

ГОДИШНИК НА СОФИЙСКИЯ УНИВЕРСИТЕТ „СВ. КЛИМЕНТ ОХРИДСКИ“

БИОЛОГИЧЕСКИ ФАКУЛТЕТ

Книга 2 – Ботаника

Том 102, 2018

ANNUAL OF SOFIA UNIVERSITY “ST. KLIMENT OHRIDSKI”

FACULTY OF BIOLOGY

Book 2 – Botany

Volume 102, 2018

BIODIVERSITY OF MEDICINAL PLANTS FROM THE NORTHERN BLACK SEA COASTAL WETLANDS. PART 1. BIODIVERSITY OF MEDICINAL PLANTS FROM SHABLA-EZERETZ LAKE COMPLEX PROTECTED AREA

DOBRI L. IVANOV & DJENI P. CHERNEVA*

Faculty of Pharmacy, Department of Biology, Medical University „Prof. D-r Paraskev Stoyanov“ - Varna, 55 Marin Drinov Str., 9000 Varna, Bulgaria

Abstract. This study aims to supplement the available research data on medicinal plants for the territory of Shabla-Ezeretz Lake Complex Protected Area by carrying out a taxonomic and analysis of the floristic elements and creating a database of their therapeutic action, usable parts and the groups of diseases they are applicable for.

The medicinal plants identified as such in our surveys constitute 113 species of higher plants referring to 46 families and 91 genera. The predominant biological types are herbaceous perennial plants - 69 species or 61 percent. With respect to moisture and humidity as a factor dominant position hold the mesophytes - 49 species (43%). Eurasian geo-elements are prevalent (26 species or 23%), followed by Euro-Mediterranean, cosmopolitans and sub-Mediterranean (14 species or 12%). Among the medicinal plants in the studied wetlands there are 33 species (29%) of conservation significance. The established medicinal plants have a wide variety of more than 38 types of healing action. Half of them are used mainly for the treatment of gastrointestinal diseases, kidney and urinary tract diseases, respiratory diseases, and those with haemostatic action. The species in which the above ground part (herba) is collected dominate over the rest and represent half of the established for the area medicinal plants.

Keywords: ethnobotany, threatened species, wetlands

*corresponding author: D. P. Cherneva - Faculty of Pharmacy, Department of Biology, Medical University „Prof. D-r Paraskev Stoyanov“ - Varna, 55 Marin Drinov Str., 9000 Varna, Bulgaria; djeni_cherneva@abv.bg

INTRODUCTION

The wetlands are among the most productive ecosystems on Earth providing unique living conditions for numerous plants and animal species, many of which are protected or found only within that area. The latter is setting their conservation as a priority in human activities since the deterioration and annihilation of species would lead to their extinction. In this respect, the Northern Black Sea Coastal Wetlands of Bulgaria among which is the Shabla-Ezeretz Lake Complex included in the Ramsar List of Wetlands of International Importance (RAMSAR CONVENTION SECRETARIAT 2010), and in the Red List *Critically Endangered* category wetlands in Bulgaria (MICHEV & STOYNEVA 2007), represent a definite research interest.

In-depth floristic studies of the Shabla-Ezeretz Lake Complex Protected Area were carried out within the 1992-1994 period as part of the North Wetlands Coastal Area project of the Bulgarian – Swiss Biodiversity Conservation Programme (BSBCP) (PHILIPOVA ET AL. 2002). However, there is limited evidence on the medicinal plants in the area. Information is found in a few publications referring to the biological diversity of medical plants along the Northern Black Sea coast (DIMITROV ET AL. 2000; FILIPOVA ET AL. 2002; IVANOV ET AL. 2002; ZAHARIEV ET AL. 2016). This has driven us to supplement the available data on medicinal plants on the Shabla-Ezeretz Lake Complex area by producing a taxonomic analysis, analysis of the floristic elements and creating a database of their healing action, usable parts and the groups of diseases they exert influence on.

MATERIALS AND METHODS

The Shabla-Ezeretz Lake Complex is located in the most North-eastern part of Bulgaria, 24 km from the Bulgarian-Romanian border and 3-5 km northeast of Shabla, district of Dobrich. The wetlands area includes two coastal lakes - Shabla Lake and Ezerets Lake connected by a canal, adjacent sand dunes, grassland, forest-tree and shrub communities and arable agricultural land (GEORGIEV ET AL. 2003).

Field surveys were conducted by way of the inventory route technique during the 2013-2015 vegetation seasons.

The floristic analysis was based on the method of TOLMACHEV (1974).

Species were identified after the *Flora of the Republic of Bulgaria* (YORDANOV 1963-1979; VELCHEV 1982-1989; KOZHUHAROV 1995; PEEV 2013) and *Identification. Guide to Higher Plants in Bulgaria* (KOZHUHAROV 1992).

The analysis of the floristic elements is according ASYOV & PETROVA (2006).

The status of medicinal plants is based on the MEDICINAL PLANTS ACT (2000, 2014) and the *National Strategy for Biodiversity Conservation* (HARDALOVA ET AL. 1994).

The conservation status of the species has been determined nationwide accordant with the *Red Data Book of the Republic of Bulgaria* (PEEV 2013), the BIOLOGICAL

DIVERSITY ACT (2002, 2007), Order RD-83 of 03.02.2014, LUCAS (1983), the IUCN Red List (2014), Appendix 1 to the CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS (BERN CONVENTION 1979) and the Appendices to the CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA (CITES 1975) were used as determinants and basis at an international level. Endemism is demonstrated at the level of Balkan and Bulgarian endemics, according to the *Balkan Endemics in the Bulgarian Flora* (PETROVA & VLADIMIROV 2010) and the *List of Bulgarian Endemic Plants* (PETROVA & VELCHEV 2006).

The phytotherapeutic characteristics of the plants are reported after PETKOV (1982), ASENOV (1988) and NIKOLOV (2006), and their uses and utilization in traditional medicine are according to PETKOV (1982).

RESULTS AND DISCUSSIONS

From 278 species of higher plants of the flora in the area we determined 113 species as medicinal plants. Of these, 105 (92%) are medicinal plants as per the MEDICINAL PLANTS ACT (2000, 2014) and 47 (41%) are classified as medicinal plants according to the National Strategy for Biodiversity (HARDALOVA ET AL. 1994). In total, they account for 41% of the area's higher plants and for 15% of the medicinal wild plants in Bulgaria.

The medicinal plants established for the Shabla-Ezeretz Lake Complex belong taxonomically to 46 families and 91 genera. Families with the greatest number of species are: Lamiaceae - 21 species or 19%, Asteraceae - 16 species or 14%, Fabaceae - 7 species or 6%, and Apiaceae - 5 species or 4%, which club together for 43% of the established types of medicinal plants. These families, with the exception of Poaceae, Cyperaceae, Brassicaceae and Chenopodiaceae, are among the most species-rich families among the flora of the research area (FILIPOVA ET AL. 2002). The least presented are 9 families with 2 species each and 25 families with 1 species each. Families with the largest genera variety of medicinal plants are: Asteraceae (13), Lamiaceae (12), Fabaceae (5), Apiaceae (4) and Brassicaceae (4), the same being the most well represented in the flora of the area. Genera with the most species are *Artemisia* (4), *Mentha* (4), *Salvia* (3) and *Teucrium* (3). At the same time the genera *Artemisia* and *Salvia* are among the richest in species and in the flora of the area (FILIPOVA ET AL. 2002).

Herbaceous perennial type plants are the predominant biological type - 69 (61%), followed by the annual ones - 21 (18%), and the shrubs - 9 (8%). The biennials are represented by 7 species (6%), annuals to biennials - with 3 species (3%), annuals to perennials are presented by 2 species (2%), while biennials to perennial and perennial to shrubs have only 1 species (1 %) each to account for. Analysis display that the distribution of the biological types identified in the area follows that of all plants species of the same area (FILIPOVA ET AL. 2002).

Moisture and humidity as factors differentiate the medicinal species as follows: mesophytes occupy the dominant position of 49 species (43%), followed by the xerophytes - 39 species (35%); hygrophytes - 21 species (19%) and hydrophytes presented with only 4 species (3%). A similar ecological structure for the flora of Shabla-Ezeretz Lake Complex is established by FILIPOVA ET AL. (2002).

Primary analysis of the floristic elements of the established medicinal plants indicates predominance of the Eurasian geo-elements (26 species or 23%). Second in numbers come the Euro-Mediterranean, cosmopolitan and Sub-Mediterranean (14 or 12%), followed by Boreal (13 species or 11%), European (8 species or 7%) and Euro-Siberian (7 or 6%). In total, there are 35 species with different types of Mediterranean distribution, representing 31% of the overall number of species. The count of species with different types of European distribution is 57 representing 50% of the total number of species. Analysis of the floristic elements of the flora of Shabla-Ezeretz Lake Complex Protected Area shows similar distribution (FILIPOVA ET AL. 2002). The presence of a large number of cosmopolites among the medicinal species (12%), as well as within the area's flora (14%) is due mainly to the fact that the subject of our survey is a wetlands area dominated by marsh plants the majority of which are cosmopolitans.

There are 33 species (29%) of medicinal plants with conservation significance in the studied wetland area. Depending on the degree of threat to the biological diversity they refer to different conservation categories and status.

The *Near Threatened* category (NT) of the European Red List for endangered species includes 22 species: *Alisma plantago-aquatica* L., *Apium graveolens* L., *Bidens tripartita* L., *Butomus umbellatum* L., *Ephedra distachya* L., *Equisetum palustre* L., *Myriophyllum spicatum* L., *Iris pseudacorus* L., *Lycopus europaeus* L., *Mentha aquatica* L., *Mentha pulegium* L., *Mentha spicata* L., *Salvia officinalis* L., *Lemna minor* L., *Lythrum salicaria* L., *Najas marina* L., *Nymphaea alba* L., *Galium palustre* L., *Salix alba* L., *Veronica beccabunga* L., *Sparganium erectum* L. and *Typha angustifolia* L. The Bulgarian Red Data Book for endangered species includes 3 species: *Eryngium maritimum* L., *Nuphar lutea* (L.) S. et S. and *Nymphaea alba* L.

Protected plants according to BULGARIAN BIOLOGICAL DIVERSITY ACT, Appendix 3, Article 37, are 6 species: *Eryngium maritimum* L., *Artemisia lerchiana* Web., *Ephedra distachya* L., *Euphorbia peplis* L., *Nuphar lutea* (L.) S. et S. and *Nymphaea alba* L. There are 2 species fully prohibited for collection from their natural habitats according to Order № RD-83 of 03.02.2014 of the Minister for the Environment and Water issued on the basis of the MEDICINAL PLANTS ACT, Article 10: *Althaea officinalis* L. and *Artemisia santonicum* L. subsp. *patens* (Neibr.) K. Pers.

On account of research data for the healing activity and plant substances, we grouped the medicinal plants of the studied Shabla-Ezeretz Lake Complex according to the diseases they are relevant or appropriate (Table 1).

Table 1. Groups of diseases, healing action and plant substance

Species	Healing action	Plant substance
Plants used for treatment of cardiovascular diseases		
<i>Adonis aestivalis</i> L.	cardiovascular, diuretic, sedative	Herba Adonidis
<i>Lycopus europaeus</i> L.	coronary dilated	Herba Lycopi
<i>Nymphaea alba</i> L.	cardioactive agent	Rhizoma Nymphaeae albae
<i>Vincetoxicum hirundinaria</i> Medic.	cardiovascular, laxative, anti-ulcer	Rhizoma et radix Vincetoxici
Plants used for treatment of gastrointestinal diseases		
<i>Artemisia vulgaris</i> L.	appetite exciting, sedative, haemostatic action	Herba et radix Artemisiae
<i>Artemisia absinthium</i> L.	appetite exciting	Herba Absinthii
<i>Ballota nigra</i> L.	spasmolytic, anti-inflammatory, pain reliever	Herba Ballotae
<i>Cichorium inthybus</i> L.	appetite exciting, diuretic, stimulating bile release	Flores Cetaureae
<i>Convolvulus arvensis</i> L.	laxative, diuretic, epithelium tonic	Herba Convolvuli
<i>Cuscuta europaea</i> L.	purgative, diuretic, analgesic	Herba Cuscutae
<i>Datura stramonium</i> L.	spasmolytic	Folium Stramonii
<i>Lythrum salicaria</i> L.	constipative, haemostatic action, antiseptic	Herba Litri salicarii
<i>Malva sylvestris</i> L.	spasmolytic, expectorant, sedative	Flos et folium Malvae sylvestris
<i>Matricaria chamomilla</i> L.	anti-inflammatory, antiseptic, spasmolytic	Flores Chamomillae
<i>Mentha arvensis</i> L.	carminative, antiseptic	Folium et oleum Menthae arvensis
<i>Mentha pulegium</i> L.	spasmolytic, carminative, antiseptic	Folium et oleum Menthae pulegiumae
<i>Mentha spicata</i> L.	spasmolytic, carminative, antiseptic	Folium et oleum Menthae spicatae
<i>Mentha aquatica</i> L.	spasmolytic, carminative, antiseptic	Folium et oleum Menthae aquaticae
<i>Nuphar lutea</i> (L.) S. et S.	anti-inflammatory	Rhizoma Nupharis Jutei
<i>Potentilla reptans</i> L.	constipative, haemostatic action, anti-inflammatory, spasmolytic	Herba Potentillae reptani
<i>Prunus spinosa</i> L.	astringent, anti-inflammatory	Flos et fructus Pruni spinosae

Species	Healing action	Plant substance
<i>Rhamnus catharticus</i> L.	laxative, anti-inflammatory	Cortex, folium et fructus Rhamni cathartici
<i>Solanum nigrum</i> L.	spasmolytic, sedative, analgesic	Herba Solani nigri
<i>Teucrium scordium</i> L.	anti-inflammatory, analgesic, astringent, constipative	Herba Teucrii
<i>Teucrium chamaedrys</i> L.	anti-inflammatory, analgesic, astringent, constipative	Herba Teucrii
<i>Teucrium polium</i> L.	disinfecting, constipative, analgesic	Herba Teucrii
Plants used for treatment of liver and biliary tract		
<i>Marrubium vulgare</i> L.	stimulating bile release, spasmolytic	Herba Marrubii
<i>Marrubium peregrinum</i> L.	stimulating bile release, spasmolytic	Herba Marrubii
<i>Taraxacum officinalis</i> Veb.	stimulating bile release, diuretic	Herba et radix Taraxaci
Plants used for treatment of respiratory diseases		
<i>Althaea officinalis</i> L.	expectorant, anti-inflammatory	Radix Althaeae
<i>Anchusa officinalis</i> L.	expectorant, constipative	Herba Anchusi
<i>Glechoma hederacea</i> L.	anti-inflammatory	Herba Glechomae
<i>Iris pseudacorus</i> L.	expectorant, anti-inflammatory, analgesic	Radix Iridis
<i>Iris pumila</i> L.	anti-inflammatory	Radix Iridis
<i>Papaver rhoeas</i> L.	expectorant	Flos Rhoeados
<i>Salvia aethiopis</i> L.	expectorant, anti-inflammatory	Folium Salviae
<i>Sideritis montana</i> L.	expectorant	Herba Sideritis montanae
<i>Verbascum tapsiforme</i> Schrad.	expectorant, anti-inflammatory	Flos Verbasci
<i>Veronica beccabunga</i> L.	expectorant, expectorant, anti-inflammatory	Herba Veronicae
Plants used for treatment of kidney and urinary tract diseases		
<i>Agropyron repens</i> L.	diuretic, laxative	Rhizoma Graminis
<i>Alisma plantago-aquatica</i> L.	diuretic	Rhizoma Plantaginis aquaticae
<i>Apium graveolens</i> L.	diuretic, appetite exciting, anti-rheumatic	Radix, folium et fructus Apii
<i>Arctium lappa</i> L.	diuretic, anti-ulcer	Radix Bardanae
<i>Asparagus officinalis</i> L.	diuretic	Radix et rhizoma Asparagi
<i>Carduus acanthoides</i> L.	diuretic, strengthens the secretion of the digestive tract	Herba Carduus acanthii

Species	Healing action	Plant substance
<i>Cynodon dactylon</i> L.	diuretic, expectorant, laxative	Rhizoma Graminis italici
<i>Eryngium campestre</i> L.	diuretic, spasmolytic	Radix Eringii
<i>Eryngium maritimum</i> L.	diuretic, spasmolytic	Radix Eringii
<i>Galium palustre</i> L.	astringent, anti-inflammatory, antimicrobial, laxative	Herba Galii palustri
<i>Galium aparine</i> L.	diuretic, laxative, analgesic	Herba Galii aparinis
<i>Herniaria hirsuta</i> L.	diuretic, spasmolytic	Herba Herniariae
<i>Ononis arvensis</i> L.	diuretic, anti-inflammatory	Radix Ononidis
<i>Ononis spinosa</i> L.	diuretic, anti-inflammatory	Radix Ononidis
<i>Polygonum aviculare</i> L.	diuretic, astringent, haemostatic action	Herba Polygoni avicularis
<i>Reseda lutea</i> L.	diuretic, capillary reinforcing	Herba Resedae luteae
<i>Sambucus ebulus</i> L.	diuretic, antiseptic, expectorant	Radix, fructus et flos Ebuli
Plants used for treatment of rheumatic and colds diseases		
<i>Salix alba</i> L.	antipyretic, anti-rheumatic	Cortex Salicis
<i>Salvia verticillata</i> L.	anti-inflammatory, disinfecting, expectorant	Folium Salviae
<i>Salvia officinalis</i> L.	anti-inflammatory, disinfecting, expectorant	Folium et oleum Salviae
<i>Solanum dulcamara</i> L.	stimulation of sweat, anti-inflammatory	Herba Dulcamarae
<i>Verbena officinalis</i> L.	stimulation of sweat, antipyretic, sedative	Herba Verbenae
<i>Xanthium spinosum</i> L.	anti-rheumatic, anti-inflammatory	Herba et fructus Xanthii spinosi
<i>Xanthium strumarium</i> L.	anti-rheumatic, anti-inflammatory	Herba et fructus Xanthii strumarii
Plants used for treatment of metabolic and endocrine diseases		
<i>Galega officinalis</i> L.	hypoglycaemic, diuretic	Herba Galegae
<i>Lepidium ruderae</i> L.	antidiabetic, stimulation of sweat, diuretic, sedative	Herba Lepidii
Plants used for treatment of parasitic diseases		
<i>Artemisia santonicum</i> L. subsp. <i>patens</i> (Neibr.) K. Pers.	anthelmintic	Flos Artemisiae
<i>Artemisia lerchiana</i> Web.	anthelmintic	Flos Artemisiae
<i>Nepeta cataria</i> L.	antimicrobial, anthelmintic	Herba Nepetae catariae
<i>Ranunculus ficaria</i> L.	antibacterial	Herba et rhizome Ficarii

Species	Healing action	Plant substance
Plants that affect central nervous system		
<i>Conium maculatum</i> L.	analgesic	Fructus et herba Conii
<i>Consolida regalis</i> S. F. Gray	anthelmintic, laxative	Herba et semen Consolidae
<i>Ephedra distachya</i> L.	anti-asthmatic, hypertonic	Herba Ephedrae
<i>Melilotus alba</i> Med.	sedative	Herba Meliloti
<i>Melilotus officinalis</i> (L.) Pall.	sedative	Herba Meliloti
<i>Ranunculus repens</i> L.	analgesic	Rhizoma Ranunculi repensis
<i>Scutellaria altissima</i> L.	spasmolytic, astringent, diuretic, sedative	Herba Scutellarii
Plants with predominantly haemostatic action		
<i>Achillea millefolium</i> L.	haemostatic action, anti-inflammatory	Herba Millefolii
<i>Bidens tripartita</i> L.	astringent, diuretic, stimulation of sweat	Herba Bidentis
<i>Capsella bursa-pastoris</i> (L.) Medic.	haemostatic action	Herba Bursae - pastoris
<i>Echium italicum</i> L.	haemostatic action, expectorant, antiepileptic	Radix et folium Ehii italici
<i>Erodium cicutarium</i> (L.) L'Her.	haemostatic action	Herba Erodii cicutarii
<i>Plumbago europaea</i> L.	anti-inflammatory, astringent	Radix et herba Plumbaginis
<i>Sanguisorba minor</i> Scop.	haemostatic action, astringent, anti-inflammatory	Rhizona et radix Sanguisorbe
<i>Urtica dioica</i> L.	haemostatic action, diuretic	Folium Urticae
Plants used primarily for wound healing		
<i>Hypericum perforatum</i> L.	regenerative, anti-inflammatory, astringent, anti-ulcer, haemostatic action, sedative	Herba Hyperici
<i>Plantago lanceolata</i> L.	anti-inflammatory, laxative, anti-ulcer, diuretic	Folium Plantaginis lanceolatae
<i>Plantago major</i> L.	anti-inflammatory, laxative, anti-ulcer, diuretic	Folium Plantaginis majoris
<i>Stachys annua</i> L.	regenerative, spasmolytic	Herba Stachi annuae
<i>Stachys recta</i> L.	regenerative, spasmolytic	Herba Stachi rectae
Plants used in skin diseases		
<i>Euphorbia amygdaloides</i> L.	keratolytic	Succus Euphorbiae

Species	Healing action	Plant substance
<i>Euphorbia peplis</i> L.	keratolytic	Succus Euphorbiae
Plants with other types of actions		
<i>Anthemis tinctoria</i> L.	hair bleaching	Fructus, folium et cortex
<i>Butomus umbellatum</i> L.	nutrient	Rizoma Butomi
<i>Chenopodium album</i> L.	nutrient	Folium et semen Chenopodii
<i>Chenopodium hybridum</i> L.	nutrient	Herba Chenopodii hybridi
<i>Lamium purpureum</i> L.	nutrient	Herba Lamii
<i>Lotus corniculatus</i> L.	fodder	Herba Corniculati
<i>Salicornia europaea</i> L.	nutrient	Herba Salicornii
<i>Sisymbrium loeselii</i> L.	rich in vitamins	Herba Sysimbrii
<i>Trifolium repens</i> L.	fodder	Herba Trifolii repensis

Analysis display that half of the studied medicinal plants are used primarily for treatment of gastrointestinal diseases, kidney and urinary tract diseases, respiratory diseases, along with those with haemostatic action. The remaining types of diseases are associated with 1 to 5 medicinal plant species.

Medicinal plants established for the area have a wide variety of healing action - more than 38 types. Most of the medicinal plants of the studied area have diuretic (15 species), anti-inflammatory (11 species) and spasmolytic action (8 species). The rest of the plants' healing activities relate to less than 5 medicinal plants.

Different vegetative and generative parts are used as a plant substance from the established medicinal plants. The above ground part (herba) of the plant is collected from half of the species. Different plant parts can be harvested and used in a quarter of all analyzed species.

CONCLUSION

There is a considerable taxonomic variety of medicinal plants on the territory of Shabla-Ezeretz Lake Complex. The results obtained could be grounds for comparative floristic studies of the medicinal plants in Bulgaria's wetlands. They could be used to promote wetlands' role in the life-system of the population and to outline conservation perspectives and requisites for rational use of the medicinal plant resources.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this article.

References

- ASENOV I. & NIKOLOV S. 1988. Pharmacognosy. Medicine and Physical Education, Sofia, 465 pp. (In Bulgarian).
- ASSYOV B., PETROVPA A., DIMITROV D. & VASSILEV R. 2006. Conspectus of the Bulgarian vascular flora. Distribution maps and floristic elements. - Bulgarian Biodiversity Foundation, Sofia, 452 pp. (In Bulgarian).
- BERN CONVENTION. 1979. Convention on the Conservation of European Wildlife and Natural Habitats. Appendix I.
- CITES. 1975. Convention on International Trade in Endangered Species of Wild Fauna and Flora. <https://www.cites.org/eng/disc/text.php> (last assessed 13.11.2017).
- DIMITROV D., FILIPOVA-MARINOVA M. & IVANOV D. 2000. Flora and vegetation in the region of Durankulak Lake. - Proceedings of the National Museum Varna. 30–31 (45–46): 314–332. (In Bulgarian).
- GEORGIEV D. (COMP.) 1998. Management Plan of the Durankulak Lake Nature Complex. - Ministry of Environment and Water / Bulgarian-Swiss Biodiversity Conservation Program.
- HARDALOVA R., EVSTATIEVA L. & GUSEV CH. 1994. Characteristics of the resource from the wonderfully healing plants in Bulgaria and the provision for sustainable development. In: National strategy behind bio-diversity denomination. 2: 41-72. (In Bulgarian).
- IVANOV D., FILIPOVA-MARINOVA M. & DIMITROV D. 2002. Flora and vegetation of the nature complex „Kamchia“. - Proceedings of the National Museum. Varna. 32–33 (47–48): 314–340. (In Bulgarian).
- JORDANOV D. (ED.) 1963-1989. Florae Reipublicae Popularis Bulgarica. Aedibus Acad. Sci, Serdicae, Vol. 1-9. (In Bulgarian).
- KOZHUHAROV S. (ED.), ANDREEV N., ANCHEV M., KOZHUHAROV S. MARKOVA M. PEEV D. & PETROVA A. 1992. Determinant of the vascular plants in Bulgaria. Nauka i Izkustvo, Sofia, 787 pp. (In Bulgarian).
- KOZHUHAROV S. (ED.) 1995. Flora of the Republic of Bulgaria Prof. M. Drinov Acad. Publ., Sofia, Vol. 10. 428 pp. (In Bulgarian).
- LAW ON BIODIVERSITY OF THE REPUBLIC OF BULGARIA. ANNEX. State Gazette number 77. 9 August 2002. State Gazette number 76. 19 September 2017. (In Bulgarian).
- LUKAS G. 1983. List of Rare Threatened and Endemic Plants in Europe. Strasbourg. Council of Europe.
- MARINOVA-FILIPOVA M., IVANOV D. & DIMITROV D. 2002. Flora and vegetation in the region of Shabla and Ezerets lakes. - Proceedings of the National Museum Varna. 32–33 (47–48): 341–363. (In Bulgarian).
- MEDICINAL PLANTS ACT OF THE REPUBLIC OF BULGARIA. Annex. State Gazette number 29, 7 April 2000. 9-29. Last amended in State Gazette number 98. 28 November 2014. (In Bulgarian).
- MICHEV T. & STOYNEVA M. 2007. Conservation of Bulgarian non-lotic wetlands. - In:

- MICHEV T. & STOYNEVA M. (Eds), Inventory of Bulgarian Wetlands and their Biodiversity. Sofia, 109-119.
- NIKOLOV S. (Ed.) 2006. Specialized encyclopedia of medicinal plants in Bulgaria. Trud, Sofia, 566 pp. (In Bulgarian).
- ORDER NoRD-83 FROM 3 FEBRUARY 2014 FOR SPECIAL ARRANGEMENTS FOR THE CONSERVATION AND USE OF MEDICINAL PLANTS. State Gazette number 14, 18 February 2014. (In Bulgarian).
- PEEV D. (Ed.) 2013. Flora of the Republic of Bulgaria. Prof. M. Drinov Acad. Publ., Sofia, Vol. 11, 523 pp. (In Bulgarian).
- PEEV D. (Ed.-in-Chief) 2013. RED Data Book of the Republic of Bulgaria. Vol. 1 Plants and fungi. <http://e-codb.bas.bg/rdb/bg/voll/Lycinund.html> (Last accessed on 01.08.2013).
- PETKOV V. (Ed.) 1982. Contemporary phytotherapy. Meditsina i Fizkultura, Sofia, 517 pp. (In Bulgarian).
- PETROVA A. & VELCEV V. 2006. List of Bulgarian endemic species. – In: PETROVA A. (Ed.), Atlas of Bulgarian Endemic Plants. Gea-Libris Ltd., Sofia, 399 pp.
- PETROVA A. & VLADIMIROV V. (Eds) 2010. Balkan endemics in the Bulgarian flora. - Phytologia Balcanica. Sofia. 16 (2): 293 - 311.
- PLOETZ K. L. 2000. An ethnobotanical study of wild herb use in Bulgaria. Master Thesis. Michigan Technological University, 156 pp.
- PLOETZ K. & ORR B. 2004. Wild herb use in Bulgaria. - Economic Botany 58 (2): 231-241.
- RAMSAR CONVENTION SECRETARIAT. 2010. Wetland CEPA: The Convention's Programme on communication, education, participation and awareness (CEPA). Ramsar handbooks for the wise use of wetlands, Ramsar Convention Secretariat, Gland, Switzerland. 2009-2015; 4th edition, vol. 6.
- THE IUCN RED LIST OF THREATENED SPECIES. 2014. 3th edition. <https://www.iucnredlist.org/> (Last accessed on 01.08.2013).
- TOLMACHEV A. I. 1974. Introduction into plant geography. Publishing House of the Leningrad University. 244 pp. (In Russian).
- VALTCHEV CH. & IORDANOVA P. 2004. Statistics. Konstantin Preslavsky University of Shumen Press, Shumen, 153 pp. (In Bulgarian)
- VELCEV V. (Ed.) 1982. Florae Reipublicae Popularis Bulgaricae. Aedibus Acad. Sci. Bulgaricae, Serdicae, Vol. 8, 518 pp. (In Bulgarian).
- VELCEV V. (Ed.) 1989. Florae Reipublicae Popularis Bulgaricae. Aedibus Acad. Sci. Bulgaricae, Serdicae, Vol. 9, 539 pp. (In Bulgarian).
- ZAHARIEV D., BOYCHEVA P. & KOSEV K. 2016. Review on the medicinal plants of the north Black Sea coast (Bulgaria). - Annual of Sofia University „St. Kliment Ohridski“, Faculty of Biology, Book 2-Botany 99: 100-114.

Received 10 April 2018

Accepted 18 June 2018