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The *Bolboschoenus maritimus* group (*Cyperaceae*) in Central Europe, including *B. laticarpus*, spec. nova

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Summary

MARHOLD K., HROUDOVÁ Z., DUCHÁČEK M. & ZÁKRAVSKÝ P. 2004. The *Bolboschoenus maritimus* group (*Cyperaceae*), in Central Europe, including *B. lati-*

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carpus, spec. nova. – Phyton (Horn, Austria) 44 (1): 1–21, 3 figures. – English with German summary.

Information on populations referred to as a putative hybrid of *Bolboschenus maritimus* × *B. yagara*, or morphological type "*B. maritimus* subsp. *maritimus* with wide fruits" in previous literature is summarized. They are compared with other related taxa native in Central Europe, and described as a new species, *Bolboschoenus laticarpus* MARHOLD, HROUDOVÁ, DUCHÁČEK & ZÁKRAVSKÝ. *B. laticarpus*, although undoubtedly of hybrid origin, represents a well established taxon occurring independently of the area of putative parents. While *Bolboschenus maritimus* (L.) PALLA and *B. yagara* (OHWI) Y. C. YANG & M. ZHAN were previously suggested as putative parents, the present authors consider *B. planiculmis* (F. SCHMIDT) T. V. EGOROVA and *B. yagara* as its more probable parents. Meiotic chromosome numbers for *B. laticarpus* were established as n=54 and 55. Plants classified here as *B. laticarpus* share several characters with *B. yagara*, namely richly branched inflorescence, dark brown to black colour of fruits, and triangular shape of fruits in a cross-section. They differ from this species, however, in having wider fruits, with exocarp thicker and formed by cylindrical cells (isodiametric cells in exocarp of *B. yagara*), in number of spikelets on rays in the inflorescence being equal or slightly higher than the number of sessile ones (considerably higher in *B. yagara*), and in perianth bristles persistent to partially or totally caducous (persistent in *B. yagara*). *B. laticarpus* has a wider ecological amplitude in comparison with other related taxa, being particularly characteristic for habitats along rivers.

Zusammenfassung

MARHOLD K., HROUDOVÁ Z., DUCHÁČEK M. & ZÁKRAVSKÝ P. 2004. Die *Bolboschoenus maritimus* Gruppe (*Cyperaceae*) in Mittel-Europa, inkl. *B. laticarpus*, spec. nova. – Phyton (Horn, Austria) 44 (1): 1–21, 3 Abbildungen. – Englisch mit deutscher Zusammenfassung.

Informationen über Populationen, die in der bisherigen Literatur entweder der vermuteten Hybride *Bolboschoenus maritimus* × *B. yagara* oder dem morphologischen Typ "*B. maritimus* subsp. *maritimus* mit breiten Früchten" zugeordnet worden waren, sind zusammengefasst. Die Pflanzen wurden mit den anderen, in Mittel-Europa heimischen Taxa verglichen und werden hier als *Bolboschoenus laticarpus* MARHOLD, HROUDOVÁ, DUCHÁČEK & ZÁKRAVSKÝ, spec. nova, beschrieben. *B. laticarpus* ist zwar zweifelsfrei hybridogen entstanden, stellt aber ein eigenständiges Taxon, das unabhängig vom Areal der Eltern vorkommt, dar. Während früher *B. maritimus* (L.) PALLA und *B. yagara* (OHWI) Y. C. YANG & M. ZHAN als Eltern angesehen worden sind, erscheinen *B. planiculmis* (F. SCHMIDT) T.V. EGOROVA und *B. yagara* als Eltern wahrscheinlicher. Die meiotischen Chromosomenzahlen von *B. laticarpus* betragen n=54 und n=55. *B. laticarpus* hat einige Merkmale mit *B. yagara* gemeinsam, namentlich die reich verzweigte Infloreszenz, die dunkelbraune bis schwarze Farbe der Früchte und die dreieckige Form das Frucht-Querschnittes. Er unterscheidet sich von letzterem aber durch breitere Früchte mit einem Exokarp, das dicker ist, und aus zylinderförmigen Zellen gebildet wird (isodiametrische Zellen im Exokarp von *B.* yagara), durch die gleiche oder etwas höhere Zahl der gestielten Ährchen in der Infloreszenz (deutlich höher bei *B. yagara*) gegenüber den sitzenden Ährchen und durch die persistierenden bis teilweise oder ganz abfallenden Perigonborsten (per-

sistierend bei *B. yagara). B. laticarpus* hat eine breitere ökologische Amplitude als die verwandten Taxa und ist speziell für Standorte entlang von Flußläufen charakteristisch.

1. Introduction

There has been much controversy in the taxonomical treatment of the species of the genus *Bolboschoenus* (ASCH.) PALLA (sometimes treated as a subgenus of a broadly conceived genus *Scirpus* L.) in its European area. Populations characterized by whitish-yellow, stramineous or silvery-membranaceous glumes which occur in SE Europe (in the sense of Flora Europaea) and extend as far as to India, have been treated alternatively either as *B. affinis* (ROTH) DROBOV (BROWNING & GORDON-GRAY 2000), or *B. maritimus* subsp. *affinis* (ROTH) T. KOYAMA (KOYAMA 1979), or *Scirpus maritimus* subsp. *affinis* (ROTH) T. NORLINDH (NORLINDH 1972, DEFILIPPS 1980), or *B. popovii* T. V. EGOROVA (EGOROVA 1976). The rest of the European populations of the genus is classified either as one species with or without additional infraspecific taxa, or as several different species. In Flora Europaea (DEFILIPPS 1980) only two subspecies of *S. maritimus* L., namely subsp. *maritimus* and subsp. *affinis* were reported, following the treatment by NORLINDH 1972. In Central Europe CASPER & KRAUSCH 1980 further divided subsp. *maritimus* in the sense of DEFILIPPS 1980 into *B. maritimus* (L.) PALLA subsp. *maritimus* and subsp. *compactus* (HOFFM.) HEJNÝ. For the European part of the former Soviet Union, EGOROVA 1976 documented, apart from *B. popovii* T. V. EGOROVA (= *B. affinis*) and *B. maritimus*, also *B. planiculmis* (F. SCHMIDT) T. V. EGOROVA. BROWNING & al. 1996 divided European *Bolboschoenus* into three taxa: *B. maritimus*, *B. affinis*, *B. yagara* (OHWI) A. E. KOZHEVN. [the correct authority for this combination is "(OHWI) Y. C. YANG & M. ZHAN"] – a newly reported taxon for Europe, and a hybrid *B. maritimus* × *B. yagara*. This taxonomic treatment, however, was dependent on a new lectotypification of the name *S. maritimus* (see below). Later, BROWNING & al. 1998 reported *B. glaucus* (LAM.) S. G. SM. for Italy, Yugoslavia and Bulgaria (apart from its extra-European area). The same species was reported by HROUDOVÁ & al. 1999b as most probably introduced in the Czech Republic and as native also from Greece and Portugal. As the original lectotype of the name *S. maritimus* (specimen LINN 71.44) selected by KOYAMA 1962: 933 was in serious conflict with the protologue, because of its North American origin, a new lectotype, namely a specimen from herbarium Celsius in UPS was chosen by SMITH & KUKKONEN 1999, together with an epitype, representing a specimen originating from coastal area of E Sweden. This new lectotypification enabled an unequivocal interpretation of the name *S. maritimus* and subsequently to solve the questions of correct nomenclature for European *Bolboschoenus* taxa. BROWNING & GORDON-GRAY 2000, discussing fruit morphology and style branch number in the genus *Bolboschoenus* throughout its global

distribution area, regarded populations from a part of Central Europe, from E Europe and northern part of Asia as problematic in respect of taxonomy and nomenclature. The concept introduced by BROWNING & al. 1996 has been recently accepted also in various national treatments, e.g., by KIFFE 1998 and JÄGER & WERNER 2002 who accepted *B. maritimus*, *B. yagara* and their alleged hybrid for the area of Germany, or by HOHLA 2001, 2002 who reported the occurrence of the hybrid *B. maritimus* × *B. yagara* from Austria.

In the previous studies by HROUDOVÁ & al. 1997, 1998a,b, 1999a and JAROLÍMOVÁ & HROUDOVÁ 1998 attention was paid to various aspects of Central European populations of the genus *Bolboschoenus*, namely to fruit morphology, buoyancy of fruits, inflorescence morphology, chromosome numbers, and ecology. Because of unsettled nomenclature, especially the problems in the interpretation of the name *B. maritimus* caused by the lectotypification by KOYAMA 1962 (see above), they provisionally followed the nomenclature by CASPER & KRAUSCH 1980. At first, they recognized only two subspecies, but later on distinguished four morphological types called "*B. maritimus* subsp. *maritimus* with narrow fruits" (corresponding to *B. yagara* in the sense of BROWNING & al. 1996), "*B. maritimus* subsp. *maritimus* with wide fruits" (corresponding to the putative hybrid of *B. maritimus* × *B. yagara* in the sense of BROWNING & al. 1996), *B. maritimus* subsp. *compactus* (corresponding to *B. maritimus* in the sense of BROWNING & al. 1996 and also to the correct interpretation of this name following the recent lectotypification by SMITH & KUKKONEN 1999), and *B. planiculmis* (F. SCHMIDT) T. V. EGOROVA. The interpretation of the last name was not fully settled until recently, as KOZHEVNIKOV 1988 considered *B. planiculmis* as a separate taxon from the Far East, different from European populations, while EGOROVA (in litt.) insisted on maintaining its application for both E Asian and European populations. In addition, original material of the name *Scirpus planiculmis* F. SCHMIDT is hard to interpret for the correct application of the name as there are no fruits on these plants. This problem was solved by EGOROVA & TATANOV 2003, who selected an epitype for the name *S. planiculmis*, which fully corresponds to Central European populations. Another name which was provisionally used for the European populations of *B. planiculmis* is *B. koshewnikovii* (LITV.) A. E. KOZHEVN. (e.g. HROUDOVÁ & al. 2001, HROUDOVÁ 2002), however, this is a later name and there is no original material for this name either.

It is interesting that young tubers of *Bolboschoenus*, because of the high content of polysacharides, were sometimes used for nutrition. There is evidence that they were in use in this respect already in the Neolithic (CIARALDI 2001).

The present paper is a part of the revision of the genus *Bolboschoenus* in Europe and N Asia, which is under preparation. It summarizes in-

formation on populations referred by BROWNING & al. 1996 to the putative hybrid of *B. maritimus* × B. *yagara*, and by HROUDOVÁ & al. 1998b and JAROLÍMOVÁ & HROUDOVÁ 1998 to the morphological type "*B. maritimus* subsp. *maritimus* with wide fruits". We compare them with other related taxa native in Central Europe, and describe them as a new species, *B. laticarpus*.

2. Materials and Methods

The present paper is primarily based on results of the studies in the area of Central Europe by HROUDOVÁ & al. 1997, 1998a,b and JAROLÍMOVÁ & HROUDOVÁ 1998, dealing with morphology, chromosome numbers and ecology of the *B. maritimus* group, as well as on the study of the relevant material in several European herbaria (BRNU, BRNM, CHOM, HR, LD, LE, LIT, MMI, MJ, MP, P, PR, PRA, PRC, ROZ, SAV, SLO, SO, SOM, W, WU). In addition, principal components analysis (PCA), based on correlation matrix and populations as operational taxonomic units, OTUs (KRZANOWSKI 1990), was performed in order to depict the relationships of species native in Central Europe, including *B. laticarpus*. On 46 population samples from the area of the Czech Republic (1150 plants in total, for the list of localities see 3.3.2) the following characters were measured or recorded on each plant:

OI – order (degree) of the branching in the inflorescence,

NR – number of rays (branches) in the inflorescence,

RF – number of rays bearing fascicles,

RS – number of spikelets on rays,

RSS – number of rays with a single spikelet,

NS – number of sessile spikelets,

NB – number of flat herbaceous bracts,

S3 – number of styles with three branches out of 20 randomly selected flowers from the inflorescence,

NS/TS – ratio of the number of sessile spikelets to the total number of spikelets in the inflorescence,

NR/TS – ratio of the total number of rays in the inflorescence to the total number of spikelets in the inflorescence,

RS/NR – ratio of the number of spikelets on rays to the total number of rays in the inflorescence,

NR/NLSF – ratio of the total number of rays in the inflorescence to the number of all lateral single spikelets and lateral fascicles (sessile and on rays).

As PCA is based on the characters of plants in flower, fruiting individuals from each locality studied were checked and their morphology (shape and anatomical structure of fruits as shown in Table 1) was used in the interpretation of the PCA ordination diagram (i.e. taxa were defined by fruit morphology and marked with different symbols in the ordination diagram). Results of the PCA analysis are part of the more broadly conceived morphometric study of the *B. maritimus* group in the Czech Republic, results of which will be published elsewhere. They are mostly beyond the scope of the present paper, which is primarily devoted to the relationships of *B. laticarpus* to other species. Voucher specimens documenting our studies are deposited in herbarium PRA.

Table 1.

Differentiating characters among *Bolboschoenus laticarpus* MARHOLD, HROUDOVÁ, DUCHÁČEK & ZÁKRAVSKÝ, *B. maritimus* (L.) PALLA, *B. planiculmis* (F. SCHMIDT) T. V. EGOROVA and *B. yagara* (OHWI) Y. C. YANG & M. ZHAN.

Character	***B. yagara***	***B. laticarpus***	***B. maritimus***	***B. planiculmis***
inflorescence structure	compound, formed by a central group of sessile spikelets and by rays each bearing 1–3 spikelets	compound, formed by a central group of sessile spikelets and by rays bearing 1–4 spikelets	simple head-like or compound, formed by a central group of sessile spikelets and by rays bearing 1–4 spikelets	simple head-like or compound, formed by a central group of sessile spikelets and by rays bearing 1–3 spikelets
number of sessile spikelets in the inflorescence	(1–) **2–4** (–8)	(2–) **4–7** (–9)	(1–) **5–9** (–13)	(1–) **3–6** (–10)
number of rays in the inflorescence	(2–) **5–7** (–9)	(1–) **3–6** (–8)	(0–) **1–3** (–4)	(0–) **0–3** (–4)
number of spikelets on rays	(2–) **6–17** (–27)	(1–) **3–22** (–38)	(0–) **1–11** (–17)	(0–) **0–7** (–13)
number of rays with only one spikelet	(0–) **2–5** (–7)	(0–) **0–3** (–5)	(0–) **0–1** (–2)	(0–) **0–1** (–4)
number of style branches	3	3 (2)	3 (2)	2
nut shape	narrowly obovate, gradually narrowed into a beak	broadly obovate, abruptly narrowed into a beak	obovate to broadly obovate, abruptly narrowed into a beak	obovate to broadly obovate, abruptly narrowed into a beak
nut in cross-section (* = when styles with two branches)	equilateral triangle, more or less isodiametric	triangle with a wide base (*rarely nearly flattened or only slightly convex)	lenticular, semi-circular to sub-trigonous (*rarely sligthly convex to flattened lenticular)	oval with concave or plano-concave faces
nut colour	dark brown to black	dark brown to black	medium to rusty brown	ochre, light brown to rusty brown
nut surface when dry (at 20×)	smooth, glossy	smooth, ocassionally faint cell outlines visible	regularly cellular	regularly cellular
perianth bristles	persistent	persistent to partially or totally caducous	caducous	caducous
number of perianth bristles	(2–) **4–6** –6)	(0–) **1–6** (–6)	(0–) **0–2** (–4)	(0–) **0–2** (–4)
number of perianth bristles longer than $^1/_2$ of nut length	(2–) **4–6** (–6)	(0–) **1–5** (–6)	(0–) **0–2** (–3)	(0–) **0–1** (–3)
exocarp thickness (relative to that of mesocarp)	very thin, ca. 1/10 to 1/15 of mesocarp thickness	thin, ca. 1/3 of mesocarp thickness	ca. 2 times as thick as mesocarp	ca. as thick as mesocarp, wider over angles than on concave faces
exocarp cell cross-section shape	cells isodiametric or compressed, rarely filled by air	cells slightly cylindrical, ca. 2 times longer than wide, usually filled by air	cells cylindrical, ca. 3–4 times longer than wide, filled by air	cells cylindrical, ca. 2–4 times longer than wide, filled by air

3. Results and Discussion

3.1. *Bolboschoenus laticarpus* Marhold, Hroudová, Ducháček & Zákravský, spec. nova

Diagnosis: A *Bolboschoeno yagara* differt fructibus latioribus, in sectura transversa forma trianguli aequicrurii, vel plana, in dorso rotundato; epidermide (exocarpio) fortius (cellulae exocarpii breviter cylindricae) quam in *B. yagara*; setulae perigonii partim deciduae; flores stylis trifidis vel bifidis in una inflorescentia; A *B. yagara* differt etiam numero maiore spicularum sessilium in inflorescentia (numerus totus spicularum peduncularium inflorescentiae circiter aequalis aut paulo maior quam numerus spicularum sessilium).

Holotypus: E Bohemia, Jílovka fishpond near the road from Bukovka to Lázně Bohdaneč, 1 km SE of the village of Bukovka, alt. 225 m, 50° 6′ N, 15° 38′ E; Hroudová et Zákravský, 5. 9. 2002 (PRA).

Description: Perennial plants (0.7–) 0.8–1.1 (–1.5) m tall, with underground rhizome system bearing ellipsoid to spherical tubers. Stems erect, trigonous, with leaves spirally arranged in three lines. The upper leafless part of the stem under the inflorescence takes about $^1/_3$ of the total stem length. Inflorescence compound, consisting of a group of sessile spikelets and rays, bearing one to several spikelets on each ray. Flowers in the axils of floral glumes; glumes oblong, medium brown to rusty brown, margins lacerate to the apex, excurrent into an outwardly recurwing awn. Style usually with three branches, within one inflorescence styles with two and three branches mostly present together. Fruits (nuts) broadly obovate in outline, trigonous, on the abaxial side with the edge somewhat rounded; dark brown to black. Fruit cross-section of the shape of flat isosceles triangle with wide base. Fruit pericarp formed by thin sclerenchymatous endocarp, well developed sclerenchymatous mesocarp and thin epidermis (exocarp). Exocarp consisting of one layer of slightly elongated (cylindrical) air containing cells. Surface of nuts smooth (at 20× magnification), sometimes with detectable faint cell outlines as a fine network (depending on the development of exocarp layer). Perianth bristles persistent on the nut or partially or totally caducous, densely retrorsely spinulose, dark brown at maturity.

3.2. Chromosome Numbers

Various chromosome numbers were published for the taxa of the *B. maritimus* group, ranging from 2n=26 (Probatova & Sokolovskaya 1988) to 2n=112 (Stoeva 1992) (for full review of the data see Jarolímová & Hroudová 1998). Jarolímová & Hroudová 1998 counted meiotic chromosomes on the material from the Czech Republic, Poland, Slovakia, Hungary, the Netherlands and Sweden, and found n=55 for *B. yagara*, n=55

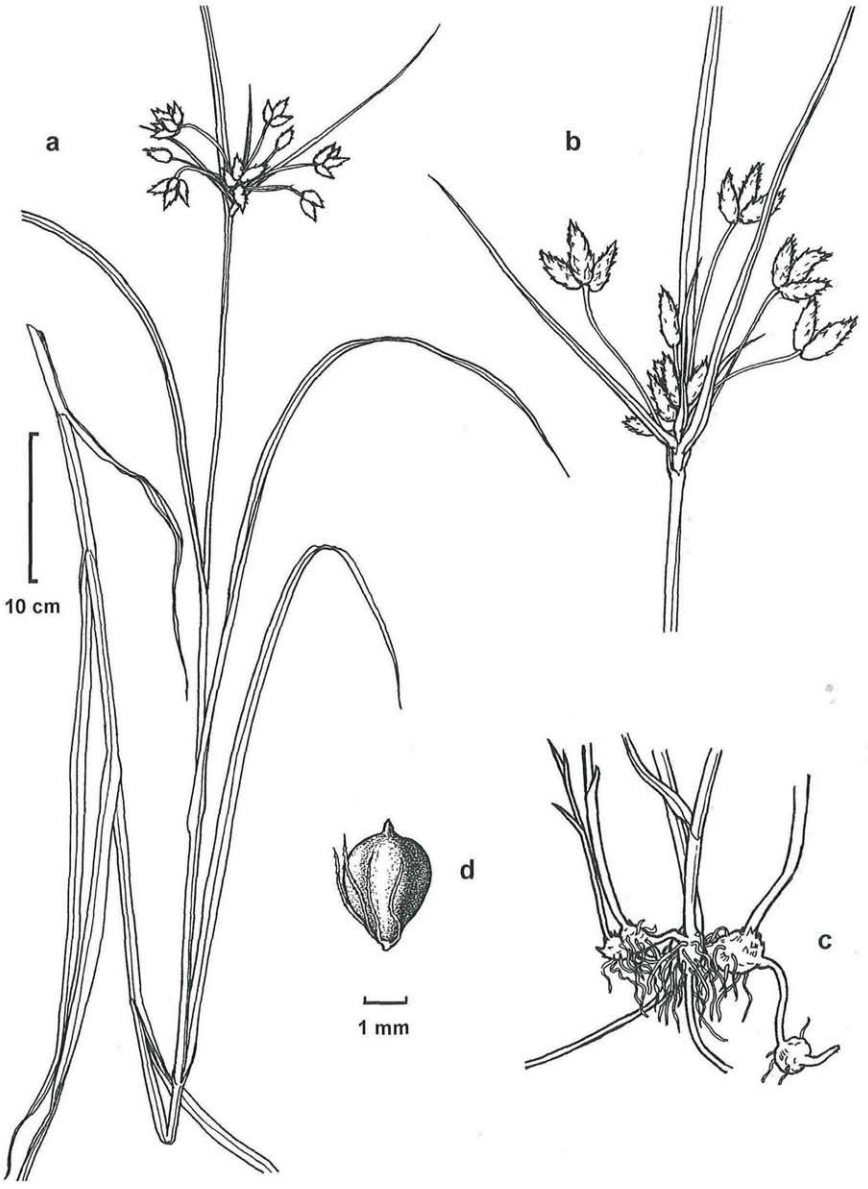

Fig. 1. *Bolboschoenus laticarpus*. a – overall habit, b – detail of the inflorescence, c - detail of the rhizome with tubers, d - fruit (abaxial side). (Del. Z. HROUDOVÁ)

(with a few localities with n=54) for *B. maritimus*, n=54 (n=55 in one locality) for what is considered *B. planiculmis* following EGOROVA & TATANOV 2003, and finally, n=54, 55 for the new species described here as *B. laticarpus* (by JAROLÍMOVÁ & HROUDOVÁ 1998 called as "*B. maritimus* subsp. *maritimus* with wide fruits" and by BROWNING & al. 1996 as hybrid *B. maritimus* × *B. yagara*). It should be stressed, however, that owing to the possibility of agmatoploidy and probable hybridization, the somatic chromosome number does not need to be twice the gametic number in all cases.

3.3. Morphology and Anatomy

3.3.1.

Table 1 summarizes data on morphology of plants and anatomy of nuts of four taxa native in Central Europe, based on our own data and those of BROWNING & al. 1995, 1996, 1997 and BROWNING & GORDON-GRAY 2000. Plants, which we classify here as *B. laticarpus* share several characters with *B. yagara*, namely richly branched inflorescence, dark brown to black colour of fruits, triangular shape of fruits in a cross-section. Both *B. laticarpus* and *B. yagara* possess a thin exocarp (epidermis, formed by one layer of cells), much thinner in comparison with the sclerenchymatous mesocarp (Fig. 2). While in *B. yagara* the exocarp is formed by isodiametric cells, in *B. laticarpus* cells are cylindrical and the exocarp, in comparison with mesocarp is thicker than in *B. yagara*; in addition, while in *B. yagara* the cells forming the exocarp are only rarely filled by air, which causes poor floating abilities of fruits (see HROUDOVÁ & al. 1997), in *B. laticarpus* they are usually filled by air and fruits float somewhat better. The other two taxa (*B. maritimus* and *B. planiculmis*) possess a thick exocarp formed by a layer of air containing cylindrical cells (causing good floating abilities of fruits), which is thicker than the mesocarp in *B. maritimus* or approximately as thick as the mesocarp in *B. planiculmis*. Therefore, in respect of the fruit morphology, *B. laticarpus* represents somewhat a transient type from *B. yagara* into *B. maritimus* and *B. planiculmis*.

Results of the principal components analysis based entirely on the characters of flowering plants are shown in Fig. 3. Four taxa, identified on the base of the fruit morphology (as indicated in Table 1) are marked by different symbols on the ordination diagram. Populations belonging to the four taxa form compact, only slightly overlapping groupings. Populations of *B. laticarpus* occupy again an intermediate position between *B. yagara* on one side and *B. maritimus* and *B. planiculmis*, on the other. All four taxa are differentiated along the first and second axis, while the third axis separates only *B. maritimus* and *B. planiculmis*. Among the characters included in the analysis, the first axis is correlated especially with the ratio of the number of sessile spikelets to the total number of spikelets in the inflorescence (NS/TS), with the number of rays in the inflorescence (NR),

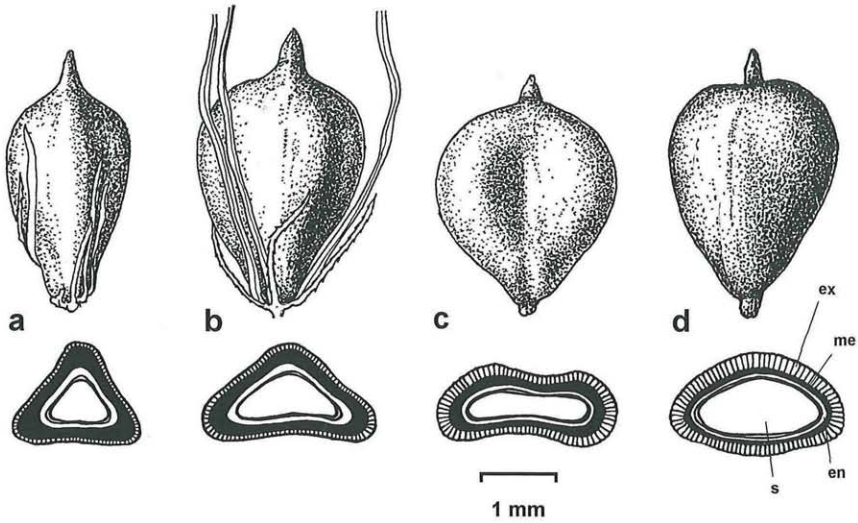

Fig. 2. Fruits of four Central European *Bolboschoenus* species (abaxial side of fruit and its cross section): a: *Bolboschoenus yagara* (locality: Czech Republic, South Bohemia, Zadní Svinětický fishpond, 4 km W of the town of Vodňany, alt. 413 m, 49° 09′ N, 14° 06′ E). – b: *B. laticarpus* (locality: Czech Republic, Central Bohemia, Dubeč suburb of the city of Prague, depression in a wet meadow near the road from Dubeč to Štěrboholy, alt. 255 m, 50° 03′ N, 14° 35′ E). – c: *B. planiculmis* (locality: Czech Republic, South Moravia, wet field depression on the shore of the lower of Nové Mlýny dam reservoirs 7 km SSE of the town of Hustopeče, alt. 170 m, 48° 52′ N, 16° 41′ E). – d: *B. maritimus* (locality: Hungary, the channel near the road from Apaj to Szityóürbó, about 55 km NW of the town of Kecskemét, alt. 80 m, 47° 07′ N, 19° 10′ E). ex – exocarp, me – mesocarp, en – endocarp, s – seed. (Del. Z. HROUDOVÁ)

and with the ratio of the total number of rays in the inflorescence to the number of all lateral single spikelets and lateral fascicles (NR/NLSF), while the second axis correlates more strongly with the number of sessile spikelets (NS), ratio of the number of spikelets on rays to the total number of rays in the inflorescence (RS/NR), and with the number of rays with a single spikelet (RSS). The third axis is strongly influenced by the number of styles with three branches [out of 20 randomly selected flowers from the inflorescence (S3)] (see Table 2).

3.3.2. List of localities of the four taxa of the *B. maritimus* group from the Czech Republic included in the principal component analysis (all material collected by M. DUCHÁČEK)

Bolboschoenus yagara

S Bohemia, Zhoř fishpond, 2.5 km E of the railway station of Čimelice, alt. 430 m, 49° 28′ N, 14° 7′ E;

Table 2.

Principal components analysis of populations of *Bolboschoenus laticarpus*, *B. maritimus*, *B. planiculmis* and *B. yagara* (based on characters of flowering plants only). Eigenvectors showing correlation of the characters with the first three components (PC1, PC2, PC3). Characters: order of the branching in the inflorescence (OI), number of rays (branches) in the inflorescence (NR), number of rays bearing fascicles (RF), number of spikelets on rays (RS), number of rays with single spikelet (RSS), number of sessile spikelets (NS), number of flat herbaceous bracts (NB), number of styles with three branches out of 20 randomly selected flowers from the inflorescence (S3), ratio of the number of sessile spikelets to the total number of spikelets in the inflorescence (NS/TS), ratio of the total number of rays in the inflorescence to the total number of spikelets in the inflorescence (NR/TS), ratio of the number spikelets on rays to the total number of rays in the inflorescence (RS/NR), ratio of the total number of rays in the inflorescence to the number of all lateral single spikelets and lateral fascicles (sessile and on rays, NR/NLSF).

	PC1	PC2	PC3
OI	0.2997	0.2410	0.1753
RF	0.2884	0.3076	−0.3027
NR	**0.3365**	−0.0979	−0.0963
RS	0.3082	0.2053	−0.3589
RSS	0.2666	**−0.3862**	0.0973
NS	−0.1393	**0.5413**	0.3227
NB	0.3101	0.0333	−0.3539
S3	0.2803	0.0402	**0.6477**
NR/TS	0.2935	−0.2858	0.2609
NS/TS	**−0.3401**	−0.0141	−0.0315
RS/NR	0.2113	**0.4870**	0.0971
NR/NLSF	**0.3275**	−0.1781	0.0523

S Bohemia, Jezero fishpond, 1.1 km S of the village of Radomilice, 7 km ESE of the town of Vodňany, alt. 405 m, 49° 7′ N, 14° 16′ E;

S Bohemia, Chlumský fishpond 1.8 km W of the town of Křemže, alt. 530 m, 48° 54′ N, 14° 17′ E;

S Bohemia, Tobolky fishpond, 1 km SW of the village of Branná, 4 km S of the town of Třeboň, alt. 442 m, 48° 58′ N, 14° 46′ E;

S Bohemia, Černičný fishpond, 2 km SE of the town of Lomnice nad Lužnicí, alt. 420 m, 49° 5′ N, 14° 45′ E;

S Bohemia, Stružky fishpond, 1 km E of the village of Břilice, 2.5 km NW of the town of Třeboň, alt. 445 m, 49° 1′ N, 14° 43′ E;

S Bohemia, Verfle fishpond, 2 km W of the town of Třeboň, southern shore, alt. 445 m, 49° 0′ N, 14° 43′ E;

S. Bohemia, Verfle fishpond, 2 km W of the town of Třeboň, northern shore, alt. 445 m, 49° 0′ N, 14° 43′ E;

S Bohemia, Oběšený fishpond, on the SE border of the village of Mláka, alt. 445 m, 49° 3′ N, 14° 50′ E;

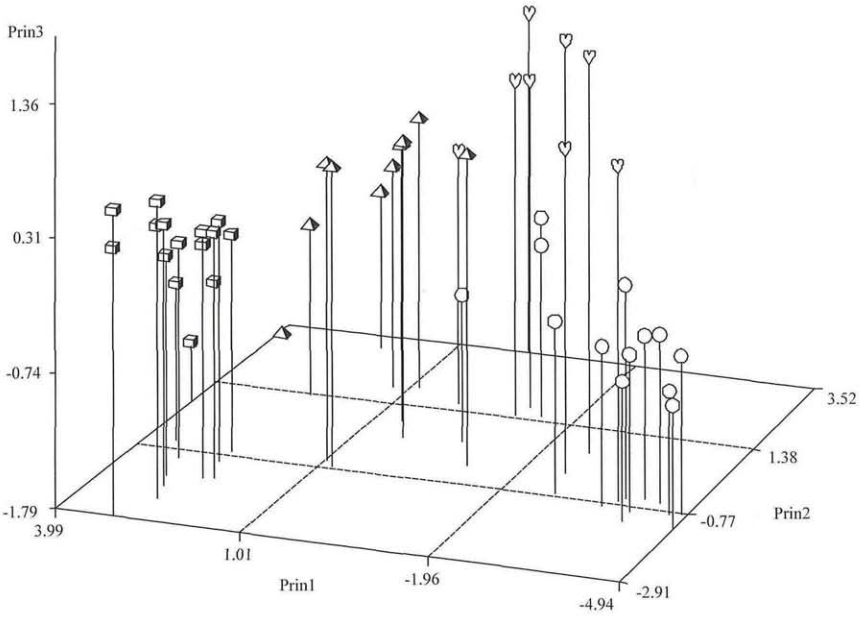

Fig. 3. Principal components analysis of populations of *Bolboschoenus laticarpus* (pyramid), *B. maritimus* (heart), *B. planiculmis* (ball) and *B. yagara* (cube) (based on characters of plants in flower only). The first three axes account for 70.9, 20.2 and 3.8 percent of variation.

S Bohemia, Biskupský fishpond, 1.4 km W of the village of Višňová, 4 km NNW of the town of Kardašova Řečice, alt. 458 m, 49° 13′ N, 14° 49′ E;

S Bohemia, Velká Ochoz fishpond, SSW of the town of Kardašova Řečice, alt. 437 m, 49° 10′ N, 14° 50′ E;

S Bohemia, Prase fishpond, 1.4 km WNW of the castle of Červená Lhota, near the town of Jindřichův Hradec, alt. 495 m, 49° 15′ N, 14° 52′ E;

S Bohemia, Kačležský fishpond, 6 km SE of the town of Jindřichův Hradec, NE shore, alt. 529 m, 49° 7′ N, 15° 4′ E;

S Bohemia, Kačležský fishpond, 6 km SE of the town of Jindřichův Hradec, SW shore, alt. 529 m, 49° 6′ N, 15° 5′ E;

S Bohemia, the fishpond on the N border of the village of Člunek, 8 km ESE of the town of Jindřichův Hradec, alt. 540 m, 49° 7′ N, 15° 8′ E;

Bolboschoenus laticarpus

Central Bohemia, abandoned field near the Podhůrka secluded farm 1.1 km NNW of the village of Lišany, 5 km N of the town of Rakovník, alt. 340 m, 50° 9′ N, 13° 44′ E;

Central Bohemia, field depression near the Netluky farm, 1.5 km N of the village of Uhříněves (suburb of the city of Prague), alt. 270 m, 50° 3′ N, 14° 37′ E;

E Bohemia, field on the SSW border of the village of Dolní Rokytňany, 13 km ESE of the town of Mladá Boleslav, alt. 230 m, 50° 22′ N, 15° 7′ E;

E Bohemia, field near the fishpond about 1.1 km NE of the castle of Kopidlno, 10.5 km SSW of the town of Jičín, alt. 225 m, 50° 20′ N, 15° 17′ E;

E Bohemia, Jílovka fishpond near the road from Bukovka to Lázně Bohdaneč, 1 km SE of the village of Bukovka, alt. 225 m, 50° 6′ N, 15° 38′ E;

E Bohemia, abandoned field near the way to Mordýř fishpond, 1.7 km NE of the village of Horní Ředice, 2 km NW of the town of Holice, alt. 242 m, 50° 5′ N, 15° 58′ E;

E Bohemia, field depression on the N border of the village of Dolní Jelení, 11 km NNW of the town of Vysoké Mýto, alt. 280 m, 50° 3′ N, 16° 7′ E;

S Bohemia, Hvězdáře swimming pool N of the town of Hluboká nad Vltavou, alt. 390 m, 49° 4′ N, 14° 26′ E;

S Moravia, Hlohovecký fishpond shore on the northern border of the village of Hlohovec, 2 km SW of the town of Lednice, alt. 168 m, 48° 47′ N, 16° 46′ E;

S Moravia, small drained fishpond near the Nový fishpond 1 km NWW of the village of Sedlec, 3 km SE of the town of Mikulov, alt. 183 m, 48° 47′ N, 16° 40′ E;

Bolboschoenus maritimus

Central Bohemia, wet field depression about 0.3 km NNE of the village of Štěrboholy (suburb on the eastern border of the city of Prague), alt. 245 m, 50° 5′ N, 14° 33′ E;

W Bohemia: saline wetland Soos 1.3 km NW of the village of Nový Drahov, about 4 km NE of the town of Františkovy Lázně, alt. 435 m, 50° 9′ N, 12° 24′ E;

NW Bohemia, small fishpond on the NW border of the village of Libočany, about 2 km NW of the town of Žatec, alt. 208 m, 50° 20′ N, 13° 30′ E;

NW Bohemia, flooded sand pit about 200 m SE of the village of Lišnice, 3 km of the southern border of the town of Most, alt. 225 m, 50° 27′ N, 13° 38′ E;

NW Bohemia, wet abandoned field near the road from Cítoliby to Blšany, 0.7 km NZ of the village of Chlumčany, 2 km SE of the town of Louny, alt. 215 m, 50° 20′ N, 13° 50′ E;

NW Bohemia, field depression near the Bečovský potok brook about 1 km S of the village of Bečov, near the road to Volevčice, 9 km NW of the town of Louny, alt. 225 m, 50° 27′ N, 13° 43′ E;

E Bohemia, former clay pit near the village of Metličany, 0.5 km E of the town of Nový Bydžov, alt. 230 m, 50° 15′ N, 15° 31′ E;

S Moravia, western shore of the fishpond on the northern border of the village of Starovice, 1.5 km NW of the town of Hustopeče, alt. 190 m, 48° 57′ N, 16° 43′ E;

Bolboschoenus planiculmis

Central Bohemia, wet abandoned field on the southwestern border of the town of Neratovice, near the railway line to Kojetice, alt. 180 m, 50° 15′ N, 14° 30′ E;

Central Bohemia, small fishpond on the eastern border of the village of Hořátev, 4 km S of the town of Nymburk, alt. 185 m, 50° 9′ N, 15° 3′ E;

Central Bohemia, fishpond on the southwestern border of the village of Svídnice, 4 km S of the town of Rožďalovice, alt. 195 m, 50° 16′ N, 15° 11′ E;

NW Bohemia, field 2 km W of the village of Lenešice, near the road to Postoloprty, 4 km NNW of the town of Louny, alt. 185 m, 50° 23′ N, 13° 44′ E;

S Moravia, field about 1 km SSW of the village of Jevišovka, near railway line, 5 km E of the town of Hrušovany nad Jevišovkou, alt. 176 m, 48° 49′ N, 16° 28′ E;

S Moravia, field depression W of the southern bay of the Nesyt fishpod, about 3.5 km NW of the town of Valtice, alt. 180 m, 48° 46′ N, 16° 44′ E;

S Moravia, field border S of the Nesyt fishpond, near the road to Sedlec and the Svodnice brook, about 3 km NW of the town of Valtice, alt. 180 m, 48° 46′ N, 16° 44′ E;

S Moravia, field between southern bay of the Nesyt fishpond and the road to Sedlec, about 3 km NW of the town of Valtice, alt. 177 m, 48° 46′ N, 16° 44′ E;

S Moravia, sand pit near the Mahenovo jezero wetland, NE of the village of Bulhary, 7 km NEE of the town of Mikulov, alt. 160 m, 48° 50′ N, 16° 47′ E;

S Moravia, Aloch IV fishpond, 3 km S of the town of Lednice, alt. 175 m, 48° 46′ N, 16° 48′ E;

S Moravia, the border of reed-bed about 400 m N of the village of Stará Břeclav (suburb of the town of Břeclav), alt. 158 m, 48° 47′ N, 16° 54′ E;

S Moravia, wet field depression 1 km of the village of Velké Němčice, about 7 km NW of the town of Hustopeče, alt. 177 m, 48° 59′ N, 16° 40′ E;

S Moravia, field about 2.1 km N of the village of Terezín, 2 km NW of the town of Čejč, alt. 180 m, 48° 59′ N, 16° 56′ E.

3.4. Distribution and Ecology

3.4.1.

Bolboschoenus laticarpus is distributed throughout Central Europe extending to European Russia in the East, and France, the Netherlands and Denmark in the West. The most southern localities were found in Bulgaria (see 3.4.2.). Most of the data presented here are from the Czech Republic. The larger amount of our data from this area in comparison with the rest of Europe reflects our field experience mostly from Central Europe, while the distribution data from other countries are based on collections from public herbaria. Other data on the distribution of this taxon are provided by Kiffe 1997 from Germany and Hohla 2001 and 2002 from Austria (referring to the hybrid of *B. maritimus* × *B. yagara*). Although the distribution data are still incomplete, it seems that this species does not occur in the Asian part of Russia, as we have not found any specimen of *B. laticarpus* from this area in the herbarium LE.

Differentiation of *B. laticarpus* and the three other Central European taxa discussed here is clearly expressed also in respect of ecological requirements. While investigating Central European localities of all four taxa as well as one Swedish one of *B. maritimus*, Hroudová & al. 1999a found strong differences in this respect between *B. yagara* and *B. maritimus*. The former species was found to inhabit the most acid soils, while the latter the most alkaline ones. Soil chemistry divides the four taxa into two groups corresponding to the above-mentioned morphological differences: *B. laticarpus* and *B. yagara* occupy freshwater habitats (*B. yagara* occurs on acid to neutral, nutrient poor soils and *B. laticarpus* on neutral

to alkaline soils), while *B. maritimus* and *B. planiculmis* are found on more alkaline to highly saline habitats. Particularly, *B. laticarpus* appeared to be least determined by the soil chemistry, forming a sort of transition among the other three species. It has the widest ecological amplitude and is particularly characteristic for the localities along rivers.

3.4.2. Representative Specimens of *Bolboschoenus laticarpus*

Czech Republic (phytogeographic division follows SKALICKÝ 1988). 2a. Žatecké Poohří: Wet depressions on the meadow 0.3 km WSW of the village of Čejkovice [8 km W of the town of Žatec], 1985, SLÁDEK, PRC. – 4b. Labské středohoří: Right bank of the Labe river in the town of Ústí nad Labem, 1998, ONDRÁČEK, CHOM 26753. – 5a. Dolní Poohří: Right bank of the Labe river in the town of Litoměřice, opposite to the village of Mlíkojedy [Mlékojedy], 1968, JEDLIČKA, LIT 16091a. – 5b. Roudnické písky: Right bank of the Labe river near the village of Černěves [3 km N of the town of Roudnice nad Labem], 2000, RYDLO, ROZ. – 6. Džbán: Prague: oxbows of the Vltava river near Troja, 1893, KOŠŤÁL, MP 951. – 7b. Podřipská tabule: Field depression near the village of Vehlovice, 1 km NNW of the town of Mělník, alt. 160 m, 1989, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – 7c. Slánská tabule: Field depression W of the village of Chržín, 3 km NE of the town of Velvary, alt. 180 m, 2001, DUCHÁČEK, PRC. – 8. Český kras: Wet meadows along the Vltava river near the village of Velká Chuchle and on banks of the Vltava river near Zlíchov [suburb of the city of Prague], alt. 200 m, 1945, GÜTTLER, PRC. – 9. Dolní Povltaví: Surrounding of the city of Prague, wetlands on the right bank of the Vltava river near the village of Klecánky N of the city of Prague, 1943, PULCHART, PRC. – 10b. Pražská kotlina: Wet depression in meadow near the village of Dubeč, on eastern border of the city of Prague, alt. 255 m, 1995, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – 11a. Všetatské Polabí: Mělník distr.: Wet field "U Háje" near the northern border of the village of Chlumín, 1993, RYDLO, ROZ 62403. – 11b. Poděbradské Polabí: Field depression by left shore of the Mlynařice brook, near the road from Lysá n. L. to Dvorce, NW of the town of Lysá nad Labem, alt. 180 m, 1998, ZÁKRAVSKÝ et MORAVCOVÁ, PRA. – Nymburk distr.: the Mdlina [Mrlina] river near the village of Budiměřice, 2000, RYDLO, ROZ. – 12. Dolní Pojizeří: Mělník, Vrutice [wetland near the village of Mělnická Vrutice], alt. 180 m, 1944, MIKULÁŠ, PRC. – 13a. Rožďalovická tabule: Pilský fishpond 4 km N of the town of Rožďalovice, alt. 209 m, 1984, HROUDOVÁ, PRA. – Nymburk distr.: swimming pool "Teletník" 1 km S of the railway station of Dymokury, 2001, RYDLO, ROZ. – 13c. Bakovská kotlina: Červenský fishpond near the northern border of the town of Dolní Bousov, alt. 240 m, 1995, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – 14a. Bydžovská pánev: The fishpond about 1 km W of the village of Myštěves, 9 km SW of the town of Hořice, alt. 240 m, 2000, DUCHÁČEK, PRC. – 15a. Jaroměřské Polabí: Velký rybník fishpond 1.5 km NW of the village of Velky Vřešťov, 9 km E of the town of Hořice, alt. 280 m, 2001, DUCHÁČEK, PRC. – 15b. Hradecké Polabí: Plachta fishpond, Nový Hradec Králové [suburb of the town of Hradec Králové], 1980, BELICOVÁ, HR 33806. – 15c. Pardubické Polabí: The pool on the northern border of the village of Řečany nad Labem, 4.5 km E of the town of Chvaletice, alt. 205 m, 1992, HROUDOVÁ, PRA; 2000, RYDLO, ROZ. – Jílovka fishpond near the road from Bukovka to Lázně Bohdaneč, 1 km SE of the village of Bukovka, alt. 225 m, 2001, HROUDOVÁ et

ZÁKRAVSKÝ, PRA. – 16. Znojemsko-brněnská pahorkatina: Wetland along the brook near alder-carr by the road from Olbramovice to Dobelice, about 450 m W of the railway station of Rakšice, alt. 250 m, ŘEPKA 4989, PRA 13373. – 17c. Milovicko-valtická pahorkatina: Small fishpond near Nový rybník fishpond, 1 km NWW of the village of Sedlec, 3 km SE of the town of Mikulov, alt. 183 m, 1995, HROUDOVÁ, PRA. – 18a. Dyjsko-svratecký úval: Břeclav distr.: ditches by the railway stop of Jevišovka, 1982, GRULICH, MMI . – The former Pansee wetland E of the village of Strachotín [destroyed by the lower of Novomlýnské dam reservoirs], alt. 165 m, 1982, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – The meadow near the Bruksa oxbow near the town of Břeclav, alt. 160 m, 1990, HROUDOVÁ, PRA. – 18b. Dolnomoravsky úval: Wet field about 1.4 km W-WSW of the railway station in the town of Bzenec, alt. 185 m, 1991, ŘEPKA, PRA 14064. – 20a. Bučovická pahorkatina: Vyškov distr.: wet abandoned field along the Litava brook near the village of Malínky, 2001, KOKEŠ, PRC. – 21a. Hanácká pahorkatina: Vyškov distr.: Pruský rybník fishpond, wetland 1.26 km N of the Moravské Prusy village, alt. 238 m, 2001, KOKEŠ, PRC. – 21b. Hornomoravský úval: Sand pit 1.5 km E of the town of Tovačov, E of the Skašovský fishpond, alt. 196 m, 2000, DUCHÁČEK, PRC. – 30b. Rakovnická kotlina: Field depression near the secluded farm of Podhůrka, 0.5 km NW of the village of Lišany, 5 km N of the town of Rakovník, alt. 340 m, 2001, DUCHÁČEK, PRC. – 31a. Plzeňská pahorkatina vlastní: Field depression near the Vejprnický potok brook, about 2.8 km WSW of the railway station in the town of Nýřany, 2002, SLADKÝ, PRC. – 32. Křivoklátsko: Rakovník distr.: left bank of the Berounka river about 2 km SSE of the bridge in the village of Zbečno, alt. 230 m, 1973, HAVLÍČKOVÁ, ROZ 7634. – 36a. Blatensko: Storage ponds (pond No. 16) in the village of Tchořovice, 300 m S of the railway stop, alt. 450 m, 2001, ŠUMBEROVÁ, PRC. – 38. Budějovická pánev: Storage ponds in the town of Hluboká nad Vltavou, alt. 375 m, 2001, ŠUMBEROVÁ, PRC. – 39. Třeboňská pánev: Opatovický fishpond, 2 km S of the town of Třeboň, alt. 435 m, 1994, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – 40a. Písecko-hlubocký hřeben: Hvězdáře swimming pool N of the town of Hluboká nad Vltavou, alt. 390 m, 2000, DUCHÁČEK, PRC. – 41. Střední Povltaví: Jílové near Prague: Nebesák fishpond near the village of Chleby [2.5 km W of the town of Týnec nad Sázavou], alt. 300 m, 1946, MEDLINOVÁ, PRC. – 55b. Střední Pojizeří: Field on the right bank of the Libuňka brook, NW of the road to the railway stop of Hrubá Skála, about 7 km SE of the town of Turnov, alt. 256 m, 2001, DUCHÁČEK, PRC. – 55d. Trosecká pahorkatina: Maize field 460 m WSW of the railway stop of Borek, 8.5 km SW of the town of Turnov, alt. 265 m, 2001, DUCHÁČEK, PRC. – 55e. Markvartická pahorkatina: Jičín distr.: water reservoir on right riverside of the Mrlina river, 1 km SW of the railway station of Pševes, 1989, RYDLO, ROZ 47622. – 58b. Polická kotlina: Náchod, Plhov [suburb of the town of Náchod], 1939, PAČES, ROZ. – 60. Orlické opuky: The town of Častolovice: small fishpond near Bažantnice, s.d., SOUČEK, PR. – 61c. Chvojenská plošina: Field depression on the N border of the village of Dolní Jelení, 11 km NNW of the town of Vysoké Mýto, alt. 280 m, 2000, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – 62. Litomyšlská pánev: Šváb fishpond N of the village of Horky, 7 km SE of the town of Vysoké Mýto, alt. 308 m, 2002, DUCHÁČEK, PRC. – 64a. Průhonická plošina: Road margin on the E border of the village of Újezd nad Lesy (suburb of the city of Prague), 2001, DUCHÁČEK, PRC. – 64c. Černokostelecký perm: Field depression near the railway line about 1 km NW of the town of Český Brod, alt. 235 m, 1998, HROUDOVÁ et

ZÁKRAVSKÝ, PRA. – 65. Kutnohorská pahorkatina: Wet abandoned field 400 m WNW of the railway stop of Golčův Jeníkov-Město, alt. 356 m, 1995, ČECH, MJ 28531. – 66. Hornosázavská pahorkatina: Storage ponds "Vavřinec" S of the town of Kolín, alt. 380 m, 2001, ŠUMBEROVÁ, PRC. – 68. Moravské podhůří Vysočiny: Wet abandoned field 1.2 km WSW of the village of Omice, in the floodplain of the Bobrava river, alt. 290 m, 1985, ŘEPKA, PRA 5020. – 69a. Železnohorské podhůří: Wet meadow below the dam of the Horecký fishpond near the town of Chrast near Chrudim, alt. 275 m, 1983, HROUDA, PRA. – 77a. Ždánický les: Emerged shore of the Nový fishpond, in forest valley 1.9 km of the village of Kobeřice near Brno, alt. 245 m, 1994, ŘEPKA, PRA 21838. – 83. Ostravská pánev: Skřížovský fishpond on the western border of the village of Rychvald (suburb of the town of Ostrava), alt. 215 m, 1989, HROUDOVÁ, PRA.

Slovakia (phytogeographic division follows FUTÁK 1980). 4. Záhorská nížina: field depression near the village of Jakubov, alt. 140 m, 1999, HROUDOVÁ, ZÁKRAVSKÝ et MORAVCOVÁ, PRA. – Flooded sand pit SW of the village of Jakubov, alt. 140 m, 1995, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – W Slovakia. Between the villages of Láb and Plavecký Štvrtok, 1965, MÁJOVSKÝ, SLO. – 6. Podunajská nížina: Bodíky SE of the village Kráľovský les, alt. 112 m, 1986, BERTA et BERTOVÁ, SAV. – Čalovec, alt. 100 m, 1989, BERTA et BERTOVÁ, SAV. – Wet field depression near the road E of the town of Komárno, alt. 100 m, 1999, HROUDOVÁ, ZÁKRAVSKÝ et MORAVCOVÁ, PRA. – Field depression near the way near the village of Číčov, alt. 100 m, 1985, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – The village of Starý Tekov – in the ditch near the Hron river, alt. 160 m, 1941, FUTÁK, SLO. – Šoporňa, oxbow lake, 1973, NIKOVÁ, SLO. – 8. Východoslovenská nížina: pool in the meadow near the village of Velké Raškovce, alt. 80 m, 1985, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – Channel W of the village of Strážné, alt. 80 m, 1985, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – Northern shore of the Zemplínská Šírava dam reservoir, emerged bottom in camping site near the village of Klokočov, alt. 100 m, 2002, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – Northern shore of the Zemplínska Šírava dam reservoir, emerged bottom in camping site near the village of Kaluža, alt. 100 m, 2002, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – Oxbow of the Bodrog river, between the villages of Viničky and Somotor, about 1 km SW of the town of Somotor, alt. 80 m, 2002, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – Somotorský kanál channel on southern border of the village of Somotor, alt. 80 m, 2002, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – 14d. Poľana: Central Slovakia, wetland around the mineral water spring near the village of Zvolenská Slatina, alt. 325 m, 2002, HROUDOVÁ et ZÁKRAVSKÝ, PRA.

Hungary. Left shore of the Tisza river near the confluence with the Bodrog river, in the town of Tokaj, 1995, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – The oxbow by the left shore of the Tisza river, near the ferry from Tiszalök to Tiszatardos, 1995, HROUDOVÁ et ZÁKRAVSKÝ, PRA. – Wet field depression in wetland along the Marcal river, NW of the town of Pápa, 1999, HROUDOVÁ, ZÁKRAVSKÝ et MORAVCOVÁ, PRA. – Comit. Pest, in paludosis salsis, prope pag. Erzsébetfalva, alt. 100 m (*Cyperaceae*, *Juncaceae*, *Typhaceae* et *Sparganiaceae* Hung. Exs. No. 14 as *B. maritimus* (L.) PALLA), 1909, DEGEN, PRC, BRNM 0544163, SO 8985, SOM 8600.

Austria. Lower Austria: Bei W. Neustadt, alt. 234 m, 1912, FRÖHLICH, BRNU 191106. – Tulln, alt. 160 m, 1873, FÜRST, PR. – W. Neustadt, Fischau-Bach, 1916, H. KUBER, W. – Fischau, 1905, J. SCHNEIDER, W. – Pulkau, 1902, J. SCHNEIDER, W. – Marchtal, am Rande eines Tümpels der March oberhalb Stillfried, 1922, KORB, W.

Bulgaria. Wet meadows around the town of Mezdra, 1960, PENEV, SO 8972. – In paludosis mt. Strandzha ad riv. Veleka (Rezvana) prope pagum Rezovo, 1921, ACHTAROFF, SOM 8661, 8627.

Romania. Comana, in paludosis, 1882, GRECESCU, PRC.

Russia. Voyage dans la Russie Méridional et la Crimée, 1842, DEMIDOFF, LE. – Königsberg i. Pr. Pregelwiesen, 1870, BAENITZ, W. – Near Orenburg, along the bank of the oxbow lake behind urban wood, alt. 119 m, 1893, LITVINOV, LE. – Pskov district: ravine near Barshovits along the river, 1896, PURING, LE. – Novocherkassk, near the Aksaya river, 1911, JAKUSHEV, LE. – Voronezh region, Pavlov district, bank of the Don river, 1914, DINGELSHTADT, LE.

Estonia. Flora baltica. Im Festungsgraben bei Arensburg, alt. 0 m, s.d., W. v. BRUTTAU, LE.

Ukraine. Tauria, 18 ?, s. coll., LE. – In conwalle super flum. Tyrae: Babina prope Sambor, in fossa pr. locum "Zakutyna" dictum, alt. 300 m (Pl. Polon. Exs. No. 191 as *B. maritimus* (L.) PALLA), 1932, MĄDALSKI, PRC, BRNU 357329.

Moldova. Bender district, surroundings of the village of Kopanka, bank of the oxbow lake of the Dnestr river, alt. 0 m, 1959, PROSKURINA, LE.

Poland. Szczecin – wetlands near the Arkon forest, alt. 0 m, 1948, REITMAYEROVÁ, BRNM 78179, admixt *B. maritimus*. – Urbs Torunium (Toruń), suburbium Rybaki, in ripa meandri mortui fluminis Vistulae ad viridarium urbanum versam, alt. 20 m (Exs. Torun. No. 12 as *Bolboschoenus maritimus* (L.) Palla subsp. *maritimus*), 1973, GUGNACKA, PRC, BRNM 544174. – Poloniae meridionalis districtus Kazimierza Wielka: pagus Kazimierza Mala, in fossa ad pedes collis, alt. 182 m (Fl. Polon. Exs. No. 489 as *Bolboschoenus maritimus* (L.) PALLA), 1972, TACIK et PALKOWA, BRNU 469759, W.

Germany. Heidelberg, 1848, LEONHARDI, PR. – Neckar Ufer b. Heidelberg, alt. 111 m, 1861, BOCHHOLTZ, BRNU 8269. – Im Donau-Main Kanal b. Erlangen, 1901, REINSCH, WU. – Flora von Bayern, Unterfranken, Am Ufer des Mains b. Lohr, alt. 168 m, 1918, HIRTH, W. – Flora von Brandenburg, Guben: In Altwässern der Oder bei Kusshavn, alt. 20 m, 1931, LADEMANN, PR. – Bavaria, ad ripas fluvii „Regnitz" prope „Bamberg", alt. 240 m (DÖRFLER Herb. Norm. No. 5350 as *B. maritimus* (L.) PALLA), 1908, HARZ, PRC, BRNU 350997, 6377. – Altwasser des Regnitz bei Bruck, alt. 284 m (Fl. Exs. Bavar. No. 232 as *Scirpus maritimus* L.), 1899, REINSCH, BRNM 08154/38, WU.

The Netherlands. Nijmegen, Milingerwaad – freshwater along river Waal near Nijmegen (stagnant), 1994, CLEVERING, PRA.

Denmark. Bornholm: Soseodde, 1896, HOLMBERG, PR, LD. – Bornholm: Dammebaek, 1896, HOLMBERG, LD.

France. Ain: Dans les étangs de la Dombre et de la Bresse, à Lent, Chalamont, alt. 260 m, 183?, MARLET, P. – Seine-et-Marne: Flamboin S-et-M. Marais, 1912, GAUME, P. – Trilport, s.d., DUCLOS, P. – Fossi marécageoux derrière le village de Vimpelles, alt. 40 m, 1913, s. coll., P. – Meurthe-et-Moselle: Jarville, dans la Meurthe (rivière), alt. 274 m, [19]04, s. coll., P. – Nancy, alt. 200 m, s.d., GODRON., P. – Val-de-Marne: Bords de la Seine à Charenton, alt. 20 m, 1840, WEDDELL, P. – Esonne: Bords des eaux. Vigneux. – ru d' Oly, alt. 31 m, 1910, DEBAIRE, P. – Val-d'Oise: L' Isle Adam, alt. 33 m, 1906, HIBON, P. – Hauts-de-Seine: Chaville, bords de l' étang d' Ursines, alt. 106 m, 1906, HIBON, P. – Maine-et-Loire: Chambellay, alt. 30 m, s.d., LE CHÂTELIER, P. – Moyenne: St. Denis d' Anjou (Moyenne), autour de

l' ancienne Chaussie du moulin de Pimé, alt. 68 m, 1878, CHEVALLIER, P. – Nievre: L' Epau: Bords de l' Huèm, alt. 40 m, 1871, CHEVALLIER, P. – Sarthe: Précigné (Sarthe), Bords de la Sarthe aux Chopinière, alt. 20 m, 1878, CHEVALLIER, P. – Oise: Bords de l'Oise à Compiègne, s.d., BOIVIN, P. – Eure: Pont-de-l'Arche, dans la Seine, 12. 8. 1885, Herbier ABBÉ TOUSSAIT, P.

3.5. Position of *B. laticarpus* and its Putative Parentage

BROWNING & al. 1996 suggested that populations classified here as *B. laticarpus* represent the hybrid of *B. maritimus* × *B. yagara*. However, we are of the opinion that although *B. laticarpus* is very likely of hybrid origin, it does not represent a primary hybrid for which a hybrid formula should be used. It seems that this taxon already has its stabilized distribution area independent of its putative parents. The question of the parentage is also not so unequivocal as suggested by BROWNING & al. 1996. As already pointed by HROUDOVÁ & al. 1999a, *B. maritimus* and *B. yagara* occupy in their European distribution area very different habitats in respect of salinity, thus the probability of their co-occurrence at the same locality and hybridization is very low. HROUDOVÁ & al. 1999a therefore proposed a different parentage for this taxon, namely *B. planiculmis* × *B. yagara*, which is more likely both in respect of ecological requirements and chromosome data (JAROLÍMOVÁ & HROUDOVÁ 1998). In *B. planiculmis* n=54 strongly prevails, *B. yagara* possesses n=55 and in *B. laticarpus* both n=54 and n=55 occur. The parent combination *B. maritimus* × *B. yagara* is less probable in this respect, because in *B. maritimus* n=55 strongly prevail. Another fact supporting this hypothesis is overlapping of area of distribution of *B. yagara* and *B. planiculmis* in Eurasia (see EGOROVA & TATANOV 2003, TATANOV 2003), and thus greater possibility of contact of both taxa. Taking into account the data on morphology of plants in flower, the possibility of parentage of *B. maritimus*, however, could not be completely ruled out.

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