

# SEVERAL ISSUES REGARDING THE CONSERVATION AND PROTECTION OF VULNERABLE PSAMMOPHYLOUS SPECIES *POLYGONUM MARITIMUM* L. AND *SILENE THYMIFOLIA* SIBTH. ET SM. AT THE ROMANIAN BLACK SEA COAST

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## ABSTRACT

The phenomenon of vegetation dynamics and the fragile balance of the coastal ecosystems and also the large number of endangered plant species from these areas represent a permanent challenge to which many specialists have to respond.

In this paper we present some issues regarding the ecology, chorology, current conservation status of the species populations within their specific habitats related to the main factors of anthropic and natural impact that affect the populations of the studied plant species and identification and description of measures that can be taken for their conservation and protection.

By means of the results obtained through out this study, we present the current status of *Polygonum maritimum* and *Silene thymifolia*, as well as their habitats, specific to the Romanian Black Sea coastal area.

## INTRODUCTION

The main purpose of this study is the *in situ* research of two vulnerable psammophylous species *Polygonum maritimum* and *Silene thymifolia* at the Romanian Black Sea littoral in order to evaluate their current conservation status and to identify appropriate protection measures. Both species are vulnerable (Dihoru, Negrean, 2009), faced a high risk of extinction in the wild in a mean future, with decreasing populations due to habitat alteration or even destruction for anthropic as well as natural causes.

The two psammophylous plant species *Polygonum maritimum* and *Silene thymifolia* are in danger of becoming extinct in the natural habitats of the sandy beaches from the Black Sea Coast area in Romania (F g ra , 2012) and Bulgaria too (Tzonev et al., 2005, Petrova, Vladimirov, 2009), as their habitats and/or populations have been reduced drastically due to the continuous pressure of the environmental threatening factors, especially anthropic ones (F g ra et al., 2008).

## EXPERIMENTAL

In the period April 2008 - July 2015 we conducted field observations in several areas along the Romanian Black Sea coast, between Sulina and Vama-Veche, on these points: Sulina, Sf. Gheorghe, Gura Portitei - Periboina, Gura Portitei - Periteasca, Grindul

Chituc, Grindul Lupilor, Grindul Saele, Corbu-Cap Midia, Navodari, Mamaia, Constanta, Agigea, Eforie Nord, Eforie Sud, Tuzla, Costinesti, Mangalia, 2 Mai-Vama Veche.

The method of fixed points was used for the collection of field data. This method involves covering certain tracks within the habitats characteristic to the littoral area, with at least ten stops in every assessed area (Joint Nature Conservation Committee, 2004). The total number of stops or sample squares was 177, irregularly distributed.

The coverage of species populations in the analysed areas are denoted in accordance with a scale which specifies the coverage: no specimen, rare- non significant coverage, coverage 25%, coverage 26 - 50%, coverage 51 – 80%, coverage 81 -100%.

To analyse the data obtained was used a version of the DAFOR scale (acronym for: dominant, abundant, frequent, occasionally, rare), which was adapted to the particular characteristics of marine dune habitats:

- Dominant: the species appears at most (>60%) stops and it covers more than 50% of each sampling unit;
- Abundant: species occurs regularly throughout a stand, at most (>60%) stops and its cover is less than 50% of each sampling unit;
- Frequent: species recorded from 41-60% of stops;
- Occasional: species recorded from 21-40% of stops;
- Rare: species recorded from up to 1-20% of stops.

The *DAFOR scale* is used for semi-quantitative sampling, to provide a quick estimate of the relative abundance of species (generally plants species) in a given area (Kent, Coker, 1992).

In order to determine the zoological category were taken into account the main Romanian Red lists (Boiciu et al., 1994, Dihoru, Dihoru, 1994, Oltean et al., 1994, Oprea, 2005) especially the last published, *The red book of vascular plants of Romania* (Dihoru, Negrean, 2009).

For the determination of the two species chorology were indicated both the locations according to the bibliographical data (Ciocârlan, 2006, Sârbu et al., 2013) and the ones according to the own data picked on the field.

The evaluation of the conservation status was done by applying the method known as the 'semaphore method' (Combroux, Schwoerer, 2007). This method is normally used for assessing the conservation status of habitats and species of Community interest, but we believe that it can be successfully used in case of rare/endangered species, too.

Methodology used for the identification of the studied species habitats was based on the typical plant associations from the Manual for the Interpretation of Natura 2000 Habitats of Romania (Gafta, Mountford, 2008).

The information regarding the names, characteristics and distribution of habitats and plant associations is mainly based on the bibliographical sources available (Doni et al., 2005, Fîgîra et al., 2008, Sanda et al., 2008, Niculescu, 2009, Trif et al., 2015, Trayanova et al., 2007), as well as own observations conducted on field.

## RESULTS AND DISCUSSION

*Polygonum maritimum* L. and *Silene thymifolia* Sibth. et Sm. both of them are vulnerable (Vu) coastal dune plant species (Dihoru, Negrean, 2009) in Romanian Black Sea

Coast. In the case of *Silene thymifolia* its zoological status is also considered as a rare (R) species (Dihoru, Dihoru, 1994) and near threatened (NT) species (Oltean et al., 1994).

The importance of these psammophilous plant species in zoological terms is significant not only strictly referring to each taxon in part, but especially to their specific habitats. It is already proven that protecting isolated populations of threatened species without taking into account the relationship organisms-biotope is ineffective.

*Polygonum maritimum* L.- Fam. Polygonaceae

It is a perennial, with stout, woody stock (Fig. 1.). Stems are 10- 50 cm, procumbent, branched, stout. Leaves are narrowly elliptical, acute, glaucous, with revolute margins. The petioles are reddish- brown at the base, with 8-12 conspicuous, branched veins, silvery-hyaline distally, longer than most of internodes. Flowers are pedunculate, pink or whitish, often grouped in axillary clusters of 2-5; peduncles longer than the perianth; bracts leaf-like. The fruit is a brownish glossy nut, 3,5- 5 mm in length and 2,5-3 mm in diameter, equalling or slightly exceeding the perianth (Tutin et al., 1972, S. vulescu ed., 1952, 1953).



Fig. 1. Natural view of *Polygonum maritimum* L. (original)

*Silene thymifolia* Sibth. et Sm.- Fam. Caryophyllaceae

It is a perennial plant with branched, woody stock. Stems are numerous, 15-20 cm, procumbent or ascending to erect, scabrid-puberulent (Fig. 2). Leaves are little, fleshy, 8-20 mm, ovate, rarely elliptic, conspicuously pubescent. The flowers are disposed in dichasial inflorescence, few-flowered. Flower has a glandular-villous calyx, narrowly clavate, 12-15 mm, and a corolla with white bifid petals, neck ligulate. Capsule (8- 9 mm) is slightly longer than carpophore (7 mm) (Tutin et al., 1972, S. vulescu ed., 1952, 1953).



Fig.2. Natural view of *Silene thymifolia* Sibth. et Sm. (original)

*Polygonum maritimum* L. is a hemicryptophyte (H) characteristic on littoral dunes with spreading on shores of Atlantic Ocean, Mediterranean and Black Seas (Tutin et al., 1972). It is a heliophile species, spread especially in warm areas, with dried and very dried

neutral and oligohaline soils (Cicârlan, 2009, Sârbu et al., 2013). It grows on the maritime sand dunes in very small and strongly fragmented populations. It was identified in the associations: *Cakilo euxinae-Salsoletum ruthenicae* Vicherek 1971, *Lactuco tataricae-Glaucietum flavae* Dihoru et Negrean, *Elymetum gigantei* Morariu 1957, *Artemisietum tschernieviana (arenariae)* Popescu et Sanda 1977. These associations are part of two Natura 2000 natural habitat types- 2110 Embryonic shifting dunes and 1210 Annual vegetation of drift lines.

Distribution in Romania for *Polygonum maritimum* fragmented population is as follows: Sulina, Sf. Gheorghe, Portita-Periteasca, Portita-Periboina, Chituc maritime sandbank, Corbu beach, Midia Cape, Mamaia Nord- Navodari, Eforie Nord- Eforie Sud, Tuzla, 2 Mai, Vama Veche (Dihoru, Negrean, 2009, Cicârlan, 2009, Sârbu et al., 2013).

*Silene thymifolia* Sibth. et Sm. is a hemicryptophyte (H) characteristic on littoral dunes with spreading on North-West of Black Sea sandy seashore (Tutin et al., 1972). It is a heliophile species, spread in warm areas, with dried to moderately moist soils, neutral soil (Cicârlan, 2009, Sârbu et al., 2013). It grows on marine sand dunes. It is extremely rare. Vegetal associations that has been cited are the following: *Secali sylvestris-Alysetum borzeani* (Borza 1931), *Secali sylvestris-Brometum tectorum* Hargitai 1940; *Alyso borzeani* – *Ephedretum distachyae* Tzonev et al. 2005. These associations are part of two Natura 2000 natural habitat types: 2110 Embryonic shifting dunes, 2130\* Fixed coastal dunes with herbaceous vegetation ('grey dunes').

Distribution at the moment in Romania for *Silene thymifolia* population is only in Agigea Natural Reserve.

Distribution in Romania of Natura 2000 habitats referred to above is in the north of the Black Sea coast area (in the Danube Delta Biosphere Reserve area) and also in several isolated areas in the south of it.

In the field observations we noticed the presence of *Polygonum maritimum* L. especially in Natura 2000 habitat 1210 Annual vegetation of drift lines. Rarely forming clusters as seen on Corbu Beach (next to the eroded cliff) and in the Port of Midia. The species was observed along the sandy beach of the Danube Delta Biosphere Reserve, Corbu beach, Midia Cape, Mamaia North beach - Navodari, Constanta (between 3 Papuci Beach and Modern), between Eforie Nord and South Beach, Eforie South Beach, and Vama Veche Beach.

It must be mentioned that *Polygonum maritimum* population are heavily exposed to strong winds and high waves during storms, but at the same time human activities (especially in the southern Romanian coast), where the trend of expanding recreational areas on the beaches it destroys typical vegetation of the Natura 2000 habitat 1210 Annual vegetation of drift lines.

Taking into account the field observations, we concluding that *Silene thymifolia* is extremely rare. It was recovered in recent years than in Agigea Natural Reserve included in Natura 2000 site ROSCI 0073 Dunele Marine de la Agigea. Natura 2000 habitats representative of this species are 2130 \* Fixed coastal dunes with herbaceous vegetation ('grey dunes') and 2110 Embryonic shifting dunes have a good conservation status in Danube Delta Biosphere Reserve, but both are affected in southern coastline (excluding Agigea Marine Sand Dunes Natural Reserve). Without the application of urgent protection and conservation measures it is possible the extinction of *Silene thymifolia* species from

the Romanian flora, despite the effort to preserve *Silene thymifolia* individuals in the natural protected area Agigea Reserve.

Currently the conservation status of the species in the Agigea Natural Reserve is satisfactorily maintained because the custodian of the protected area which has periodically cleaned up dunes by removing steppe, invasive species and *Polytrichum piliferum* moss<sup>23</sup>.

Data analysis obtained by using the method of fixed points shows that the presence of:

- *Polygonum maritimum* was found in 12,4% of the sample squares or stops from total of 177 sample squaresinequal distributed in all observation points along the coastal area.It should be noted that *Polygonum maritimum*it was obsevedin 13 points from a total of 18 points along the coastal area (Fig. 3.).
- *Silene thymifolia* was found in 1,12% of the sample squares or stops, which it means into a single point of observation (Fig.4.), only in two stops.

After assessing the presence and coverage of the soil both studied species can be qualified as *Rare- with insignificant coverage* which means that the species was registered in 1-20% of sample squares, according to the DAFOR scale (Kent, Coker, 1992), adapted to the particular characteristics of marine dune habitats.

Assessment of the conservation status of *Polygonum maritimum* and *Silene thymifolia* populations was achieved depending on the following parameters:species distribution, population status, species habitat status, perspectives and finally resulta global assessment of conservation status in the studied area. The conservation status is assessed based on 3-level scale as follows:

- Favorable conservation status;
- Unfavorable conservation status;
- Totally inadequate unfavorable conservation status;

According Methodological Guide: Assessment of conservation status of habitats and species of Community interest in Romania(Combroux, Schwoerer, 2007).

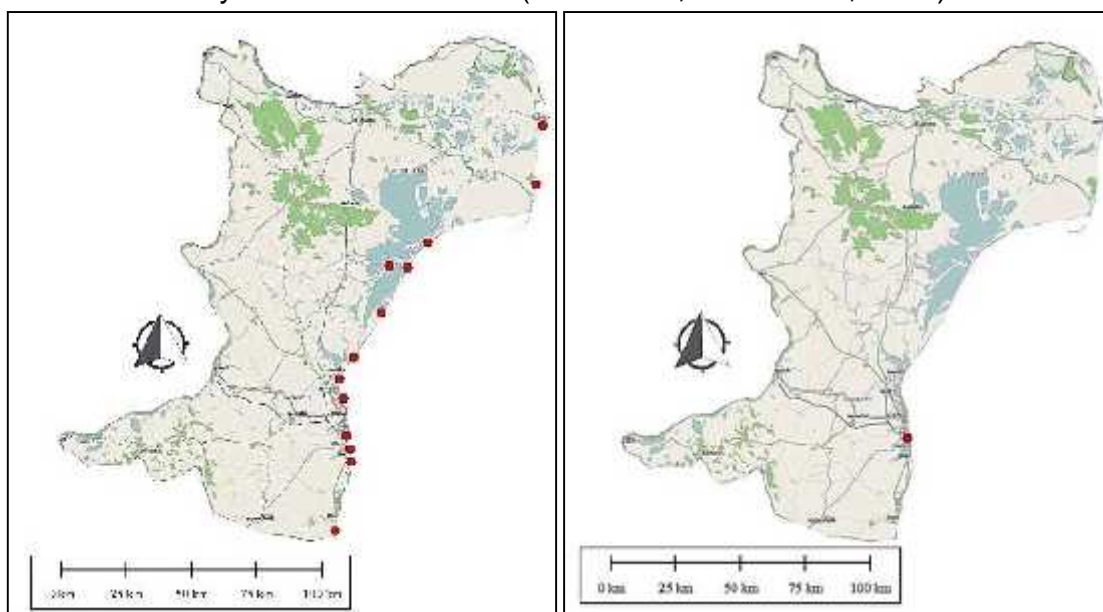


Fig. 3. Observation points where

Fig.4. Observation points where Silenethymifolia

*Polygonum maritimum* populations were found during the study period along the Romanian coastal area

As a result of the current conservation status of the *Silene thymifolia*, the conclusion is that species distribution, population status and perspectives have a totally inadequate unfavorable conservation status. The habitat of the *Silene thymifolia* populations have an unfavorable conservation status, the main causes being the intensified human activities in the Romanian coastal area over the past 50-60 years.

For the populations of *Silene thymifolia* located in Romanian coastal area the global assessment of conservation status 'totally inadequate' was identified. Due to this critical situation urgent measures being necessary for the reduction of the anthropic and natural factors impact. Management interventions absolutely necessary for the species conservation are: keeping in optimum state the maritime dune habitats by elimination of the risk factors represented by the humification of dunes, overgrowth of steppe and ruderal species and also the foreign bushes and/or trees intrusion.

For *Polygonum maritimum* the assessing of the current conservation status it can be concluded that the species distribution is unfavorable. The populations of the *Polygonum maritimum* species display an unfavorable conservation status, the main causes being like in the previous species the limitation of the surfaces occupied as a result of the intensified human activities in the Romanian coastal area (e.g. coastal rehabilitation at that moment). Given the trends of development of new tourist capacities in the northern part of the Romanian coast (Golumbeanu et al, 2014) and in the absence of concrete measures for the protection and conservation it can be considered that the long term viability of the species is threatened.

By maintaining constant anthropogenic pressures as a result of economic activities in the coastal area (tourism, grazing, coastal facilities, construction, waste accumulation, mechanized works for beaches maintenance, beaches nourishment etc.) are created premises for profound changes in the structure and composition of arenicolous phytocoenosis by ruderalised vegetation and installation of steppe species.

Thus, the main risk factors in Black Sea shore area for the *Polygonum maritimum* populations can be considered: coastal urbanisation, development of mass tourism, reducing the area occupied by beaches and dunes, interventions with heavy equipment for beach nourishment and arranging beaches for tourism. For *Silene thymifolia* small population, distributed in two small patches, from Agigea Natural Reserve is the marine dune habitat alteration, by humification (marine dunes humification) and ruderalisation of the specific habitats.

In the case of the studied species, as a natural risk factors shall be mentioned coastal erosion (Golumbeanu, Nicolaev ed., 2015), extreme weather conditions (big storms), which also contributes to reducing psammophilous populations, including *Polygonum maritimum* and far less in the case of *Silene thymifolia* population. In the case of the latter, are other natural risk factors involved (such as dunes humification, overgrowth of steppe and ruderal species and the invasive ones).

The measures necessary for the reduction of the pressure exerted by the human activities on the *Polygonum maritimum* and *Silene thymifolia* populations and their natural habitats, with conservation value, will have as main purpose the total elimination or control of the deterioration mechanisms of the habitats status.

The critical state of the psammophylous species and their habitats of Romania, especially in the southern sector of the Romanian Black Sea littoral, requires the identification of viable strategies for the development of activities of protection, improvement or restoration of the conservation status and ecological recovery.

It is especially important at this stage that all the decision factors to be involved: at local, national trans-border and regional levels as well as the civil society.

Thereby, the specific measures to protect and conserve the populations of studied plant species in the Romanian Black Sea coastal area might be:

- for *Polygonum maritimum* population: habitat inventory and mapping for habitats 1210 Annual vegetation of drift lines and 2110 Embryonic shifting dunes: integrated coastal zone management; *ex situ* conservation;
- for *Silene thymifolia* population: regular monitoring of the remaining populations by any means ensuring a favorable conservation status; *ex situ* conservation; reintroduction of the species in habitats characteristic of which it disappeared.

For the population of *Polygonum maritimum* located in Danube Delta Biosphere Reserve and for these of *Silene thymifolia* located in Agigea Natural Reserve the main *ex situ* conservation measure applied is the protection compliance with the management plans protection and conservation measures.

For the populations located outside the protected area and distributed over the littoral area on sandy substrate the recommendation is to declare new protected areas of local or national interest (F g ra et al., 2006) or to institute a protection regime by declaring the population or the isolated individual monuments of nature and requesting approval from the central authorities for environmental protection.

Besides the creation of the protected area of IUCN categories I, II and IV, Biosphere Reserves and setting up biodiversity conservation networks at international, European and national level (such as Natura 2000 network in the European Union) is necessary to consider the protection of individual species by establishing special arrangements for declaring Natural Monument (IUCN category III), endangered or vulnerable species inclusion in national and international Red Lists (including annexes lists of national legislative acts) and not least the protection of species in areas without protection status.

However, it is important to stress that maintaining habitats and species of flora and fauna of national or European level in a favorable conservation status we cannot achieve without information, communication, education and involvement of all stakeholders in the effective management of these areas.

## CONCLUSIONS

*Polygonum maritimum* L. and *Silene thymifolia* Sibth. et Sm. are two threatened psammophylous species, faced a high risk of extinction in the wild in a mean future, in the natural habitats of the sandy beaches from the western Black Sea Coast area, in Romania and Bulgaria too, due to the continuous pressure of the environmental threatening factors, especially anthropic ones. Explicitly according to Romanian Red Lists *Polygonum maritimum* and *Silene thymifolia* are vulnerable (VU) coastal dune plant species in Romanian Black Sea Coast.

Our results on the current conservation status of the *Silene thymifolia* population reveal an 'unfavorable- totally inadequate' conservation status while for the *Polygonum maritimum* the current conservation status it can be assessed as 'unfavorable'. Without the application of urgent protection and conservation measures it is possible sooner than expected the extinction of *Silene thymifolia* species from the Romanian flora.

It can be stated that the restoration of *Polygonum maritimum* and particularly *Silene thymifolia* population alongside the other components of the phytodiversity in the Romanian coastal area represents a difficult and lengthy process, with allotment of significant financial and human resources in order to conserve the natural habitats still present, simultaneous to the restoration of those affected.

## REFERENCES

1. DIHORU, G.; NEGREAN, G.: 2009. Cartearo ie a plantelor vasculare din România, Edit. Acad. Rom., Bucure ti.
2. F G RA , M.: 2012. Habitats of Conservative Interest and Plant Communities in the Sandy Black Sea Coast area of Romania and Bulgaria. J Environ Prot Ecol, **13** (3A), 1688.
3. TZONEV, R.; DIMITROV, M.; ROUSSAKOVA, V.: 2005. Dune Vegetation of the Bulgarian Black Sea Coast. Hacquetia (Warsaw), **4** (1), 7.
4. PETROVA, A.; VLADIMIROV, V. (ed.): 2009. Red List of Bulgarian vascular plants, Phytol. Balcan., **15** (1), 63-94.
5. F G RA , M. (coord.); GOMOIUM. T.; JIANUL.; SKOLKAM.; ANASTASIUP.; COG LNICEANUD.: 2008. Strategia privind conservarea biodiversit ții costiere a Dobrogei, Edit. Ex Ponto, Constan a.
6. F G RA , M.: 2008. Several Wetlands from the Romanian Black Sea Shore and Their Specific Plant Communities. J Environ Prot Ecol, **9** (2), 344.
7. Joint Nature Conservation Committee: Common Standards Monitoring Guidance for Sand dune Habitats. on-line Version, August 2004 (updated from February 2004).
8. KENT, M.; COKER, P.: 1992. Vegetation Description and Analysis. A Practical Approach. John Wiley and Sons, Chichester, U.K.
9. BO CAIU, N.; COLDEA, G.; HOREANU, C.: 1994. Lista ro ie a plantelor vasculare disp rute, periclitate, vulnerabile i rare din Flora României, Ocrot. nat. med. înconj., **38**, (1): 45-56.
10. DIHORU, G.; DIHORU, A.: 1994. Plante rare, periclitate i endemice în Flora României – Lista ro ie, Acta Botanica Horti Bucurestiensis. Lucr rile Gr dinii Botanice (1993-1994): 173-197.
11. OLTEAN, M.; NEGREAN, G.; POPESCU, A.; ROMAN, N.; DIHORU, G.; SANDA, V.; MIH ILESCU, S.: 1994. Lista ro ie a plantelor superioare din România, Studii, Sinteze, Documenta ii de Ecologie, Acad. Rom. Bucure ti I: 5-52.
12. OPREA, A.: 2005. Lista critic a plantelor vasculare din România, Edit. Univ. „Al. I. Cuza”, Ia i.
13. CIOCÂRLAN, V.: 2009. Flora ilustrat a României, Edit. Ceres, Bucure ti.
14. SÂRBU, I.; NICOLAE, S.; OPREA, A.: 2013. Pante vasculare din România- Determinator ilustrat de teren, Ed. Victor B Victor, Bucure ti.



15. COMBROUX, I.; SCHWOERER, C.: 2007. Evaluarea statului de conservare al habitatelor și speciilor de interes comunitar din România - ghid metodologic, Edit. Balcanic, Timișoara, România.
16. GAFTA, D.; MOUNTFORD, J. O. (ed.): 2008. Manual de interpretare a habitatelor Natura 2000 din România, Risoprint, Cluj-Napoca.
17. DONI, N.; POPESCU, A.; PAUC-COMANESCU, M.; MIHĂILESCU, S.; BIRI, A. I.: 2005. Habitatele din România, Ed. Tehnic Silvic, București.
18. FĂGĂRAȘ, M., SKOLKA, M., ANASTASIU, P., COGNĂȚEANU, D., NEGREAN, G., BANIC, G., TUDOR, M., SAMOIL, C.: 2008. Biodiversitatea zonei costiere a Dobrogei dintre Capul Midia și Capul Kaliakra, Edit. Ex Ponto, Constanța.
19. SANDA, V.; OLLERER, K.; BURESCU, P.: 2008. Fitocenozele din România, Sintaxonomie, Structură, dinamică și evoluție, Ars Docendi, Universitatea din București.
20. NICULESCU, M.: 2009. METODE DE CERCETARE ȘI PREZENTARE A FLOREI, Ed. Sitech, Craiova, 119 p.
21. TRIF, C. R., FĂGĂRAȘ, M. M., HÎRJEU, N. C., NICULESCU, M.: 2015. Ghid sintetic de monitorizare pentru habitate de interes comunitar (șiruri, dune continentale, pajiti, apa dulce) din România, Ed. Bolda, Constanța.
22. TRAYANOVA, T.; RAYANOV, V.; MARINOVA, V.; MICHNEVA, V.; ZAHARIA, T.; MAXIMOV, V.; YANKOVA, M.; GOLUMBEANU, M.: 2007. Marine Protected Areas in the Northern Part of the Bulgarian Black Sea Shelf. *J Environ Prot Ecol*, **8** (3), 574.
23. TUTIN, T. G.; HEYWOOD, V. H.; BURGESS, A.; MOORE, M.; VALENTIN, H.; WALTERS, M.; WEBB, D. A. (ed.): 1972. *Flora Europaea*. Vol. 3, Cambridge University Press, Cambridge.
24. ȘUVULESCU, T. (Ed): 1952, 1953. *Flora României*, Vol. I, Vol. II. Ed. Acad. R.P.R.-R.S.R.
25. Plan de Management ROSCI 0073 Dunele Marine de la Agigea- Aprilie 2011. [http://www.bio.uaic.ro/agigea/doc/Management\\_plan\\_agigea.pdf](http://www.bio.uaic.ro/agigea/doc/Management_plan_agigea.pdf) (accessed in 20.10.2015).
26. GOLUMBEANU, M.; OROS, A.; NENCIU, M.; ZAVATARELLI, M.; DRAGOS, A.: 2014. Contribution of Environmental Indices in Meeting the Objectives and Principles of the Marine Strategy Framework Directive (MSFD). *J Environ Prot Ecol*, **15** (3), 1130.
27. GOLUMBEANU, M.; NICOLAEV, S. (ed.): 2015. Study on Integrated Coastal Zone Management. Ex Ponto Publishing House, Constanta.
28. FĂGĂRAȘ, M.; BERCU, R.; JIANU, L.: 2006. The reasons in favour of setting up a new natural reserve in the Black Sea shore area between North and South Eforie (Constantza County), in *Nature Conservation – Concepts and Practice*, D. Gafta, J. Akeroyd (ed.), SPRINGER Berlin Heidelberg New York, 90-97.