Biodiv. Res. Conserv. 1-2: 89-91, 2006

DOI 10.14746/biorc.2006.1-2.19

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Phytogeographic aspects of transformation of the vascular plant flora in coastal mires exemplified by the eastern part of the Kashubian Coastal Region (northern Poland)

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Abstract: Mires in a coastal zone are distinct from the others because of presence of Atlantic and boreal species in their flora. During the last century far-reaching changes in peatland flora were observed. The aim of this research was to analyse the phytogeographical aspects of transformation of vascular plants flora in disturbed coastal mires. The research was conducted in a complex of mire habitats in the Kashubian Coastal Region. Long term anthropic pressure in this area caused significant changes in abiotic conditions as well as in the plant cover. Contemporary vascular flora was recorded between 2000 and 2004 and compared with all the data from former research. Groups of Atlantic and boreal species were characterized by their sociological and biological structure as well as local habitat amplitude. There were 32 boreal and 38 Atlantic taxa found within this area. Nowadays, ratio between them is slightly moved towards Atlantic species. The probable reason of this change is the anthropic transformation of environment, which caused enlargement of the area of dry mineral habitats, colonized by grasslands and heathlands species.

Key words: phytogeography, geobotany, transformation of flora, Atlantic species, boreal species, coastal mires, synanthropisation, anthropic pressure

1. Introduction

Climate is an important factor, which modifies floristic composition of mires in Poland. Mires in a coastal zone are distinct from others because of the presence of Atlantic and boreal species in their flora (Czubiński 1950). During the last century far-reaching qualitative and quantitative changes in peatlands flora were observed. They are caused by environment transformation resulted from anthropic pressure. The main symptoms of changes in wetlands flora are mire species extinction (hemerophobic species) and apophytes and anthropophytes expansion, which is conformable with general trends of synanthropisation. The theory of synanthropisation assumes that this process, by replacing primary ecosystems by secondary ones, leads to deprivation of these plant cover features which are predefined by regional climate and flora history (Faliński 1972). Up-to-date stage of the synanthropisation process in coastal peatlands, which are unique from geobotanical point of view, is not well recognized.

The aim of this research was to analyse the phytogeographical aspects of changes in flora of disturbed coastal mires.

2. Material and methods

The research was conducted in the Błota Przymorskie Plain and the Płutnica Valley, which were a complex of mire habitats: widespread fens and three raised bogs of Baltic type. As a consequence of a long term anthropic pressure in this area significant changes both in abiotic conditions and in plant cover took place (Budyś 2005).

Contemporary flora of the studied area was recorded between 2000 and 2004 and it was compared with all the data from former research. The most important archival materials were: Abromeit *et al.* (1898-1940), Graebner (1895), Preuss (1911), Czubiński *et al.* (1954) and Machnikowski *et al.* (1985). In order to characterize phytogeographical features of the flora two groups of taxa were distinguished: Atlantic and boreal species. The geographical range of each species was diagnosed

after: Czeczottowa (1928), Czubiński (1950), Hultén (1964-1971, 1973), Meusel *et al*. (1965, 1978), Pawłowska (1977), Hultén & Fries (1986), Meusel & Jäger (1992). Both groups were described by their sociological structure (according to Matuszkiewicz 2001), biological structure (Raunkiaer 1905) and local habitat amplitude.

3. Results

There were 32 boreal and 38 Atlantic species found within this area (Table 1), which make respectively 3.3% and 4.0% of the total flora (N=956). The number of taxa belonging to these groups in contemporary flora (N=806) equals 19 (2.4%) for boreal and 29 (3.6%) for Atlantic species. Both boreal and Atlantic taxa are nowadays very rare or rare within the studied area. The highest frequency, among others, have: *Calamagrostis stricta*, *Carex rostrata* (boreal species) and *Erica tetralix*, *Myrica gale*, *Rubus sprengelii*, *Sarothamnus scoparius* and *Hydrocotyle vulgaris* (Atlantic species).

In the group of boreal species the biggest share have water plants and species typical of mires, rushes and swamp forest (68%). Smaller percentage have coniferous forests and heathlands taxa (16%) as well as species with wide sociological amplitude (16%). The rate of extinction among boreal species is high (13 species) and it affected mainly mires taxa (e.g. *Carex chordorrhiza*,

Table 1. The Atlantic and boreal species noted between 1809 and 2004 within the studied area

Boreal species	H/C	L	Atlantic species	H/C	L
† *Arctostaphylos uva-ursi*	?	-	† *Aira caryophyllea*	10	-
† *Carex chordorrhiza*	1	-	† *Carex punctata*	1, 2	-
† *Isoëtes lacustris*	7	-	† *Drosera intermedia*	1	-
† *Juncus stygius*	6	-	† *Juncus subnodulosus*	2, 6	-
† *Linnaea borealis*	3	-	† *Littorella uniflora*	7	-
† *Lobelia dortmanna*	7	-	† *Lycopodiella inundata*	1, 3, 4	-
† *Pedicularis sceptrum-carolinum*	1	-	† *Myriophyllum alterniflorum*	7	-
† *Pinguicula vulgaris*	1, 2	-	† *Pedicularis sylvatica*	3, 4	-
† *Polemonium coeruleum*	2	-	† *Pilularia globulifera*	5, 6, 7	-
† *Pyrola chlorantha*	3	-	*Aira praecox*	7, 10	18
† *Saxifraga hirculus*	1	-	*Anthoxanthum aristatum*	2	6
† *Stellaria crassifolia*	1	-	*Arnoseris minima*	2, 10	17
† *Viola epipsila*	2, 3, 5, 6	-	*Baeothryon cespitosum* subsp. *germanicum*	3, 4, 9	8
Andromeda polifolia	3, 5	15	*Callitriche hamulata*	6	3
Baeothryon cespitosum subsp. *cespitosum*	4	8	*Carex arenaria*	2, 8, 9, 11	37
Calamagrostis stricta	2, 6	44	*Carex pulicaris*	2	2
Calla palustris	3, 5, 6, 7	4	*Corynephorus canescens*	2, 8, 9, 11	14
Carex buxbaumii	2	2	*Erica tetralix*	3, 4, 5	45
Carex rostrata	2, 6, 7	79	*Euphrasia nemorosa*	2, 9	9
Corallorhiza trifida	6	1	*Festuca tenuifolia*	3	9
Empetrum nigrum	3, 7	14	*Galium saxatile*	2, 3	14
Juncus balticus	9	1	*Hydrocotyle vulgaris*	2, 3, 6	88
Ledum palustre	3, 5	23	*Hypericum humifusum*	2	1
Lysimachia thyrsiflora	2, 3, 6, 7	38	*Hypochoeris glabra*	10	1
Menyanthes trifoliata	2, 6	27	*Juncus bulbosus*	5, 6, 7, 9	27
Oxycoccus palustris	3, 5, 7	12	*Juncus squarrosus*	2, 4, 9	27
Potamogeton alpinus	6	7	*Lonicera periclymenum*	3, 11	2
Pyrola minor	3, 5	7	*Lysimachia nemorum*	6	1
Rubus chamaemorus	3, 4, 11	3	*Myrica gale*	2, 3, 5, 6	37
Sparganium minimum	5	1	*Ornithopus perpusillus*	8, 9	21
Trientalis europaea	3	19	*Osmunda regalis*	3, 5	4
Vaccinium uliginosum	3, 4, 5, 6	24	*Potamogeton obtusifolius*	6	1
			Potentilla anglica	2, 6	14
			Radiola linoides	2, 7, 9	4
			Rhynchospora fusca	7	1
			Rubus sprengelii	3, 7	41
			Sarothamnus scoparius	2, 9, 11	46
			Teesdalea nudicaulis	2, 8	13

Explanations: † – locally extinct; H/C – habitats or plant communities preferred by species within the studied area: 1 – oligo- and mesotrophic moss communities, 2 – meadows, wet grasslands and pastures, 3 – forests, shrubs and trees plantations, 4 – heathlands, 5 – post-exploitation digs, 6 – drainage ditches and river banks, 7 – lakes, pools and wet depressions, 8 – dry grasslands, 9 – ground roads and roadsides, 10 – crop fields, 11 – other synanthropic habitats; L – number of localities, where locality is a square of 1 km^2 (N = 122)

Pinguicula vulgaris) and species with undefined phytosociological amplitude. The largest proportion in this group constitute chamaephytes (32%) and hydrophytes (26%). Boreal species were noted mostly in meadows, forests and in wet habitats, like ditches and post-excavation digs.

Sociological structure of Atlantic species is more complicated because, apart from water and mire species (34%), a large proportion in this group constitute species typical of grasslands on sandy soils (14%), rich deciduous forests (14%), heathlands (10%), synanthropic habitats (10%), taxa with wide phytosociological amplitude (10%) and species of wet mineral habitats (7%). There are 9 extinct species, characteristic of bogs and oligotrophic waters, among them (e.g. *Drosera intermedia* and *Pilularia globulifera*). At present the largest percentage in the group of Atlantic species have hemicryptophytes (38%) and therophytes (28%). The local habitat amplitude of Atlantic species is much wider than boreal ones, because, besides wet and moist habitats, they relatively often grow in heathlands, grasslands, at road-sides and sometimes even in crop-fields.

4. Conclusion

In spite of 200 years of anthropopressure, vascular plant flora of the studied area still have some phytogeographical features typical of coastal mires. In the contemporary flora a proportion of Atlantic and boreal species is slightly moved towards species with western range. It is probably the result of anthropic transformation of environment, which caused an enlargement of the area of dry mineral habitats. In the consequence of this changes species typical of grasslands and dry heathlands have the opportunity to develop within the researched area. The dynamics of analysed phytogeographical groups in disturbed coastal peatlands still needs to be studied.

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