25	15	15	25	
Cover (%)	80	90	100	100	100	100	80	100	80	60	
Exposition	-	-	-	-	-	-	W	-	-	-	
Slope (in degrees)	0	0	0	0	0	0	5	0	0	0	
Number of taxa	6	6	7	9	6	4	11	14	8	9	
Diagnostic taxa of association											
Carex ligerica J. Gay.	5	5	5	5	5	5	5	5	5	1	V
Stachys atherocalyx C. Koch.	+	.	2	2	.	.	.	1	.	2	III
Diagnostic taxa of higher units											
***Ammophiletea* Br.-Bl. et R. Tx. 1943**											
Centaurea arenaria Bieb. *subsp*. borysthenica (Gruner) Dostal	.	.	+	+	.	.	.	2	1	.	II
Artemisia campestris L.	.	.	.	+	.	.	.	1	.	+	II
Aurinia uechtritziana (Bornm.) Cullen et Dudley	.	.	.	1	.	.	1	.	.	.	I
Eryngium maritimum L.	+	+	.	.	.	.	.	.	.	.	I
Leymus racemosus (Lam.) Tzvel. subsp. *sabulosus* (Bieb) Tzvel.	.	.	.	.	.	.	.	+	.	1	I
Ammophila arenaria (L.) Link.	.	.	.	.	+	.	.	.	.	.	I
Accompanying taxa											
Linaria genistifolia (L.) Mill. subsp. *genistifolia*	+	+	+	+	.	.	1	.	.	.	III
Chondrilla juncea L.	.	.	.	1	.	3	2	+	1	.	III
Medicago falcata L. subsp. *tenderiensis* (Operm.) Vas.	1	1	+	.	.	.	.	2	.	.	II
Jasione heldreichii Boiss. et Orph.	.	.	.	+	.	.	.	+	+	2	II
Peucedanum arenarium Waldst. et Kit.	.	.	.	.	.	.	1	1	+	3	II
Conyza canadensis (L.) Cronq.	.	.	+	+	+	.	.	.	.	.	II
Holoschoenus vulgaris Link.	.	.	.	.	2	.	.	+	1	.	II
Linum tauricum Wills. subsp. *bulgaricum* (Podp.) Petrova	.	.	.	.	.	.	.	3	1	1	II
Teucrium polium L. subsp. *vincentinum* (Rouy) Wood.	.	.	.	.	.	.	2	.	+	.	I
Allium guttatum (Stev.) Regel. subsp. *sardoum* (Moris) Stearl.		.	.	.	.	.	+	1	.	.	I
Verbascum purpureum (Janka) Hub.-Mor.	.	.	.	.	.	.	+	.	.	+	I
Silene conica L. subsp. *conomaritima* D. Jord. et P. Pan.	+	.	.	.	.	.	.	.	.	.	I
Erysimum diffusum Ehrh.	.	+	.	.	.	.	.	.	.	.	I
Astragalus onobrychis L. subsp. *scorpili* Vel.	.	+	.	.	.	.	.	.	.	.	I
Alyssum minutum Schlecht. ex DC	.	.	+	.	.	.	.	.	.	.	I
Althaea officinalis L.	.	.	.	.	+	.	.	.	.	.	I
Verbena officinalis Voss. ин Voss. et Sieber.	.	.	.	.	+	.	.	.	.	.	I
Cirsium vulgare (Savi) Ten.	.	.	.	.	.	1	.	.	.	.	I
Crepis foetida L ssp. *foetida*	.	.	.	.	.	1	.	.	.	.	I
Poa pratensis L.	.	.	.	.	.	.	2	.	.	.	I
Clematis vitalba L.	.	.	.	.	.	.	4	.	.	.	I
Dianthus moesiacus Vis. et Panc. subsp. *moesiacus*	.	.	.	.	.	.	+	.	.	.	I
Trifolium arvense L.	.	.	.	.	.	.	.	2	.	.	I
Anchusa leptophylla Roem. et Schult.	.	.	.	.	.	.	.	+	.	.	I
Festuca vaginata Waldst. et Kit. in Willd.	.	.	.	.	.	.	.	.	.	3	I

Localities: 3, 4, 15 and 19 – Lake Dourankulak; 42, 43, 48 and 49 – village of Shkorpilovci; 98 and 99 – south from town of Primorsko – "International Youth Camp"
Dates: 3, 4, 15 and 19 – 26. 08. 03; 42, 43, 48 and 49 – 27. 08. 03; 98 and 99 – 30. 08. 03

Table 7: Vegetation of the northest fixed (grey) dunes
Association *Alysso borzaeani-Ephedretum distachiae* ass. nova, type nom. rel. 30 holotype

Tabela 7: Vegetacija najsevernejših stabilnih (sivih) sipin
Asociacija *Alysso borzaeani-Ephedretum distachiae* ass. nova, type nom. rel. 30 holotype

Rel. number	30	31	39	32	37	38	C
Area (m²)	25	25	25	25	25	25	
Cover (%)	90	80	90	90	100	100	
Number of taxa	11	10	10	7	12	11	
Diagnostic taxa of association							
Ephedra distachya L.	5	3	5	3	5	5	V
Alyssum borzaeanum E. I. Nyar.	1	3	3	2	.	.	IV
Diagnostic taxa of higher units *Ammophiletea* Br.-Bl. et R.Tx. 1943, *Ammophiletalia* Br.-Bl. 1933 and *Scabiosion ucrainicae* Boscaiu 1975							
Cynanchum acutum L.	+	1	+	3	+	+	V
Silene thymifolia Sibth. et Sm.	.	+	.	+	.	+	III
Scabiosa argentea L.	.	.	.	.	+	2	II
Ammophila arenaria (L.) Link.	+	.	.	.	.	.	I
Centaurea arenaria Bieb.	.	.	.	.	+	.	I
***Koelerio-Corynephoretea* Klika in Klika et Novak 1941**							
Syntrichia ruralis Brid.	3	3	2	.	3	2	V
Erysimum diffusum Ehrh.	+	.	+	.	+	+	IV
Accompanying taxa							
Xanthoria parietina (L.) Th. Fr.	+	3	+	.	+	1	V
Aristolochia clematitis L.	1	1	1	.	.	.	III
Euphorbia seguierana Neck.	+	+	.	1	.	.	III
Echium vulgare L.	.	.	+	.	+	+	III
Marrubium peregrinum L.	.	.	+	.	+	+	III
Verbascum purpureum (Janka) Hub.-Mor.	.	.	.	+	+	+	III
Prunus spinosa L.	+	+	.	.	.	.	II
Festuca vaginata Waldst. et Kit.	.	2	.	+	.	.	II
Astragalus onobrychis L. subsp. *scorpili* Vel.	.	.	.	.	+	+	II
Medicago falcata L. subsp. *tenderiensis* (Operm.) Vas.	+	.	.	.	.	.	I
Eryngium campestre L.	.	.	+	.	.	.	I
Melica ciliata L.	.	.	.	.	+	.	I

Localities: 30–32, 37–39 – "Anna Maria" Beach
Dates: 30–32, 37–39 – 26. 08. 03

Table 8: Synoptic table presenting the syntaxa of dune vegetation on Western Black Sea coast
Tabela 8: Sinoptična tabela vegetacije sipin na zahodnih obalah Črnega morja

Numb. of syntaxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Diagnostic taxa of associations and subassociations																					
Salsola ruthenica Iljin	**V**	**V**	**V**	**V**	**IV**	**IV**	II	**V**	.	.	I	**IV**	.	.	.	II	**III**	.	.	.	.
Cakile maritima Scop. ssp. *euxina* (Pobed.) E. I. Nyar.	**V**	**V**	**V**	**V**	**II**	I	I	**V**	.	.	II	II	.	.	.	.	.	.	.	.	.
Xanthium italicum Moretti	.	.	**V**	**IV**	II	**V**	.	.	.	.	.	II	.	.	.	I	.	.	.	.	.
Leymus racemosus (Lam.)Tzvel. ssp.*sabulosus* (Bieb)Tzvel.	.	.	.	I	II	**V**	**V**	**V**	**V**	**V**	**V**	**V**	**IV**	.	I	**III**	II	I	II	.	.
Elymus farctus (Vis.) Runem. ex Meld.	.	.	.	I	II	**III**	**V**	**V**	**V**	**V**	I	**IV**	II	.	.	I	**V**	.	.	.	.
Ammophila arenaria (L.) Link.	.	.	.	.	.	**III**	I	**V**	**V**	**V**	.	**V**	**IV**	I	I	**V**	**V**	I	.	I	.
Euphorbia paralias L.	II	.	.	I	.	I	.	**V**	**V**	**V**	.	**III**	.	.	.	.	.	.	.	.	.
Medicago marina L.	.	.	.	.	.	.	I	**III**	**III**	**III**	I	**III**	.	.	.	I	**III**	.	.	.	.
Stachys maritima Gouan	.	.	.	.	.	.	.	II	**IV**	**IV**	.	.	I	.	.	.	.	.	.	.	.
Otanthus maritimus (L.) Hoffm. et Link	.	.	.	II	.	.	II	.	.	.	.	**IV**	.	.	.	.	II	.	.	.	.
Medicago falcata L. ssp. *tenderiensis* (Operm.) Vas.	.	.	.	.	.	I	.	.	.	.	.	.	**V**	**V**	I	II	.	II	.	I	.
Festuca arenicola (Prod.) Soo	.	.	.	.	.	.	.	.	.	**V**	.	.	I	**V**	.	.	.	.	III	.	.
Aurinia uechtritziana (Bornm.) Cullen et Dudley	.	.	.	.	.	.	.	.	**II**	**III**	.	.	.	.	**V**	**III**	.	I	.	.	.
Artemisia campestris L.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	**V**	**III**	.	II	.	.	II
Pancratium maritimum L.	.	.	.	.	.	I	II	.	.	II	.	**IV**	.	.	.	**IV**	II	.	.	.	.
Centaurea kilaea L.	.	.	.	.	.	.	.	.	.	.	.	**III**	.	.	.	.	**V**	.	.	.	.
Stachys recta L. ssp. *subcrenata* (Vis.) Briq.	.	.	.	.	.	.	I	.	.	.	.	**III**	.	.	.	.	**V**	.	.	.	.
Stachys atherocalyx C. Koch.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	.	.	**III**	.	.	.
Carex ligerica J. Gay.	.	.	.	.	.	.	.	.	.	**V**	I	.	.	I	I	I	.	**V**	**V**	.	.
*Scabiosa argente*a L.	.	.	.	.	.	.	.	.	.	**V**	I	.	I	.	**IV**	I	.	.	**IV**	II	II
Ephedra distachya L.	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.	.	.	.	**III**	**V**	.
Alyssum borzaeanum E. I. Nyar.	.	.	.	.	.	.	.	.	.	.	I	.	II	.	II	.	.	.	.	**IV**	.
Festuca vaginata Waldst. et Kit. in Willd.	.	.	.	.	.	.	.	.	.	**V**	.	.	.	.	I	**IV**	.	I	.	II	**V**
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diagnostic taxa of higher units																					
Cakiletea maritimae R. Tx. et Prsg. 1950 in R. Tx.1950, *Euphorbietalia peplis* R. Tx. 1950 and *Euphorbion peplis* R. Tx. 1950																					
Atriplex hastata L. s.s.	**IV**	**II**	**IV**	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia peplis L.	**V**	**IV**	**III**	**V**	**III**	II	.	II	.	.	.	I	.	.	.	.	.	.	.	.	.
Polygonum maritimum L.	**IV**	**III**	**IV**	II	**V**	II	II	.	.	.	.	**III**	.	.	.	.	**III**	.	.	.	.
Crambe maritima L.	.	**V**	.	.	**III**	**III**	.	I	II	II	II	.	I	.	.	.	.	.	.	.	.
Glaucium flavum Crantz.	**II**	.	.	.	I	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.
Raphanus raphanistrum L. ssp. *maritimus*	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.
Atriplex tatarica L.	.	.	.	**II**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Salsola soda L.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	.	.	.	.	.	.	.
Elymion gigantei Morariu 1957 and *Ammophiletalia arudinaceae* Br.-Bl. 1933 (*Elymetalia gigantei* Vicherek 1971)																					
Lactuca tatarica (L.) C.A. Mey.	I	.	.	.	I	**IV**	.	**IV**	**IV**	**IV**	.	.	I	.	.	.	.	.	.	.	.
Cynanchum acutum L.	.	.	.	.	.	.	.	I	**IV**	**V**	II	.	.	.	.	.	.	.	.	**V**	.
Sileno thymifoliae-Jurinion kilaeae Gehu et Unslu 1989 and *Hellichryso-Crucianelletalia* Gehu, Riv.-Mart., R. Tx. 1973																					
Silene thymifolia Sibth. et Sm.	.	.	.	.	.	I	.	II	**III**	**V**	I	II	**IV**	**V**	**IV**	**III**	**IV**	.	.	**III**	.
Jurinea albicaulis Bunge ssp. *kilaea* (Azn.) Koz.	.	.	.	.	.	I	.	.	.	**V**	.	I	.	.	**V**	**IV**	**IV**	.	.	.	.
Peucedanum arenarium Waldst. et Kit.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	**III**	**III**	II	.	.	.

Numb. of syntaxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Satureja hortensis L.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	**III**	.	.	.	.
Crepis foetida L ssp. *foetida*	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	**III**	I	.	.	.
Silene otites (L.) Webel.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	.	I	.	.
Ammophiletea Br.-Bl. et R. Tx. ex Westhoff et al. 1946																					
Eryngium maritimum L.	.	**V**	.	**III**	**IV**	**V**	**V**	**V**	**V**	**V**	I	**V**	**IV**	II	.	II	**III**	I	I	.	.
Centaurea arenaria Bieb.	.	.	.	.	I	II	.	.	.	.	**III**	.	**V**	**III**	II	**V**	.	II	**III**	I	II
Cyperus capitatus Vand.	.	.	.	.	.	.	.	.	.	**III**	.	.	.	.	.	.	**III**	.	.	.	.
Calystegia soldanella (L.) R. Br.	.	.	.	I	.	.	.	.	.	.	.	**II**	.	.	.	.	.	.	.	.	.
Convolvulus persicus L.	.	.	.	.	.	.	.	.	.	.	I	**II**	I	.	.	.	.	.	I	.	.
Koelerio-Corynephoretea Klika in Klika et Novak 1941																					
Alyssum alyssoides (L.) L.	.	.	.	.	.	.	.	.	.	.	**IV**	.	.	.	.	.	.	.	.	.	.
Silene conica L. ssp. *conomaritima* D. Jord. et P. Pan.	.	.	.	.	.	.	.	.	.	.	I	.	II	**IV**	I	.	.	I	I	.	.
Cladonia foliacea (Huds.) Schaer.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	.	.	.
Poa bulbosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	.	.	.
Kochia laniflora (S. G. Gmel.) Borb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	**III**	.	I
Onosma arenaria Waldst. et Kit.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.
Erysimum diffusum Ehrh.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	I	.	.	I	I	**IV**	II
Koeleria glauca (Schrad.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	**II**
Helichrysum arenarium (L.) Moench	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	I	.	.
Others																					
Corispermum nitidum Kit. in Schult.	.	.	.	.	**II**	I	.	.	.	.	.	.	.	.	I	**II**	.	.	.	.	I
Elymus pycnanthus (Godr.) Meld.	I	.	.	.	.	.	.	**II**	I	.	.	.	.	.	.	I	.	.	.	.	.
Teucrium polium L.	.	.	.	.	.	.	.	**III**	II	.	.	.	.	.	II	**III**	**III**	II	.	.	.
Elymus elongatus (Host.) Greut.	.	.	.	.	.	.	.	II	**III**	**III**	.	.	.	.	.	.	.	.	.	.	.
Linaria genistifolia (L.) Mill. ssp. *genistifolia*	.	.	.	.	I	.	.	.	II	**III**	.	.	**IV**	**III**	**III**	II	.	**III**	II	.	I
Cionura erecta (L.) Grsb.	.	.	.	.	.	I	.	.	**III**	**III**	.	.	.	.	**III**	**IV**	.	.	.	.	.
Linum tauricum Willd. ssp. *bulgaricum* (Podp.) Petrova	.	.	.	.	.	.	.	.	.	**V**	.	.	.	.	I	I	.	II	.	.	.
Cynodon dactylon (L.) Pers.	.	.	.	.	.	.	I	.	.	.	**III**	.	.	.	.	.	.	.	II	.	.
Carex praecox Schreber	.	.	.	.	.	.	.	.	.	.	**III**	.	.	.	.	.	.	.	.	.	.
Bromus tectorum L.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	I	I	.	.	**II**	.	I
Erianthus ravennae (L.) Beauv.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	.	I	.	.	.	.	.	.
Secale sylvestre Host.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	**IV**	**III**	II	.	.	.	.	.
Chondrilla juncea L.	.	.	.	.	.	I	.	.	.	II	.	.	II	.	I	II	.	**III**	.	.	.
Euphorbia seguieriana Neck.	.	.	.	.	.	.	.	.	.	.	.	.	**IV**	**IV**	.	.	.	.	**IV**	**III**	I
Astragalus onobrychis L. ssp. *scorpili* Vel.	.	.	.	.	.	.	.	.	.	.	.	.	I	**IV**	II	.	.	I	.	II	.
Alyssum hirsutum Bieb. ssp. *caespitosum* (Dudl.) Ancev	.	.	.	.	.	I	.	.	.	.	.	.	**II**	I	I	I	.	.	.	.	.
Alyssum minutum Schlecht. ex DC	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	I	.	.	I	.	.	.
Galilea mucronata (L.) Parl.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	II	**III**	.	.	.	.	.
Silene euxina (Rupr.) Hand.-Mazz.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	**V**	.	.	.	.	.
Matthiola fruticulosa (L.) Maire	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	.	.	.	.
Linaria odora (Bieb.) Fisch.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	.
Maresia nana (DC.) Batt.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.	.
Jasione heldreichii Boiss. et Orph.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	**II**	.	.	.

Numb. of syntaxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Conyza canadensis (L.) Cronq.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.	.
Tragopogon floccosus Waldst. et Kit.	.	.	.	.	.	.	.	.	.	.	**III**	.	.	.	.	.	.	.	**V**	.	.
Syrenia montana (Pall.) Klokov	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**IV**	.	.
Polygonum arenarium Waldst. et Kit.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	**IV**	.	II
Holoschoenus vulgaris Link.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	II	**III**	.	.
Artemisisa tschernieviana Besser	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	**III**	.	.
Gypsophila perfoliata L.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	**II**	.	.
Seseli tortuosum L.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	**II**	.	.
Asperula cynanchica L.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	**II**	.	.
Linum perenne L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.	.
Xanthoria parietina (Chev.) Hillm.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	.	.	.	.	**V**	.
Syntrichia ruralis Brid.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	I	.	.	.	**V**	.
Verbascum glanduligerum Janka	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	I	.	**III**	.
Aristolochia clematitis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	.
Echium vulgare L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	**III**	.
Marrubium peregrinum L.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	**III**	.
Prunus spinosa L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**	.
Eryngium campestre L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	**II**
Dichantium ischaemum (L.) Roberti	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**
Syrenia cana (Piller et Mitterp.) Neirl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**
Euphorbia cyparissias L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**
Artemisia austriaca Jacq.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**
Carex caryophyllea La Tour.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**
Potentilla cinerea Chaix ex Vill.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**
Asperula tenella Heuffel ex Degen	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**II**

* The rare taxa with constancy less of I and with occurrence in one syntaxon only are omited.

Syntaxa:

1. *Cakilo-Salsoletum ruthenicae typicum* Vicherek 1971 (Bulgaria)
2. *Cakilo-Salsoletum ruthenicae crambetosum ponticae* Vicherek 1971 (Bulgaria)
3. *Cakilo-Salsoletum ruthenicae typicum* var. *Xanthium italicum* Vicherek 1971 (Bulgaria)
4. *Cakilo-Salsoletum ruthenicae* Vicherek 1971 (Gehu & al. 1989 – Turkey)
5. *Cakilo-Salsoletum ruthenicae* Vicherek 1971 (Tzonev & al. – Bulgaria)
6. *Xanthio-Leymetum sabulosi* ass. nova (Tzonev & al. – Bulgaria)
7. *Leymo-Elymetum farcti* Gehu et al. 1986 (Gehu & Uslu 1989 – Turkey)
8. *Ammophilo-Elymetum gigantei cakiletosum euxinae* Vicherek 1971 (Bulgaria)
9. *Ammophilo-Elymetum gigantei typicum* Vicherek 1971 (Bulgaria)
10. *Ammophilo-Elymetum gigantei festucetosum vaginatae* Vicherek 1971 (Bulgaria)
11. *Elymetum gigantei* Morariu 1957 (Roumania)
12. *Otantho-Leymetum sabulosi* Gehu et al. 1989 (Turkey)
13. *Medicago tenderiensis-Ammophiletum arundinaceae* ass. nova (Tzonev & al. – Bulgaria)
14. *Festuca arenicola* community. (Tzonev et al. – Bulgaria)
15. *Aurinio uechtritzianae-Artemisietum campestris* ass. nova (Tzonev & al. – Bulgaria)
16. *Aurinio uechtritzianae-Artemisietum campestris pancratietosum maritimae* subass. nova (Tzonev & al. – Bulgaria)
17. *Stachyo subcrenatae-Centaureetum killaeae* Gehu et al. 1989 (Turkey)
18. *Stachyo atherocalici-Caricetum ligericae* ass. nova (Tzonev et al. – Bulgaria)
19. *Scabioso-Caricetum ligericae* (Simon 1960) Krausch 1965 (Roumania)
20. *Alysso borzaeani-Ephedretum distachiae* ass. nova (Tzonev et al. – Bulgaria)
21. *Festucetum vaginatae* (Rapaics 1923) Soo 1929 (Roumania)