

Contribution to the flora of disappearing wetlands in the Toundzha Hilly Country (SE Bulgaria)

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Abstract: This study presents information on the ongoing investigations of the recent state of the disappearing wetlands in the area of Kermen town (Southeast Bulgaria, Toundzha Hilly Country) and of the vascular flora found in the wetlands and their surroundings. As a result of the investigation, 120 vascular plant species (26 of them aquatic and fen plants) from 93 genera and 41 families have been identified.

Key words: Bulgaria, vascular plants, wetlands

Introduction

Natural wetlands in Bulgaria are comparatively rare, especially in the lowlands, but they are an important part of the national heritage. Degradation has greatly diminished the wetlands in Bulgaria during the 20th century (Kotshev & Jordanov 1981) and recently the Bulgarian government has taken steps to protect the most important wet areas in the country (Mitshev 1998).

There were numerous swamps in the vicinity of Kermen town (the Toundzha Hilly Country, Southeast Bulgaria), last described by Kanev (1988). Information about the swamp and aquatic vegetation of the Kermen wet areas is very scarce (Bondev 1991). Our investigation contributes new information on the recent state of the swamps and about the vegetation of these shrinking wetlands. Since the late 1960s a systematic drainage of the swamps has been in progress. Presently, this area continues to be under strong anthropogenic impact, with most of the swamps already extinct or under continuous degradation from pollution, urbanization, partial drainage, and other destructive influences.

The aim of the present study was: 1. to find the still existing swamps and to assess the present state of the swamp vegetation; 2. to discover possibilities for Quaternary palaeoecological investigation in this area.

Material and methods

Fieldwork was conducted in the surroundings of the wetlands (in a radius about 30-40 m), or in places for which there was information that they used to be wetlands (in the vicinities of Bikovo, Omarchevo, Bozadzhi and Boyadzhik villages).

The plant material was collected in two successive years (in August 2003 and in May 2004) and the collected plant species were determined according to a plant nomenclature following Jordanov (1963-1979), Velchev (1982-1989), Kozhuharov (1992) and Kozhuharov (1995). The floristic catalogue is alphabetically arranged by families, genera and species. The species in the current floristic catalogue are referred to the respective floristic element according to the *Conspectus of the Bulgarian Vascular Flora* (Dimitrov 2002). The weeds and ruderal plants are also marked (+) and, as such, are considered according to Kozhuharov (1992) and Dimitrov (2004). The medicinal plants marked with an asterisk (*) are given according to Peev & al.(1993). The results from the floristic investigations are briefly discussed. The herbarium samples of five taxa of vascular plants identified for the first time for the Toundzha Hilly Country are introduced in the Herbarium of the Sofia University (SO) with corresponding numbers.

Abbreviations: Adv (Adventive), Asiat (Asiatic), Balk-Anat (Balkan-Anatolian), Boreal (Boreal), Sub-

Boreal (Subboreal), Bulg (Bulgarian), Eur (European), Euro-Asiat (Euro-Asiatic), Eur-Sib (European - Siberian), Euro-Med (European Mediterranean), Euro-SubMed (European Submediterranean), Cosm (Cosmopolitan), Medit (Mediterranean), SubMedit (Submediterranean), Pann-Balk (Pannonian-Balkan), Pann-Medit, (Pannonian-Mediterranean), SPont (South Pontic), ann. (annuals), ann-bi (annuals to biennials), bi (biennials), perenn (perennials), semi-shr (semishrubs), shr (shrubs), shr-tr (shrubs to trees), tr (trees).

Study area

The area of investigation lies in the northern part of the Toundzha Hilly Country, to the southwest of Kermen town. The area is encircled by the Kermen and by Svetiliyski hills, situated in the transitional Moderate-Continental to Continental-Mediterranean climatic zone. The annual precipitations amount to about 600 mm (Velev 2002). The Kermen hills are residual parts of horsts, with cellular faults in-between. In many of these faults had developed swamps: Mladovsko (Gerena), Skobelevsko, Bikovsko (Kouluka), Omarchevsko (Gerena), and the Big Kermen Swamp (Kanev 1988).

According to Bondev (1991), cultivated lands replacing the *Ulmus minor*, *Fraxinus oxycarpa* and *Quercus pedunculiflora* are most characteristic for the surroundings of Kermen town. Xerophytic herb communities with *Dichanthium ischaemum*, *Poa bulbosa* and *Chrysopogon gryllus* are also distributed. South of Kermen lie spots covered by halophytic herb communities dominated by *Puccinellia convoluta*, *Limonium gmelinii*, *Aeluropus litoralis* and *Salicornia europaea*. Swamp vegetation also exists: *Phragmites australis*, *Typha angustifolia*, *T. latifolia*, and *Schoenoplectus lacustris*

Results

Recent state of the wetlands (2003 and 2004)

1. In the vicinity of Omarchevo village (Fig. 1) /1/ Kanev (1988) described a swamp called Gerena. According to the local people, the swamp was drained out about 1970. Recently, barren lands prevail around a dry canal.

2. Near Bikovo village (Fig. 1) /2/ in the place of the drained swamp we found out abandoned farm-lands.

3. To the southwest of Bozadzhi village (Fig. 1) we found a swamp, called Solata by the local people /3/, with an area of ca. 1.5 decares. The bottom of that swamp was clayey and the open water surface was muddy. The water pH was 8.1. At the moment of our visit (in August 2003) the swamp was going to be dried out.. It was surrounded by cultivated and barren lands. Forest vegetation or single trees were almost absent. The aquatic plants were described by Atanassova, Marinova (2003).

In May 2004 the Solata swamp was already dry and the remaining swamp vegetation has been fire burned. On the dry bottom of the swamp we found numerous shells of *Lymnaea stagnalis* (Linneus 1758) identified by P.Mitov (personal communication). *L. stagnalis* is wide distributed in fresh to brackish water basins with abundant vegetation (Akimushkin 1999).

4. In May 2004 the wetlands near Boyadzhik vil-lage /4/ had an open surface of about 2 decares. The open water surface was muddy. The edge of the wet area was covered by fire burned swamp vegetation.

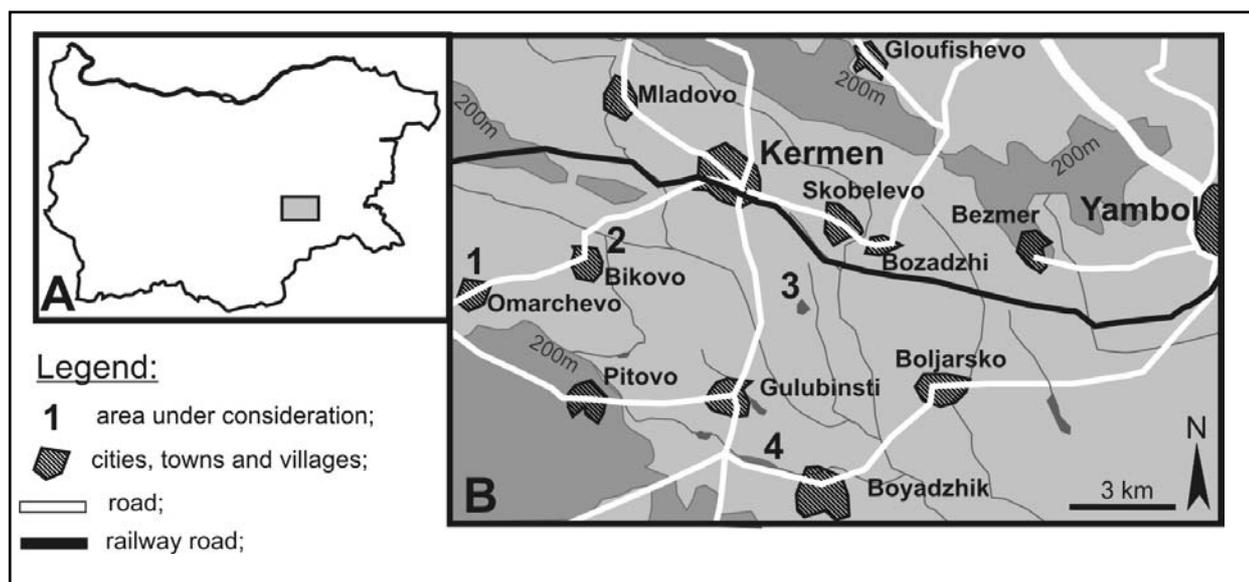


Fig. 1. Location of the study area. **A.** On the territory of Bulgaria; **B.** In the surrounding of Kermen.
1 – Gerena swamp; 2 - Bikovo swamp 3 - Solata swamp 4 - wetlands near Boyadzhik village

Floristic catalogue

Alismataceae

Alisma lanceolatum Wit. Per. /3/, per, Boreal

Apiaceae

+*Conium maculatum* L. /4/, ann-bi, Euro-As

Daucus carota L. /1, 4/, ann-bi, Euro-As

**Eryngium campestre* L. /3/, per, Pont-Med

Heracleum ternatum Vel. /4/, per, Med

Aristolochiaceae

*+*Aristolochia clematitis* L. /4/, per, Euro-Med

Asteraceae

Achillea pannonica Scheele. /3/, per, Pann-Bal

+*Anthemis arvensis* L. /1, 3, 4/, ann, Euro-Med

**Arctium lappa* L. /2, 4/, bi, Euro-Med

Artemisia lerchiana Weber /3/, per, subMed

A. vulgaris L. /1/ per, subBoreal

Carthamus dentatus (Forsk.) Vahl. /3/, ann, Bal-Anat

C. lanatus L., /1, 3/, ann-bi, subMed

Centaurea bovina Vel. /3/, bi, Bul

*+*C. cyanus* L. /1, 3, 4/, ann-bi., Euro-Med

C. solstitialis L. /1/, ann, Euro-Med

*+*Chamomilla recutita* (L.) Rausch. /3, 4/, ann, Euro-As

*+*Cichorium intybus* L. /1, 2/, per, Euro-Sib

+*Cirsium arvense* (L.) Scop. /1, 3/, per, Euro-As

C. ligulare Boiss. /1, 3/, ann-bi, Med

+*Pulicaria vulgaris* Gaertn. /3/, ann, Euro-As

Scorzonera cana (C.A.Mayer) Hoffm. /3/, per, Med

+*Senecio vulgaris* L. /3/, per, Euro-As

*+*Taraxacum officinale* Web. /1, 2, 4/, per, Euro-Med

+*Xanthium spinosum* L. /1/, ann, Kosm

Boraginaceae

Myosotis ramosissima Roch. /3/, ann, subMed

Brassicaceae

Alyssum alyssoides (L.) L. /3/, ann, Euro-Med

+*Brassica juncea* (L.) Czern. /3/, ann, As

Calepina irregularis (Asso) Thell. /3/, ann-bi, Med

*+*Capsella bursa-pastoris* (L.) Medic. /2, 4/, ann-bi, Kosm

+*Erysimum repandum* L. /3/, ann, Euro-As

Lepidium latifolium L. /4/, per, Euro-Med

Rorippa sylvestris (L.) Bess. /4/, per, Euro-As

Butomaceae

Butomus umbellatus L. /3/, per, Euro-As

Campanulaceae

Legousia speculum-veneris (L.) Chaix. /3/, ann, Euro-Med

Cannabaceae

+*Cannabis sativa* L. /1/, ann, Adv

Caprifoliaceae

*+*Sambucus ebulus* L. /4/, per, Euro-Med

Caryophyllaceae

Cerastium dubium (Bast.) Schwarz. /4/, ann, Eur

C. glomeratum Thuill. /3/, ann, Kosm

+*Gypsophila muralis* L. /3/, per, Euro-As

Ceratophyllaceae

Ceratophyllum demersum L. /4/, per, Kosm

Chenopodiaceae

+*Atriplex patula* L. /3, 4/, ann, Boreal

Camphorosma monspeliaca L. /3/, semi-shr, Euro-As

+*Chenopodium album* L. /4/, ann, Kosm

Convolvulaceae

+*Convolvulus arvensis* L. /2, 3, 4/, per, Kosm

Cyperaceae

Bolboshoenus maritimus (L.) Palla /3, 4/, per, Kosm

Carex distans L. /3, 4/, per, Euro-As

C. divisa Huds. /4/, per, Euro-As

C. hirta L. /3, 4/, per, Boreal

C. otrubae Podp. /4/, per, Euro

C. riparia Curt. /3, 4/, per, Euro-As

Eleocharis palustris (L.) R.Br. /4/, per, Kosm

Schoenoplectus lacustris (L.) Pall. /3, 4/, per, Kosm

Schoenus nigricans L. /3/, per, Euro-As

Fabaceae

+*Lotus tenuis* Willd. /3/, per, Euro-As

*+*Melilotus officinalis* (L.) Pallas /4/, ann, Euro-As

Trifilium campestre L. /2, 3/, ann, Euro-Med

Tr. dubium Sibth. /3/, ann, Euro-Med

Tr. fragiferum L. /3/ Euro-As

Tr. hybridum L. /4/, per, Euro-Med

Tr. patens L. /3/, ann, sub-Med

Tr. setiferum Boiss, ann, /3/, Med

Tr. subterraneum L. /3/, ann, subMed

Tr. resupinatum L. /4/, ann, Med

+*Vicia pannonica* Crantz /4/, ann, Euro-Med

+*V. tetrasperma* (L.) Schreb. /3/, ann, Euro-Med

Geraniaceae

+*Geranium dissectum* L. /3/, ann, Euro-As

Haloragaceae

Myriophyllum verticillatum L. /3/, per, Boreal

Iridaceae

Iris pseudacorus L. /4/, per, Eur

Juncaceae

Juncus gerardii Loisel. /3/, per, Boreal

Lamiaceae

+*Lamium amplexicaule* L., /2, 3/, ann, Euro-As

+*L. purpureum* L. /2, 4/, ann, Euro-Med

Lycopus europaeus L. /3, 4/, per, Euro-As

**Mentha pulegium* L. /2, 4/, per, Euro-As

Liliaceae

Ornithogalum nutans L. /4/, per, Eur

Najadaceae

Najas marina L. /3/, ann, Boreal

Onagraceae

Epilobium parviflorum Schreb. /3/, per, subBoreal

Plantaginaceae

*+*Plantago major* L. /3, 4/, per, Boreal

*+*Pl. lanceolata* L. /1, 2, 4/, per, Kosm

Poaceae

Alopecurus geniculatus L. /4/, per, Euro-As

+*Avena fatua* L. /2, 3/ ann, Boreal

+*Bromus sterilis* L. /4/, ann, Boreal

*+*Cynodon dactylon* (L.) Pers. /2, 3/, per, Kosm

+*Echinochloa crus-galli* (L.) Beauv. /3/, ann, Kosm

Hordeum murinum L. /1, 4/, per, Boreal
Phragmites australis (Cav.) Trin. ex Steud. /3, 4/, per, Kos
Poa annua L. /4/, ann, Kos
P. bulbosa L. /2, 3/, per, Euro-As
P. jubata A.Kern. /3/, ann
+*Sclerochloa dura* (L.) Beauv. /4/, ann, Euro-As
Taeniatherum caput-medusae (L.) Nevski /3/, ann, Euro-As

Polygonaceae

+*Bilderdykia convolvulus* (L.) Dum. /3/, ann, Euro-As
Persicaria amphibibia (L.) S. Groy /3/, per, Kosm
**P. hypodipiper* (L.) Spach. /3/, ann, Euro-As
**Polygonum aviculare* L. /1, 2, 3/, ann, Kosm

Primulaceae

+*Anagalis arvensis* ssp. *foemina* (Mill.) Schintz. et Tell. /3/, ann-bi, Kosm

Potamogetonaceae

Potamogeton crispus L. /3, 4/, per, Kosm

Ranunculaceae

+*Adonis aestivalis* L., /4/, ann, Euro-subMed
*+*Consolida regalis* Gray, /3, 4/, ann, Euro-Med
Ranunculus auricomus L. /3, 4/, per, Euro-Med
+*R. sardous* Crantz /3, 4/, ann-bi., Euro-Med
R. sceleratus L. /3/, ann-bi., Euro-Med
R. triophyllus Chaix. /3, 4/, per, Kosm

Rosaceae

**Crataegus monogyna* Jace. /4/, shr-tree, subBoreal

*+*Geum urbanum* L. /4/, per, subBoreal
**Prunus spinosa* L. /4/, shr, SPont
Prunus cerasifera Ehrh. /2, 4/, tree, Euro-As

Rubiaceae

*+*Galium aparine* L. /4/, ann., Euro-As

Salicaceae

Populus nigra L. /4/, tree, Euro-As
**Salix alba* L. /4/, tree, Euro-As

Scrophulariaceae

+*Kickxia spuria* (L.) Dum., /3/, ann., subMed
Parentucellia latifolia (L.) Garnel. /3/, ann, Med
Veronica anagallis-aquatica L. /4/, /3/, per, Boreal

Solanaceae

Lycium barbarum L. /1/, shr, Med(Adv)

Typhaceae

Typha angustifolia L. /3,4/, per, Kosm
T. latifolia L. /3, 4/, per, Kosm

Ulmaceae

Ulmus minor Mill. /1/, tree, Euro-Med

Verbenaceae

*+*Verbena officinalis* Vose /4/, per, Kosm

Violaceae

Viola jordanii Hanry /4/, per, Euro-Med

Zannichelliaceae

Zannichellia palustris L. ssp. *palustris* /4/, per, Kosm

Zygophyllaceae

+*Tribulus terrestris* L. /3/, ann, Euro-As

Discussion

As a result of the investigations, 120 plant species from 93 genera and 41 families have been established, all belonging to the Magnoliophytina. Dicotyledons (Magnoliopsida) form the prevailing group, with 89 taxa, 69 genera and 30 families. The families represented by the largest number of taxa are: Asteraceae (16% of all species), Fabaceae (10%), Poaceae (10%), and Cyperaceae (8%). The first three families also hold dominance by the number of species in the Bulgarian flora in general (Velchev 2002) and, in view of this, the area under consideration has the typical for the vegetation of Bulgaria proportion of dominating families. As an element of this vegetation, 26 aquatic and fen plant species have been identified, according to the classification of Kotshev & Jordanov (1981). Of all identified plant species, only seven were trees and shrubs, while the prevailing number went to herbs (perennials, annuals, annual-biennials and biennials). The low diversity of trees and shrubs is related to the almost complete destruction of forest vegetation in the area of investigation. In this connection mention deserves the fact that 37% of all identified vascular plants are weeds, or ruderal plants. Of all identified plant species, 19% are medicinal plants, most of them

commonly distributed ruderal and weed plants in the country too.

Two species (*Centaurea bovina* and *Artemisia lerbchiana*) are protected under the Bulgarian Biodiversity Law. Five taxa of vascular plants (one of them aquatic and one fen plant) were identified for the first time for the floristic region of the Toundzha Hilly Country:

Artemisia lerbchiana(103596 HSU) – near the Solata swamp (08.2003.). This plant is known from the Black Sea Coast (Kozhuharov 1992; Dimitrov 2002).

Cerastium glomeratum (103595 HSU) – near the Solata swamp (05.2004). This plant is known from the Danube Plain, Northeast Bulgaria, Balkan Range, Znepole region, West Frontier Mts, Central Rhodopes, Thracian Lowland and Mt Strandzha (Kozhuharov 1992; Dimitrov 2002).

Najas marina(103598 HSU) - in the Solata swamp (08. 2003). This plant is known from the Black Sea Coast, Danube Plain (Kozhuharov 1992) and Thracian Lowland (Dimitrov 2002).

Shoenus nigricans L. (103599 HSU) - on the periphery of the Solata swamp (08.2003). This plant is known from the Black Sea Coast and Thracian Lowland (Kozhuharov 1992, Dimitrov 2002).

Trifolium. subterraneum (103597 HSU) - in the vicinity of the Solata swamp (05. 2004). This plant is known from the Black Sea Coast (s), Danube Plain, Sofia region, Strouma Valley, Mesta Valley,

Thracian Lowland and Mt Strandzha (Kozhuharov 1992; Dimitrov 2002).

The Euro-Asiatic floristic element (Eur-As) prevailed in the flora of the investigated area (25%), followed by the Euro-Mediterranean (Eur-Med) (18%), Cosmopolitan (Kosm)(17%) and Mediterranean (Med) (6%) elements.

Conclusions

The region of investigation covers a confined area in the northern part of the Toundzha Hilly Country which in the past was rich in mosaic scattered swamps and small water basins drying out in summer. Of the 120 identified vascular plant taxa, 26 were aquatic and fen plants. Irrespective of the low number of identified aquatic and fen plants and the absence of protected and rare plant species, we recommend for the remaining natural wetlands in the investigated region to be preserved. In most cases the confined area occupied by them after their extinction would certainly turn out into barren lands, because of the low productivity of the clayey soils found in the place of former swamps. The results of our investigation have shown that even under such strong anthropogenic pressure the wetlands around Kermen represent an area with a valuable biodiversity potential. In this connection it should be also borne in mind that, along with the vegetation, the swamps are also a habitat to various representatives of the fauna.

The preliminary studies of sediments from the Solata swamp have shown good preservation of pollen, but after the latest drying up (in spring of 2004) of the swamp no further palaeoecological studies are possible.

Another expedition is intended for finding out a more suitable site for palaeoecological investigations.

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References

- Akimushkin, I. 1999. Animal world. Invertebrates. Misal Press, Moscow.
- Atanassova, J & Marinova, E. Disappearing wetlands in the Toundzha Hilly Country (SE Bulgaria). - Abstracts of 10th Scientific Session , 40 years Biological Faculty, St. Kl. Ohridski Univ., Sofia.
- Bondev, I. 1991. The Vegetation of Bulgaria. Map with explanatory text. St. Kl. Ohridski Univ. Press, Sofia.
- Dimitrov, D. (ed.). 2002. Conspectus of the Bulgarian Vascular Flora. Distribution Maps and Floristic Elements. Bulgarian-Swiss Biodiversity Conservation Programme, Sofia.
- Dimitrov, D. 2004. The vascular flora of the city of Sofia. - In: Penev, L., Niemela, J., Kotze, J. & Chipev, N. (eds), Ecology of the City of Sofia. Pp. 185 – 207. Pensoft Publ., Sofia.
- Jordanov, D. (ed.). 1963-1979. Fl. Reipubl. Popularis Bulgaricae. Vols 1-7. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).
- Kanev D. 1988. On the Secrets of the Bulgarian Relief. Nar. Prosveta, Sofia (in Bulgarian).
- Kotshev, H. & Jordanov, D. 1981. Vegetation of Water Basins in Bulgaria. Ecology, Protection and Economic Importance. Publishing House of the Bulgarian Academy of Sciences, Sofia (in Bulgarian).
- Kozhuharov, S. (ed.) 1992. Field Guide to the Vascular Plants in Bulgaria. Nauka & Izkoustvo, Sofia (in Bulgarian).
- Kozhuharov, S. (ed.) 1995. Flora Reipublicae Bulgaricae. Vol. 10. Editio Acad. Prof. Marin Drinov, Serdicae (in Bulgarian).
- Mitshev, T. (ed.) 1998. National Action Plan for the Conservation of the Most Important Wetlands in Bulgaria. Ministry of Environment (in Bulgarian).
- Peev, D., Anchev, M., Ivanova, D., Kozhuharov, S., Petrova, A. & Tsoneva, S. 1993. Biological diversity of vascular plants in Bulgaria. - In: Sakaljan, M. (ed.), National Strategy for Conservation of Biological Diversity. Vol. 1, pp. 73–115 (in Bulgarian).
- Velchev, V. (ed.). 1982 – 1989. Flora Reipublicae. Popularis Bulgaricae. Vol. 8-9. In Aedibus Acad. Sci. Bulgaricae, Serdicae (in Bulgarian).
- Velchev, V. 2002. Characteristic features and principles in the distribution of present-day vegetation. - In: Koprarev I. (ed.), Geography of Bulgaria. Physical Geography, Socioeconomic Geography, pp. 152-156. ForCom, Sofia (in Bulgarian).
- Velev, S. 2002. Climatic regions - In: Koprarev I. (ed.), Geography of Bulgaria. Physical Geography, Socioeconomic Geography. Pp. 152- 156. ForCom, Sofia (in Bulgarian).