Original Contribution

**BIODIVERSITY OF PLANTS AND NATURAL HABITATS IN
THE VICINITIES OF ARAPYA BAY, ROPOTAMO NATURAL RESERVE,
ALEPU BEACH, SINEMORETS AND SILISTAR CAPE
(BULGARIAN SOUTHERN BLACK SEA COAST)**

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ABSTRACT

The flora in the vicinities of Arapya Bay, Alepu beach, Sinemorets and Silistar cape of the Bulgarian Black Sea coast (which includes three beach zones and two protected natural areas) is rich in rare psammophytic and halophytic species: *Hypocoum ponticum* Velen., *Pancratium maritimum* L., *Silene thymifolia* Sm., *Eryngium maritimum* L., *Limonium latifolium* (Sm.) Kuntze, *Tulipa thracica* Davidov, *Centaurea arenaria* M. Bieb., *Trachomitum venetum* (L.) Woodson and *Maresia nana* (DC.) Batt. Within these areas some Mediterranean geo elements reach their northernmost point: *Reichardia picroides* (L.) Roth and *Romulea linairesii* Parl. All of the species mentioned above have been included in the Red List of Bulgarian vascular plants (1)

The *Tulipa thracica* Davidov species fall under a Critically Endangered (CR) category. Nine species have an Endangered (EN) status: *Hypocoum ponticum* Velen., *Pancratium maritimum* L., *Silene thymifolia* Sm., *Eryngium maritimum* L., *Trachomitum venetum* (L.) Woodson, *Reichardia picroides* (L.) Roth, *Cistus salviifolius* L., *Verbascum bugulifolium* Lam. and *Serapias vomeracea* (Burm.) Briq. Six species fall under a Vulnerable (VU) category: *Limonium latifolium* (Sm.) Kuntze, *Centaurea arenaria* M. Bieb., *Maresia nana* (DC.) Batt. and *Romulea linairesii* Parl., *Limodorum abortivum* (L.) Schwarz and *Orchis papilionacea* L. Under a Least Concern (LC) are the following species: *Fritillaria pontica* Wahlenb. and *Mespilus germanica* L. Legally protected by (2) are: *Pancratium maritimum* L., *Eryngium maritimum* L., *Limonium latifolium* (Sm.) Kuntze, *Tulipa thracica* Davidov, *Centaurea arenaria* M. Bieb., *Trachomitum venetum* (L.) Woodson, *Maresia nana* (DC.) Batt., *Reichardia picroides* (L.) Roth, *Romulea linairesii* Parl., *Verbascum bugulifolium* Lam., *Cistus salviifolius* L., *Serapias vomeracea* (Burm.) Briq., *Limodorum abortivum* (L.) Schwarz, *Orchis papilionacea* L., *Fritillaria pontica* Wahlenb. In addition, there are five species from the *Orchidaceae* family with different conservation status: the Endangered *Serapias vomeracea* (Burm.) Briq., the Vulnerable *Limodorum abortivum* (L.) Schwarz and *Orchis papilionacea* L. and two species from the CITES convention - *Orchis purpurea* Huds. and *Orchis morio* L. Three habitats were with an Endangered Conservation status: 01B1 Pontic sand beach annual communities, 02B1 Pontic embryonic dunes and 04B1 Southwestern Pontic fixed dunes (3).

Key words: flora, Black Sea coastline, protected areas, species with conservation, psamphytic species

INTRODUCTION

Due to the constant modernization and urbanization of the Bulgarian Black Sea coastline, very few natural sites are left unaffected by this trend. The five sites, subjects of this research - Arapya Bay, Alepu beach, Sinemorets, Silistar cape and Ropotamo natural

reserve, are fine examples of such localities, where visitors can still observe their pristine nature. From a scientific point of view, the biodiversity and natural habitats of these 5 popular and regularly visited by tourists sites, are worth being thoroughly examined and promoted. Therefore, within several vegetative seasons, we visited and examined their flora and natural habitats.

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MATERIAL AND METHODS

The researched sites are situated in the southern part of the Bulgarian Black Sea coast. From north to south, they are in the following order: Alepu, Ropotamo nature reserve, Arapya, Sinemorets and Silistar Cape (for reference see **Figure 1**). The natural protected area "Silistar" begins from the locality "Butamyata" and ends with Silistar Cape. Over the river Butamyata, the coastal line up to Silistar Cape is high and rocky, except for the beach south of Listi Cape. At some points, the coastal line is almost vertical; the rocks are igneous and igneous-sedimentary from the Triassic and Upper Cretaceous Periods. (4) The area is filled with picturesque fjord-like bays and small beaches. The first botanical research of this region was conducted in the beginning of 20th century (5). This researched was based on the herbarium materials already collected by prof. Stefan Georgiev, all taken from the southern Black Sea coast. Then, chronologically it was followed by the research article (6). This was a brilliant research, where the entire Bulgarian Black Sea coastal line was determined as a separate floristic region. In her thesis, (7) examined the specific plant compositions of the Bulgarian Black Sea coast and their applications

in recreation. In the beginning of the 1980s (8) conducted a research about the vegetation of the Ropotamo natural park (at the time, this site had the conservation status of a natural park). At the same time another research (9) examined the psamphitic vegetation in Bulgaria (10) made a study about the rare plant species on the coastal sand dunes and sand beaches in Bulgaria and their related issues. A specific research study was conducted about the flora in the Silistar protected area and in the Veleka river mouth by (11). Yet another research regarding these sites was conducted by (12) which provided a description of the dune vegetation of the Bulgarian Black Sea coast. Also, the halophytic vegetation in South-East Bulgaria and along the Bulgarian Black Sea coast was examined by (13) the research subject of this paper was conducted annually within the span of 2-3 months, from March until June. Frequent annual trips to the sites were made from 2002 up until 2016. The determination of the plant species was done per, (14), (15), (16) The determination of natural habitats was performed per (17) The natural conservation status of conservation significant species was done per (1),

Figure 1. A map of the Bulgaria south coast line where the examined sites' location is shown.

RESULTS

Arapya Bay

The psammophytic vegetation of Arapya Bay is referred to the habitat type 01B1

Pontic sand beach annual communities. During this study the following vascular plants were found: *Elymus elongatus* (Host) Runemark, *Poa timoleontis* Heldr.

ex Boiss., *Leymus racemosus* (Lam.) Tzvelev, *Hypocoum procumbens* L., *Alyssum turkestanicum* Regel & Schmalh., *Alyssum minutum* Schltdl. ex DC., *Lamium amplexicaule* L., *Erodium cicutarium* (L.) L'Her., *Medicago marina* L., *Muscari pulchellum* Heldr. & Sart. ex Boiss., *Silene conica* L., *Convolvulus arvensis* L., *Maresia nana* (DC.) Batt., *Senecio vernalis* Waldst. & Kit., *Crepis nicaeensis* Balb., *Medicago falcata* L. subsp. *urumovii* Degen ex O. Schwarz & Klink., *Echium italicum* L., *Erophila verna* (L.) Chevall., *Paliurus spinachristi* Mill., *Crepis sancta* (L.) Babc. subsp. *bifida* (Vis.) Babc., *Cerastium glomeratum* Thuill., *Cerastium pumilum* Curtis subsp. *pallens* F.W.Schultz) Schinz & Thell.

The Beach north from Tsarevo (ex. Michurin)

The psammophytic and halophytic vegetation was comprised of the following plants: *Cakile maritima* Scop., *Centaurea arenaria* M. Bieb., *Jurinea albicaulis* Bunge, *Hypocoum procumbens* L., *Cerastium bulgaricum* Uechtr., *Alopecurus myosuroides* Huds., *Myosotis stricta* Link ex Roem. & Schult., *Arenaria serpyllifolia* L., *Rhagadiolus stellatus* (L.) Gaertn., *Valerianella turgida* (Steven) Betcke, *Geranium dissectum* L., *Bromus tectorum* L., *Erophila verna* (L.) Chevall., *Thlaspi alliaceum* L., *Lamium amplexicaule* L., *Bellis sylvestris* Cyr., *Salsola ruthenica* Iljin

Alepu Beach

The plant species found on both sides of the road that passes through the Alepu beach, belong to the habitat 04B1 Southwestern Pontic fixed dunes: *Scandix pecten-veneris* L., *Glaucium flavum* Crantz, *Peucedanum arenarium* Waldst. & Kit., *Silene thymifolia* Sm., *Crambe maritima* L., *Carduus pycnocephalus* L., *Milium vernale* M. Bieb., *Holosteum umbellatum* L., *Tulipa thracica* Davidov and *Osyris alba* L.

Ropotamo Reserve

The vegetation of this reserve is rich and diverse, and contains many species of conservation value: *Iris suaveolens* Boiss. & Reut., *Legousia speculum-veneris* (L.) Chaix, *Buglossoides arvensis* (L.) I. M. Johnst., *Centaurea arenaria* M. Bieb., *Linaria genistifolia* (L.) Mill., *Linum tauricum* Willd. subsp. *bulgaricum* (Podp.) Petrova, *Erysimum diffusum* Ehrh., *Trachomitum venetum* (L.) Woodson, *Carex strigosa* Huds., *Hesperis tristis* L., *Papaver rhoeas* L., *Helianthemum salicifolium* (L.) Mill., *Sisymbrium altissimum* L., *Medicago minima* (L.) Bartal., *Saxifraga tridactylites* L., *Doronicum orientale* Hoffm., *Polygonatum latifolium* (Jacq.) Desf., *Tragopogon pratensis* L., *Potentilla inclinata* Vill., *Silene italica* (L.) Pers., *Teucrium*

chamaedrys L., *Pisum elatius* M. Bieb., *Cotinus coggygria* Scop., *Carpinus orientalis* Mill., *Fraxinus ornus* L., *Vicia serratifolia* Jacq., *Chaerophyllum temulentum* L., *Cornus mas* L., *Mercurialis perennis* L., *Evonymus verrucosus* Scop., *Festuca vaginata* Waldst. & Kir. ex Willd. *Asphodeline lutea* (L.) Rchb., *Valerianella locusta* (L.) Laterr., *Orchis purpurea* Huds., *Limodorum abortivum* (L.) Schwarz, *Lathyrus aphaca* L., *Arabis sagittata* (Bertol.) DC., *Orchis papilionacea* L., *Cionura erecta* (L.) Griseb., *Pancratium maritimum* L., *Juncus maritimum* Lam. and *Clypeola jonthlaspi* L. The type of habitats found here are the following: 02B1 Pontic embryonic dunes, 04B1 Southwestern Pontic fixed dunes, 05B1 Wooded dunes (3).

Sinemorets- Silistar Cape

The flora is very rich in species with high conservation value. During the spring *Romulea linaresii* Parl. develops at open spaces with sandy soil and in the oak forest next to the beach of Sinemorets, formed mainly from *Quercus pubescens* Willd. and *Carpinus orientalis* Mill. The latter goes up to the beach itself. The vegetation here is represented by: *Sanguisorba minor* Scop., *Cerastium glomeratum* Thuill., *Crepis sancta* (L.) Babc., *Prunus spinosa* L., *Fumaria officinalis* L., *Silene italica* (L.) Pers., *Jurinea albicaulis* Bunge, *Anchusa azurea* Mill., *Thymus callieri* Borbas ex Velen., *Rumex tuberosus* L., *Hypochaeris glabra* L., *Reichardia picroides* (L.) Roth, *Moenchia mantica* (L.) Bartl., *Peucedanum arenarium* Waldst. & Kit., *Xeranthemum cylindraceum* Sm., *Asparagus acutifolius* L., *Opuntia vulgaris* Mill., *Buglossoides purpureocaerulea* (L.) I. M. Johnst., *Orchis papilionacea* L., *Fraxinus ornus* L., *Anemone pavonina* Lam., *Cistus salviifolius* L., *Cistus incanus* L., *Osyris alba* L., *Lathyrus sphaericus* Retz., *Mespilus germanica* L., *Medicago marina* L., *Hypocoum ponticum* Velen., *Pancratium maritimum* L., *Silene thymifolia* Sm., *Salsola ruthenica* Iljin, *Eryngium maritimum* L., *Silene conica* L., *Crambe maritima* L., *Cakile maritima* Scop., *Rhagadiolus stellatus* (L.) Gaertn.,

Ajuga laxmannii (L.) Benth., *Trifolium subterraneum* L., *Cerastium bulgaricum* Uechtr., *Ornithogalum refractum* Kit. ex Schlecht., *Arabidopsis thaliana* (L.) Heynh., *Fritillaria pontica* Wahlenb., *Alliaria petiolata* (M. Bieb.) Cavara & Grande, *Iris graminea* L. On the rocks the following plants were found: *Sonchus asper* (L.) Hill subsp. *glaucescens* (Jord.) Ball, *Silene compacta* Fisch., *Limonium latifolium* (Sm.) Kuntze, *Vitis sylvestris* C. C. Gmel., *Crithmum maritimum* L., *Anthemis rumelica* (Velen.) Stoj. & Acht., *Holosteum umbellatum* L., *Parietaria*

lusitanica L., *Inula hirta* L., *Euphorbia agraria* M. Bieb., *Dianthus giganteus* D'Urv. In the forest meadows, the follow species can be found: *Verbascum bugulifolium* Lam., *Ferulago sylvatica* (Besser) Rechb. *Lactuca tatarica* (L.) C. A. Mey grows on the sands. *Serapias vomeracea* (Burm.) Briq. had developed a huge and thick community in the open and sunny places located close to the Butamyata locality. There grew also *Orchis morio* L., *Lathyrus digitatus* (M. Bieb.) Fiori, *Chamaecytisus hirsutus* (L.) Link, *Chaerophyllum byzantinum* Boiss. and *Barbarea vulgaris* R. Br.

The flora of the researched territories at our Southern Black Sea coastline contains 18 plant species with a conservation value: 1 Critically Endangered (CR) species, 9 Endangered (EN) species, 6 Vulnerable (VU) species and 2 Least Concern (LC) species. Furthermore, the following species is an endemic one within the territory of Bulgaria: *Anthemis rumelica* (Velen.). The following species - *Hypocoum ponticum* Velen., is a Balkan endemite. *Fritillaria pontica* Wahlenb. and *Tulipa thracica* Davidov. are both Balkan-Anatolian elements. *Linum tauricum* subsp. *bulgaricum* (Podp.) is a Pontic-Mediterranean element. It is also worthwhile pointing out the fact that there is a huge percent of various ruderal and alien species within the researched territories – 37 species, which comprise 23.8% of the total species found.

DISCUSSION

The coastal line and the three types of dunes found in the researched territories, have rich biodiversity and a lot of rare and endemic species. As a result of the conducted research, we managed to determine 155 species of vascular plants. Sixteen of these species are protected (2). This is the reason that 3 of the researched sites have a conservation status of natural protected areas - Alepu, Ropotamo nature reserve and Silistar Cape. The following natural habitats found in the researched area – 05B1 Wooden dunes, have critically endangered conservation status. The other 2 natural habitats – 02B1 Pontic embryonic dunes and 04B1 Southwestern Pontic fixed dunes, both have vulnerable conservation status. The conservation status of all 3 natural habitats is legally stated in the (18), (19).

CONCLUSION

The biodiversity and natural habitats of the examined sites are rich in conservation significant species, some of which there are endemic, relict, Mediterranean, Pontic and euxinic elements. All of them require protection and preservation, so that they might endure in the future. The biggest threat for the floral

biodiversity of these territories is the totally unregulated ongoing construction of holiday villages and parking sites in Arapya, Alepu and Sinmorets. It is out personal responsibility as citizens to prevent these sites to be completely annihilated and buried under concrete.

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