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Biodiv. Res. Conserv. 3-4: 266-268, 2006

Differentiation of *Bolboschoenus maritimus* (L.) Palla in Polish maritime populations on the basis of inflorescences and pollen grains parameters

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Abstract: The aim of this work is to define the intraspecific differentiation of maritime populations of *Bolboschoenus maritimus* (L.) Palla in Poland on the basis of the inflorescences and pollen grains parameters. In the investigated maritime populations of *B. maritimus*, both the representative of *B. maritimus* var. *maritimus* and *B. maritimus* var. *compactus* were occurred, yet *B. maritimus* var. *compactus* was less frequent component of the vegetation. The dependence between the size of pollen grains and the distinguished varieties of this taxon has not been noticed. The number and the length of the peduncles of the inflorescence, the ratio of the number of sessile spikelets to pedunculate spikelets, the number of pedunculate spikelets, the ratio of length of sessile spikelets to the length of pedunculate spikelets are the parameters which most clearly distinguish *B. maritimus* var. *maritimus* from *B. maritimus* var. *compactus*. A higher differentiation of analysed parameters of inflorescences was observed for *B. maritimus* var. *compactus*.

Key words: *Bolboschoenus maritimus* var. *maritimus*, *Bolboschoenus maritimus* var. *compactus*, variability, biometry, pollen grains, inflorescence morphology

1. Introduction

Bolboschoenus maritimus (L.) Palla (=*Scirpus maritimus* L.) is a cosmopolitan species, which grows along sea shores and in more or less saline inland localities. In Europe *B. maritimus* occurs in coastal areas, excluding the north-west shores of the Scandinavian Peninsula, and inland it ranges from western France to the Ural Mountains (Hultén & Fries 1986). *B. maritimus* is a very variable species. The differences are marked in the spikelet size, number of stigmata, fruit shape and inflorescence structure. On the basis of these parameters such ranks of taxa as forms and varieties (Ascherson & Graebner 1902-1904; Koyama 1962; Reichgelt 1956; Żukowski 1969; Rutkowski 1998), subspecies (Dostal 1989; DeFilipps 1980; Hroudova *et al.* 1998) and even species (Egorova 1976) were distinguished.

The aim of this work is to define the intraspecific differentiation of Polish maritime populations of *B. maritimus* on the basis of inflorescences and pollen grains parameters. Two varieties are recognized within the species of *B. maritimus*, that is: *B. maritimus* var. *maritimus* and *B. maritimus* var. *compactus* (Hoffm.) Egorova (=*Scirpus maritimus* L. var. *compactus* (Hoffm.) Meyer, *Scirpus compactus* Hoffm., *B. maritimus* (L.) Palla subsp. *compactus* (Hoffm.) Hejny, *B. compactus* (Hoffm.) Drobov).

2. Material and methods

The biometric investigations were performed on the material of 18 samples of *B. maritimus* from the following localities of the Polish coast: 1 – Świnoujście, 2-3 Karsibór, 4 – Wolin, 5 – Dziwnów, 6-7 Niechorze, 8 – Unieście, 9-10 Rowy, 11 – Łeba, 12 – Kuźnica, 13 –Władysławowo, 14 – Puck, 15 – Mechelinki, 16 – Kąty Rybackie, 17 – Suchacz, 18 – Nowa Pasłęka. The following parameters of inflorescences and pollen grains were selected to the analysis: 1 – length of the peduncles of the inflorescence; 2 – mean length of the peduncles in the same inflorescence; 3 – length of pedunculate spikelets; 4 – mean length of pedunculate spikelets in the same inflorescence; 5 – length of sessile spikelets; 6 – mean length of sessile spikelets in the same inflorescence; 7 – number of peduncles of the inflorescence; 8 – number of pedunculate spikelets of the inflorescence;

9 – number of sessile spikelets of the inflorescence; 10 – ratio of number of pedunculate spikelets to number of peduncles in the same inflorescence; 11 – ratio of length of sessile spikelets (mean length) to length of pedunculate spikelets (mean length) in the same inflorescence; 12 – ratio of number of sessile spikelets to number of pedunculate spikelets in the same inflorescence; 13 – length of pollen grains; 14 – width of pollen grains; 15 – ratio of length to width of pollen grains.

The measurements of pollen grains were made with the use of the microscope linked with the computer, applying the LUCIA 3.5 program for a computer analysis of microscope image, while the measurements of inflorescences parameters (1-6) were made with the use of the ruler. From each sample 30 inflorescences and 50 pollen grains were randomly collected for the analysis.

The data obtained as a result of the measurements were evaluated statistically with the use of the Statistica program (StatSoft Inc. 1997). The data were analysed using agglomerated grouping by the method of closest neighbourhood on the basis of Euclidean distances, illustrated by the dendrogram. Also the Principal Component Analysis (PCA) was conducted. For all parameters of each sample the basic statistical characteristics were calculated.

3. Results

The pollen grains of *B. maritimus* are single, oval or pear-shaped; mean length of pollen grains amounts 47.24 µm, width 29.05 µm and the ratio of length to width 1.66. The ranges of the variability of the parameters of pollen grains staid within the limits of the following scales: for length from 32.41 µm to 65.70 µm; for width from 18.25 µm to 42.98 µm; for ratio of length to width 1.03 to 2.71. The least variable parameter is the length of pollen grains; the obtained coefficients of variation for this parameter range from 4.13 to 12.09%. The dependence between the size of pollen grains and the distinguished varieties of this taxon has not been noticed.

In the investigated maritime populations of *B. maritimus* both the representatives of *B. maritimus* var. *maritimus* as well as *B. maritimus* var. *compactus* were found, although *B. maritimus* var. *compactus* occurred more rarely (7 samples).

The analysis of the dendrogram (Fig. 1), constructed on the basis of data for all 18 samples of inflorescences parameters, permits to ascertain the existing differentiation between samples. In the dendrogram two groups can be distinguished. One group was made of samples 1, 3, 8, 10-15 and 17. This group, beside the samples which are the representatives of *B. maritimus* var. *compactus*, includes also the samples representing the other variety. These are the samples: 11, 15 and 17. The other group includes the samples 2, 4-7, 9, 16 and 18. This group comprises the representatives of only *B. maritimus* var. *maritimus*.

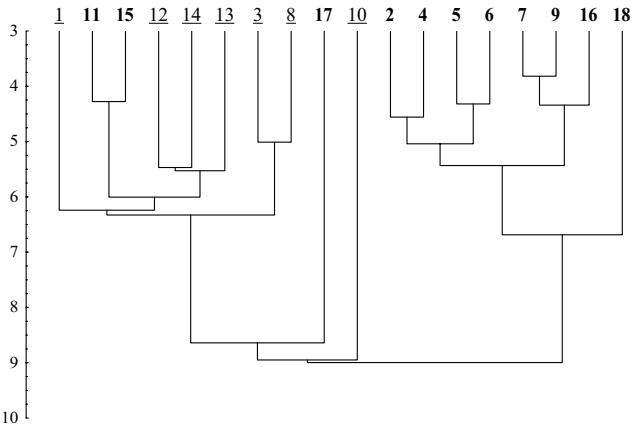

Fig. 1. Dendrogram of 18 samples of *Bolboschoenus maritimus*, constructed on the basis of the analysed inflorescences parameters (the numbers of samples of *B. maritimus* var. *compactus* were underlined)

The Principal Component Analysis was used with the aim to confirm the existing interpopulational relationships observed by the method of agglomerated grouping, after the reduction of a number of initial parameters. On the basis of PCA, the parameters which were correlated with the first three principal components (r>0.70) were chosen. These parameters differentiate the populations and explain the variation most completely. The first principal component explained 54.10%, the second 21.07% and the third 15.36% of the total variance of parameters. The first principal component was determined by the most parameters of inflorescences, e.g.: 1, 2, 3, 4, 7, 8 (negative correlation),

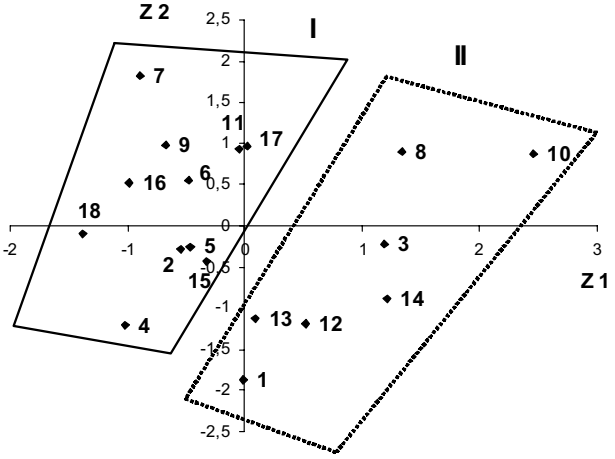

Fig. 2. Plot of the first and the second principal components, resulting from the PCA of 18 samples of inflorescences parameters of *Bolboschoenus maritimus* (I – the samples of *B. maritimus* var. *maritimus*, II – the samples of *B. maritimus* var. *compactus*)

11, 12 (positive correlation); the second principal component was negatively correlated with parameters 5 and 6; and the third principal component was also negatively correlated with the parameter 10. The plot of the first and the second principal components, resulting from the PCA of 18 samples in terms of *B. maritimus* inflorescence parameters, was presented in Fig. 2. It confirms the observed dependence with the method of agglomerated grouping; only samples 11, 15 and 17 had a different position. The received image shows the differentiation of material into two groups. The first group comprises samples belonging to *B. maritimus* var. *maritimus*. The second group consists of 7 samples of *B. maritimus* var. *compactus*.

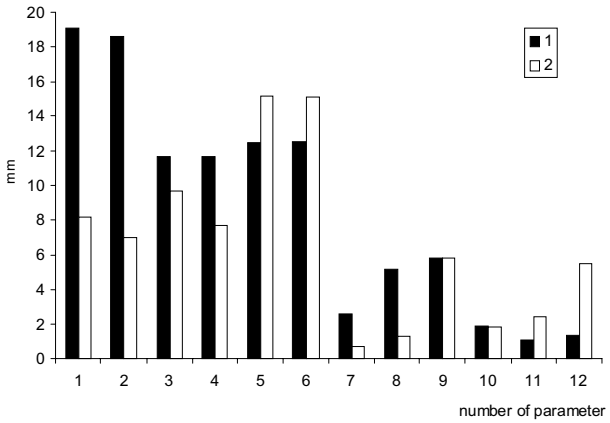

Fig. 3. Arithmetic means of the inflorescences parameters of *Bolboschoenus maritimus* var. *maritimus* (1) and *B. maritimus* var. *compactus* (2)

Bolboschoenus maritimus var. *maritimus* is represented by the following samples: 2, 4, 5, 6, 7, 9, 11, 15, 16, 17, 18 and *B. maritimus* var. *compactus* by samples: 1, 3, 8, 10, 12, 13, 14. The separate distribution of the varieties on the Polish coast was not observed. The representatives of both varieties, growing in small distances from each other, were even observed in the same locality (Karsibór, Rowy).

In the Fig. 3, arithmetic means of the inflorescences parameters of *B. maritimus* var. *maritimus* and *B. maritimus* var. *compactus* were presented. The number and the length of the peduncles of the inflorescence, the ratio of number of sessile spikelets to pedunculate spikelets, the number of pedunculate spikelets, the ratio of length of sessile spikelets to the length of pedunculate spikelets are the parameters most clearly distinguishing *B. maritimus* var. *maritimus* from *B. maritimus* var. *compactus*. The parameters of inflorescences show the higher variation in comparison with pollen grains parameters. The obtained coefficients of variation range widely. The higher differentiation of analysed inflorescence parameters of *B. maritimus* var. *compactus* versus *B. maritimus* var. *maritimus* was observed.

References

Ascherson P. & Graebner P. 1902-1904. Synopsis der Mitteleuropäischen Flora, 2, 530 pp. Engelmann, Leipzig.

DeFilipps R. 1980. *Scirpus* L. In: T. G. Tutin, V. H. Heywood, N. A. Burges, D. H. Valentine, S. M. Walters & D. A. Webb (eds.). Flora Europaea, 5, pp. 277-280. Cambridge University Press, Cambridge.

Dostál J. 1989. Nová Květena ČSRR, 2, pp. 765-1548. Academia Praha.

Egorova T. 1976. *Cyperaceae*. In: A. A. Fedorow (eds.). Flora Evropejskoj Casti SSSR, 2, pp. 83-219. Nauka, Leningrad.

Hroudova Z., Frantik T. & Zakravsky P. 1998. The differentiation of subspecies in *Bolboschoenus maritimus* based on the inflorescence structure. Preslia, Praha 70: 135-154.

Hultén E. & Fries M. 1986. Atlas of North European Vascular Plants. North of the Tropic of Cancer. I. Introduction, taxonomic index to the maps 1-996. Maps 1-996. xvi+498 pp. Koeltz Scientific Books, Königstein.

Koyama T. 1962. The genus *Scirpus* L. some North American aphylloid species. Can. J. Bot. 40: 913-937.

Lucia 3.5. A colour image analysis software system. Laboratory Imaging Ltd. Praha.

Reichgelt T. 1956. *Cyperaceae*. In: T. Weevers, B. Danser & J. Heimans (eds.). Flora Neerlandica, 1(4), pp. 16-18. Konninklijke Nederlandse Botanische Vereniging, Amsterdam.

Rutkowski L. 2004. Klucz do oznaczania roślin naczyniowych Polski niżowej. Wyd. II, popr. i unowocześnione, 814 pp. Wyd. Nauk. PWN, Warszawa.

StatSoft Inc. 1997. Statistica for Windows (Computer program manual). Tulsa.

Żukowski W. 1969. Studia systematyczne i geograficzne nad podrodziną Cyperoideae w Polsce. PTPN, Prace Kom. Biol. 33(3): 28-34.