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Taxonomy, distribution and ecology of *Bolboschoenus* in Europe

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The five species of *Bolboschoenus* — *B. glaucus*, *B. laticarpus*, *B. maritimus*, *B. planiculmis* and *B. yagara* — occurring in Europe were studied. A detailed taxonomic and nomenclatural account is provided for these taxa, together with an identification key, distribution data and maps based on a revision of herbarium specimens from 36 herbaria and on field observations. Because ecological differentiation influences the distribution of the taxa concerned, detailed information on their ecology is also provided.

Key words: *Bolboschoenus*, Cyperaceae, distribution, Europe, nomenclature, taxonomy

Introduction

The taxonomy of *Bolboschoeneus* (Cyperaceae; formerly included in *Scirpus*) has advanced considerably over the last decades. DeFilipps (1980) treated the taxa now placed in *Bolboschoenus* within the broadly conceived genus *Scirpus*. Since the treatment by DeFilipps (1980), who recognized in Europe only *Scirpus maritimus*. with two subspecies (subsp. *maritimus* and subsp. *affinis*), the taxonomy has been studied extensively in different parts of the world. Browning and her co-authors dealt in detail with the South African (Browning & Gordon-Gray 1993, 1999, Browning *et al*. 1998), North American (Browning *et al*. 1995) and Australasian (Browning *et al*. 1997) taxa. They reported *B. yagara* to be a new taxon for Europe, as well as its putative hybrid with *B. maritimus* (Browning *et al*. 1996).

Browning and Gordon-Gray (2000) provided an overview of the *Bolboschoenus* fruit morphology. Hroudová and her co-authors dealt with the inflorescence structure (Hroudová *et al*. 1998a), fruit anatomy (Hroudová *et al*. 1997, 1998b), growth response to different trophic conditions (Zákravský & Hroudová 1996), chromosome numbers (Jarolímová & Hroudová 1998) and ecological differentiation related to plant communities (Hroudová *et al*. 1999a) in the central

European taxa. They reported *B. glaucus* as a new species for the Czech Republic (Hroudová *et al.* 1999b) and described a new species, *B. laticarpus* (Marhold *et al.* 2004), corresponding to the previously reported alleged hybrid of *B. yagara* and *B. maritimus*. Hroudová *et al.* (2001) and Hroudová (2002) reported for the first time for central Europe *B. koshewnikowii* (currently synonymous with *B. planiculmis*; *see* Egorova & Tatanov 2003).

For the area of the former Soviet Union Egorova and Tatanov (2003) provided detailed data on *B. planiculmis*, and Tatanov (2003a) on *B. yagara*. They also solved some nomenclatural problems concerning these two taxa. Tatanov (2003b) mapped the distribution of *B. glaucus* in parts of eastern Europe that belonged to the former Soviet Union. Additionally, Tatanov (2003c) provided a short account of *Bolboschoenus* in the former Soviet Union, evaluated the taxonomic importance of the carpological characters (Tatanov 2004a), and proposed an infrageneric systematic arrangement of the genus (Tatanov 2004b). Nevertheless, a comprehensive treatment of *Bolboschoenus* for Europe (or Eurasia) is still lacking and relevant data are scattered throughout numerous separate papers.

The present paper aims to provide a synthesis of the taxonomy and nomenclature of *Bolboschoenus* in Europe (excluding *B. affinis* (= *B. popowii*), occurring in Europe only marginally, in Russia; *see* Egorova 1976), together with the distribution data based on revision of herbarium specimens and studies of plants in the field. Because ecological differentiation plays a major role in the expansion of plants in new localities and in their disappearance from some areas, detailed data on the ecology of the taxa are also provided. Our study concentrates on central Europe, thus the distribution data for the other parts of Europe are not presented in detail; nevertheless, even the scattered data on their occurrence provide important information reflecting their general European distribution pattern.

Material and methods

The distribution maps are based on the examined specimens kept in the following herbaria: B, BIL, BP, BRA, BRNM, BRNU, GJO, GLM, GZU, JE, KL, KRA, KRAM, LBL, LD, LE, LI, LISI, LOD, M, MSB, P, PR, PRC, SAV, SLO, SO, SOM, SZCZ, TRN, UGDA, W, WA, WRSL, WU, and ZV. Specimens from the private collections of K. F. Günther, H. Manitz, H. Melzer, H.-J. Zündorf, specimens collected by us in the Czech Republic, Slovakia, Hungary, Austria, Poland, Germany and Portugal, and specimens collected by our colleagues, namely O. Clevering, E. Collias, R. Hrivnák, M. Janišová, V. Jarolímová, Z. Kaplan, P. Koutecký, F. Krahulec, W. Lazowski, L. Moravcová, J. Sádlo and J. Štěpánková were also studied. The localities from the Czech Republic included in the maps were found during a detailed study of the distribution of *Bolboschoenus* species in the country (Ducháček 2002, Ducháček *et al.* 2006). Selected localities representing the distribution of *Bolboschoenus* species in European countries are given in the Appendix. Centres of distribution as well as individual isolated localities are included. A full list of herbarium specimens studied is available on request from the first author. In all lists only the localities, from which the herbarium specimens with fruiting plants were available are included (determination of specimens without fruits is not reliable). Additionally, more detailed surveys of the occurrence of *Bolboschoenus* in some European countries were published with full lists of known localities; such surveys were made for Austria (Hroudová *et al.* 2006) and Poland (Hroudová *et al.* 2005), and are in preparation for Germany, Slovakia and Hungary.

Morphological and anatomical characters of the studied species, and their quantitative ranges, are based on measurements of plants from natural populations from the Czech Republic, Slovakia and Hungary, and of cultivated plants (results published by Hroudová *et al.* 1997, 1998a, 1998b, 1999a, 1999b) and also on the studied herbarium material.

Identification key to European species of *Bolboschoenus*

1. Inflorescence branched, consisting of a central group of sessile spikelets and of (1–)2–7(–12) rays bearing single spikelets or fascicles of spikelets; rays mostly more

than twice longer than sessile spikelets; total number of spikelets on rays higher than or same as number of sessile spikelets; perianth bristles mostly persistent on ripe fruits; fruits (achenes) trigonous or convex with slightly developed edge on abaxial side; trigonous in cross section (rarely nearly flattened or slightly convex to subtrigonous on abaxial side); outer layer of pericarp (exocarp) thinner than mesocarp, formed by isodiametric or slightly elongated cells not always air-filled; achene surface smooth or with fine network of cell outlines (at 20× magnification) 2

1. Inflorescence head-like or branched, consisting of a central group of sessile spikelets and of 1–2(–4) rays bearing single spikelets or fascicles of spikelets; rays usually less than twice as long as sessile spikelets; total number of spikelets on rays lower than number of sessile spikelets; perianth bristles caducous; fruits (achenes) not trigonous, but concave, flattened, convex to subtrigonous on abaxial side; biconcave, lenticular, plano-convex to subtrigonous in cross section; outer layer of pericarp (exocarp) thicker than or as thick as mesocarp, formed by elongated cylindrical cells always air-filled; achene surface with a highly visible polygonal network of cell outlines (at 20× magnification) 4
2. Achenes mostly with a clear edge on abaxial side, trigonous in cross section; exocarp layer thin but visibly developed; floral scales never brownish-red or deep purplish-red 3
2. Achenes with only slightly developed edge on abaxial side, plano-convex to subtrigonous in cross section; exocarp slightly visible; floral scales frequently brownish-red or deep purplish-red ..... *B. glaucus*
3. Achenes narrow (1.6–1.8 mm wide), equilaterally trigonous in cross-section; exocarp very thin, formed of more-or-less isodiametric cells ..... *B. yagara*
3. Achenes broad (2.0–2.4 mm wide), compressed obtusely-trigonous in cross section (rarely nearly flattened or only slightly convex to subtrigonous on abaxial side); exocarp thin but visibly developed, formed of slightly elongated cells ..... *B. laticarpus*
4. Achenes convex on abaxial side, lenticular, plano-convex to subtrigonous in cross section; exocarp ± twice as thick as sclerenchymatic mesocarp; styles predominantly trifid ..... *B. maritimus*
4. Achenes concave to flattened on abaxial side, oval, concave or plano-concave in cross section; exocarp ± as thick as sclerenchymatic mesocarp, thicker over rounded angles than on concave faces; styles predominantly bifid ..... *B. planiculmis*

Taxonomic treatment

Bolboschoenus glaucus (Lam.) S.G. Sm. (Fig. 1)

Novon 5: 101. 1995. — *Scirpus glaucus* Lam., Tabl. Encycl. 1: 142. 1791. — Holotype: Senegal. *Roussilon*, s.a. (P-Herb. Lamarck 673/14, not seen).

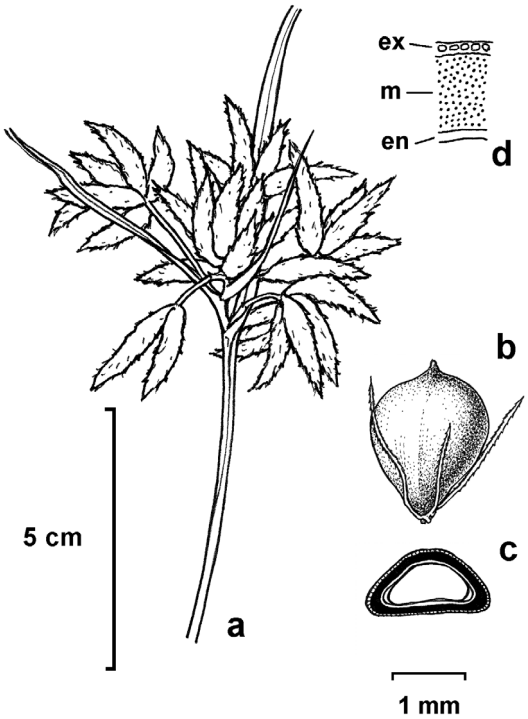

Fig. 1. *Bolboschoenus glaucus* (from Košíře, Prague, Czech Republic, (collected in 1983 and cultivated in Průhonice), 2003 *Z. Hroudová*, PRA). — **a**: Inflorescence. — **b**: Achene (abaxial view). — **c**: Achene cross-section. — **d**: Pericarp layers (ex = exocarp, m = mesocarp, en = endocarp).

Scirpus macrostachys Willd., Enum. Pl.: 78. 1809 ("*macorostachys*"), *nom. illeg.* (non *Scirpus macrostachyos* Lam. Tab. Encycl. 1: 142 1791. — *Scirpus maritimus* γ [var.] *macrostachys* Vis. Fl. Dalm. 1: 109, 1842. — *Scirpus maritimus* f. *macrostachys* (Vis.) Junge, Jahrb. Hamburg. Wiss. Anst. Beih. 25(3): 259. 1908. — *Bolboschoenus macrostachys* (Vis.) Grossh. Fl. Kavkaza 1: 145. 1928. — *Bolboschoenus maritimus* var. *macrostachys* (Vis.) T. V. Egorova Fl. Partis Eur. URSS 2: 94. 1976. — *Bolboschoenus maritimus* subsp. *macrostachys* (Vis.) Soják Čas. Nár. Mus. Odd. Přír. 152(1): 19. 1983. — Holotype: ["Habitat in Italia"], *Savi*, s.a. (B-Willd. 1236!). Epitype (designated by Marhold *et al*. 2006): Italy. Vallo, 1963 *R. Wagner* (GJO).

Perennial plants with rhizome system bearing underground elliptical to spherical tubers. Stems erect, trigonous, plants mostly robust, 1–1.5(–2) m tall, upper leafless part of flowering shoots about 1/3–1/2 of total stem length. Inflorescence consisting of a central group of (6–)7–11(–12) sessile spikelets and of (4–)5–6(–8) rays bearing fascicles of 2–7(–10) spikelets, rarely single spikelets. Total richness of inflorescence

as regards number of rays and spikelets (especially in number of spikelets in fascicles on rays) and great variation in length of branches, (3–)7–35(–50) mm, are typical characters. Sessile spikelets (6–)10–18(–21) mm long, spikelets on rays nearly same: (5–)10–17(–21) mm long; very long spikelets (over 20 mm long) frequent, usually most of spikelet sterile. Floral scales frequently brownish-red to deep purplish-red, color may change during fruit ripening. Styles trifid, perianth bristles mostly persistent on ripe fruits, but partly caducous. Achenes obovate to elliptic in outline, small, 2.2–2.5 mm long, 1.4–1.7 mm wide, with a short beak, on abaxial side convex with a slightly developed edge. Achene light or rust-brown to dark-brown, surface smooth (at 20× magnification). Achene plano-convex to subtrigonous in cross section. Pericarp with a poorly developed exocarp formed of one layer of more-or-less isodiametric cells, a thick layer of sclerenchymatic mesocarp and a thin sclerenchymatic endocarp.

Ecology: Because we were unable to study an adequate number of living plants comparable with other species of *Bolboschoenus*, ecological characteristics of this taxon are based mainly on observations in some natural habitats, on cultivated plants, and on data on habitats from herbarium material. This species is more thermophilic than the other European species. Robust plants may form dense stands under favourable conditions with sufficient water supply. *Bolboschoenus glaucus* is, however, also well adapted to terrestrial summer-dry habitats and also to high summer temperatures; the warm weather in the summer 2003 enhanced flowering of plants cultivated under limosal-terrestrial conditions, while plants cultivated in littoral conditions remained sterile (Z. Hroudová unpubl. data). *Bolboschoenus glaucus* is a freshwater plant frequently growing along rivers; this is in accordance with the ecological characteristics given by Browning *et al*. (1997) for Africa. Habitats are mostly field depressions, shallow pools, shores of rivers or streams; it seems to be a typical weed in rice paddies.

Distribution: The distribution of *B. glaucus* in Europe differs from that of the other species: it is found mainly in southern Europe, with the northern border of its distribution area running from northern Spain through southern France, northern Italy to Hungary and along the northern border of Romania. The westernmost localities are in Portugal (Z. Hroudová unpubl. data). The general distribution of *B. glaucus* continues eastwards to southern Ukraine and Russia, central Asia, Iran, Iraq, Afghanistan, Pakistan and India. Egorova and Tatanov (2002) and Tatanov (2006) mapped the distribution of *B. glaucus* in the Caucasus and Tatanov (2003b) in eastern Europe. Kukkonen (1996) included *B. glaucus* in the *Flora Iranica* and Amini Rad (2003) reported *B. glaucus* as a new species for Iran. Kukkonen (2001) also reported *B. glaucus* for Pakistan. To the south *B. glaucus* is distributed around the Mediterranean coast, and then in distant areas in sub-Saharan Africa (Browning *et al*. 1997).

Bolboschoenus glaucus is frequently distributed along large rivers; in Europe it can be found in the Rhône delta, along the Tisza in Hungary and Yugoslavia, and along the Danube in Yugoslavia and Bulgaria. Its distribution extends as far north as the vicinity of Szolnok, Hungary (Fig. 2). Evidently, *B. glaucus* was introduced into one isolated locality in Prague (Czech Republic) into a secondary habitat (Hroudová *et al*. 1999b). Although *B. glaucus* has been persistent in this locality for a long time (first herbarium specimen in PRC from 1925, last record from 1999), it has not spread to any other locality.

Bolboschoenus laticarpus Marhold, Hroudová, Zákravský & Ducháček (Fig. 3)

Phyton (Horn) 44: 7. 2004. — Holotype: Czech Republic. 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, *Z. Hroudová et P. Zákravský*, 5.IX.2002 (PRA!).

Scirpus maritimus var. *cymosus* Rchb. Fl. Germ. Excurs. 1: 79. 1830. — *Scirpus maritimus* f. *cymosus* (Rchb.) T. Koyama, Canad. J. Bot. 40: 936. 1962.— *Bolboschoenus maritimus* subsp. *cymosus* (Rchb.) Soják, Čas. Nár. Mus., Odd. Přír. 141: 62. 1972. — *Bolboschoenus maritimus* var. *cymosus* (Rchb.) Kit Tan & Oteng-Yeb., Fl. Turkey 9: 64. 1985. — Lectotype (designated by Marhold *et al*. 2006): [central Europe] Schkuhr, 1787–1791, Bot. Handbuch vol. 1, pl. 8 "*Scirpus maritimus*".

Bolboschoenus maritimus × *B. yagara sensu* Browning *et al*. (1996).

B. yagara × *B. koshewnikowii sensu* Hroudová in Kubát *et al*., Klíč ke květ. ČR: p. 795 (2002).

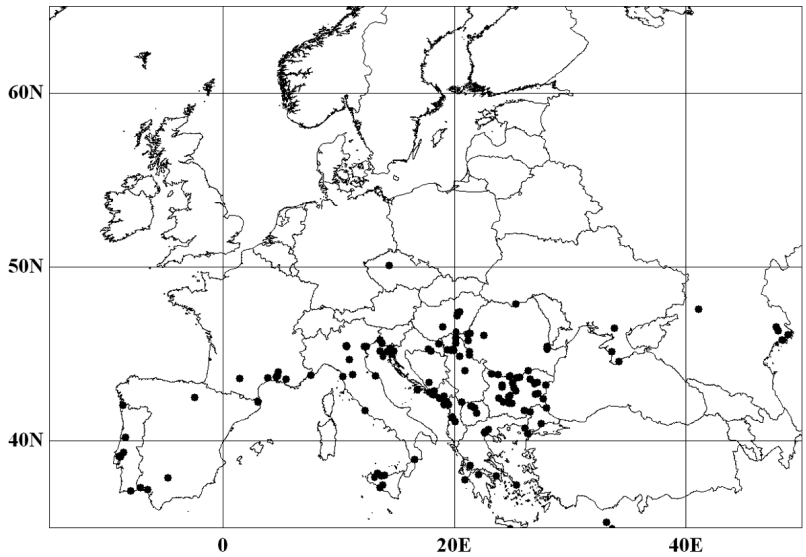

Fig. 2. Distribution of *Bolboschoenus glaucus* in Europe.

Perennial plants with branched underground rhizome bearing elliptical to spherical tubers; tubers (1.5–)2–3 cm in diameter. Stems erect, trigonous. Plants usually (0.3–)0.7–1.1(–1.5) m tall; upper leafless part of flowering shoots about 1/3 of total stem length. Inflorescence branched, consisting of a central group of (1–)2–7(–13) clustered, sessile spikelets and of (1–)2–5(–7) rays bearing fascicles of 2–4(–8) spikelets, more rarely single spikelets. Rays usually at least two times as long as sessile spikelets; rays (5–)10–35(–55) mm long, sessile spikelets (6–)10–16(–21) mm long, spikelets on rays (4–)8–16(–21) mm long. Floral scales light to rust-brown; styles trifid, but frequently also bifid styles in same inflorescence. Achenes obovate to broadly obovate in outline, narrowed at base, on top suddenly narrowed into beak, 3.1–3.7 mm long, 2–2.4 mm wide, trigonous, on abaxial side with a low, sharp or sometimes nearly round edge, sometimes flattened (for flowers with bifid styles); dark-brown to black at maturity. Perianth bristles partly persistent on achene at maturity, sometimes caducous. Surface of achenes smooth (at 20× magnification), sometimes with anticlinal cell walls depressed, forming a fine network structure (depending on development of exocarp). Fruits compressed obtusely trigonous in cross section. Fruit pericarp formed by a thin exocarp, a thick sclerenchymatic mesocarp and a thin sclerenchymatic endocarp. Exocarp consists of one layer of isodiametric to slightly elongated air-filled cells, ratio of exocarp:mesocarp thickness ca. 1:3.

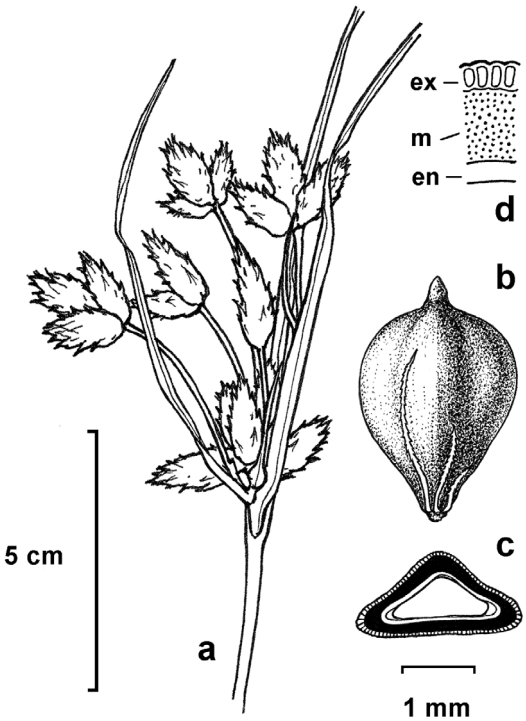

Fig. 3. *Bolboschoenus laticarpus* (from Ruda Sulowska, ca. 10 km W of Milicz, Poland, 30.VIII.2003 *Z. Hroudová & P. Zákravský*, PRA.). — **a**: Inflorescence. — **b**: Achene (abaxial view). — **c**: Achene cross-section. — **d**: Pericarp layers (ex = exocarp, m = mesocarp, en = endocarp).

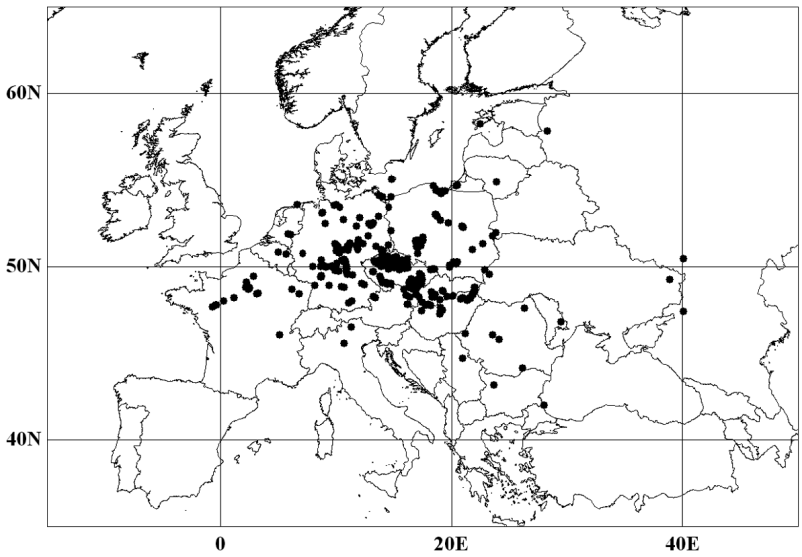

Fig. 4. Distribution of *Bolboschoenus laticarpus* in Europe.

ECOLOGY: *Bolboschoenus laticarpus* inhabits a wide range of habitats and has a wide ecological amplitude as regards water depth and soil chemistry (Hroudová *et al.* 1999a). It is a typical species of river floodplains, inhabiting riverbanks and oxbows or small streams, ditches and channels. It also forms extensive littoral stands in water reservoirs (after water level decrease), and thrives successfully in terrestrial habitats that are only temporarily flooded. It has become an undesirable weed on arable lands in the Czech Republic (Mikulka & Chodová 1998, Mikulka *et al.* 1999). *Bolboschoenus laticarpus* may spread by running water (by tubers set free and swept away after erosion of the soil, and by seeds) and also probably by birds. Seed germination of *B. laticarpus* is enhanced by high day/night temperature fluctuations (similarly to other *Bolboschoenus* species), but seed germination usually exceeds germination rates of other species (Moravcová *et al.* 2002), even in saline or eutrophicated environments (L. Moravcová unpubl. data). This may enable crowded seedling establishment, when favorable conditions exist. If high seedling mortality occurs, however, no reserve storage of dormant seeds remains and the whole juvenile population may die. This situation may occur in summer-dry saline habitats with fluctuating salt concentration, which evidently limits plant establishment and the spread of *B. laticarpus* on extensive saline areas (e.g., in Hungary).

DISTRIBUTION: *Bolboschoenus laticarpus* is frequent in Europe, growing mainly in the center of the continent (Fig. 4), sometimes reaching the sea along rivers to their mouths (Wisła in Gdańsk, Odra in Szczecin, Elbe in Hamburg). Only exceptionally does it occur on isles in the North Sea and the Baltic Sea (Borkum, Bornholm, Ösel). Browning *et al.* (1996) recorded herbarium specimens of this taxon (named as "putative *Bolboschoenus maritimus* × *yagara* hybrid") from Belgium and Germany; consequently, this taxon was recorded from Germany by Kiffe (1997), Gregor (1999), von Glahn (1999), Krumbiegel (2005), and was included in the surveys of the flora of Germany (Kiffe 1998, 2000, Senghas & Seybold 2000, Jäger & Werner 2002). Hroudová *et al.* (2005) mapped this taxon in Poland, and Hohla (2001, 2002) and Hroudová *et al.* (2006) recorded this taxon for Austria; *B. laticarpus* was also included in the determination key to Austrian flora (Fischer *et al.* 2005). In the Czech Republic it was recorded by Hroudová *et al.* (2001), mapped by Ducháček (2002) and included in the determination key as *B. yagara* × *B. koshewnikowii* (Hroudová 2002).

Bolboschoenus laticarpus occurs especially along great rivers in lowland floodplains (e.g., Main, Wesser and Elbe rivers in Germany, Labe (Elbe) and Morava rivers in the Czech Republic, Odra and Wisła rivers in Poland, Danube in Germany and Austria, and Tisza in Hungary). Its distribution is concentrated in the southern and

central Germany, Czech Republic (central Bohemia and Polabí lowland, southern Moravia), and southern and eastern Slovakia; it is scattered in Poland, northern Hungary and rarely found in northeastern Austria. In the Czech Republic *B. laticarpus* is the most abundant of all *Bolboschoenus* species; when recognized it would probably also appear to be more frequent in other surrounding countries.

Bolboschoenus laticarpus is rare in southern Europe (with the exception of several localities in Bulgaria, Romania, former Yugoslavia and northern Italy); western localities extend to France, and the northernmost localities are in Estonia (Ösel) and Russia. Eastwards, the continuous distribution of *B. laticarpus* extends to the southern European part of Russia to the Ural Mountains (near the town of Orenburg, *see* Tatanov 2004). Very distant localities were found in the Far East (Tatanov 2004), which suggests a possible relationship of those plants to the Japanese "*B. fluviatilis* subsp. *yagara*, type B" (Hayasaka & Ohashi 2002).

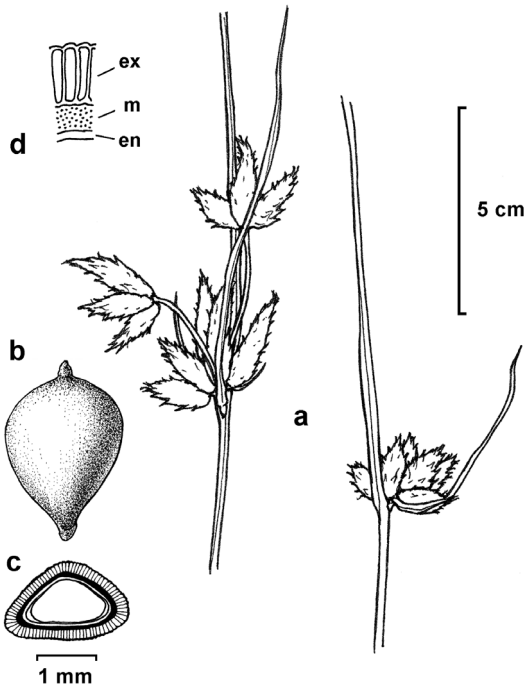

Fig. 5. *Bolboschoenus maritimus* (right inflorescence from Kis-rét salt lake, Kiskunsági NP, Hungary, 27.VII.1995 *Z. Hroudová & P. Zákravský*, PRA; left inflorescence and others from Fehér salt lake, Kiskunsági NP, Hungary, 26.VII.1995 *Z. Hroudová & P. Zákravský*, PRA). — **a**: Inflorescences. — **b**: Achene (abaxial view). — **c**: Achene cross-section. — **d**: Pericarp layers (ex = exocarp, m = mesocarp, en = endocarp).

Bolboschoenus maritimus (L.) Palla (Fig. 5)

in Hallier & Brand, Syn. Deutsch. Schweiz. Fl., ed. 3, 3: 2532. 1905. — *Scirpus maritimus* L., Sp. Pl.: 51, 1753. Protologue: "Habitat in Europae litoribus maritimis". — Lectotype (designated by Smith & Kukkonen 1999: 356): Herb. Celsius 2: 212 (UPS). Epitype (designated by Smith & Kukkonen 1999: 356): [Sweden] E. Roslagen, par. Börstill, 2 km W. Kallö, near Husbacka, *Nilsson 9515*, 14.X.1995 (UPS, isoepitype PR!).

Scirpus compactus Hoffm., Deutschl. Fl.: 25, 1800. — *Bolboschoenus maritimus* subsp. *compactus* (Hoffm.) Hejný in Dostál, Květ. ČSR: 1844. 1950. — *Scirpus maritimus* f. *compactus* (Hoffm.) Junge, Jahrb. Hamburg. Wiss. Anst. Beih. 25(3): 259. 1908. — Lectotype (designated by Tatanov (2005: 1577): Krocker, 1796, Fl. Silesiaca [Editio altera], 1: tab. 15 (but *see* the discussion of the Krocker's illustration in Marhold *et al.* 2006).

Perennial plants with richly branched underground rhizome bearing spherical or elongated tubers (1–)2–3 cm in diameter. Stems erect, trigonous, plants usually (0.3–)0.7–1(1.5) m tall; upper leafless part of flowering shoots 1/3–1/2 of total stem length. Inflorescence either head-like, consisting only of sessile spikelets or poorly branched, consisting of a central group of 3–7(–10) sessile spikelets and of 1–2(–4) rays bearing single spikelets or fascicles of 2–4(–5) spikelets. Sessile spikelets (5–)10–25(–40) mm long, spikelets on rays (3–)7–30(–50) mm long; evident tendency to form very long spikelets (over 20 mm, macrostachyate form). Floral scales light to rust-brown; styles trifid, but frequently also bifid in same inflorescence. Achenes elliptical, obovate to broadly obovate in outline, with a short beak on summit, 3–4 mm long, (1.8–)2.1–2.7 mm wide, on abaxial side convex or with a round edge, sometimes lenticular. Perianth bristles caducous. Achenes medium- to rust-brown, rarely dark-brown, with a highly visible polygonal network on surface (cell wall outlines depressed). Achenes oval, flat-convex to subtrigonous in cross section; pericarp with well developed exocarp formed by one layer of cylindrical cells radially elongated

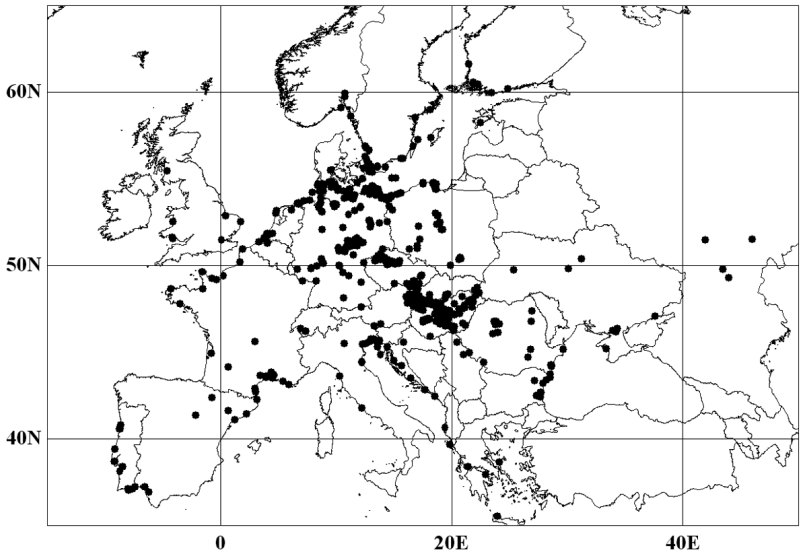

Fig. 6. Distribution of *Bolboschoenus maritimus* in Europe.

and air-filled, and sclerenchymatic mesocarp and endocarp; exocarp layer thicker than mesocarp (ratio of exocarp:mesocarp ca. 2:1).

Ecology: Although *Bolboschoenus maritimus* is a halophyte, it also thrives under non-saline conditions (P. Zákravský & Z. Hroudová unpubl. data). The seeds germinate well in saline habitats with fluctuating salt content (induced secondary dormancy enables seeds to germinate after salinity decreases; L. Moravcová unpubl. data). The vegetative parts are also highly salt-resistant: in summer-dry salt lakes in Hungary the plants survived on soils with pH 9–10 (Hroudová *et al.* 1999a). Sprouting tubers cultivated in a saline gradient were more resistant than those of other *Bolboschoenus* species; the seedlings of *B. maritimus* cultivated in the same gradient, however, did not differ considerably in resistance from the other species (Z. Hroudová unpubl. data). The dormancy ability of seeds and tubers seems to be an important adaptation enabling survival during dry periods with high salt concentrations in soil.

Distribution: The centre of general distribution of *B. maritimus* is in Europe. Because in most floras of European countries only the broadly conceived *B. maritimus* was listed without differentiation into separate taxa as they are known at present, or, at least, *B. maritimus* was not distinguished from *B. planiculmis*, literature data on the distribution of this taxon in Europe are not taken into consideration here. *B. maritimus* inhabits seashore as well as inland regions with saline habitats (Fig. 6): it is widely distributed throughout the seacoasts of southern and western Europe, on the coast of the North Sea and Baltic Sea, it occurs on the British Isles. In Scandinavia, it reaches southern Norway, Sweden and Finland. Tatanov (2004) reported the northernmost locality to be in Murmansk region in Russia. Southwards the distribution continues along the Mediterranean Sea coast to the Black Sea and Turkey; some remote localities are in Iraq, Iran and Afghanistan. The eastern border of *B. maritimus* distribution is not known in detail: according to our revision of herbarium material it reaches through the south of the European part of Russia to the Ural Mountains, and isolated localities were found in Kazakhstan and Kyrgyzstan. The easternmost isolated area is in Siberia near the town of Barnaul; this is in agreement with the localities given by Tatanov (2004). Hayasaka and Ohashi (2002) included *B. maritimus* among the Japanese species of the genus; Egorova and Tatanov (2003) considered it to be introduced there.

In inland European areas *B. maritimus* is distributed especially throughout the Pannonian region: in Hungary (e.g., salt lakes in the surroundings of Kecskemét and in the Hortobágy Puszta), Austria (Neusiedler See), southern Slovakia and southern Moravia. It frequently occurs in Germany in inland saline habitats (e.g., near

Halle and in many localities in the northern part of the country). Similarly, *B. maritimus* is distributed mainly in scattered localities in northern Poland (Hroudová *et al.* 2005). In the Czech Republic, suitable habitats for *B. maritimus* are rare; there are only remnants of salt marshes or secondary habitats on the sites of former saline wetlands (Ducháček 2002). These habitats are concentrated in northwestern Bohemia and southern Moravia.

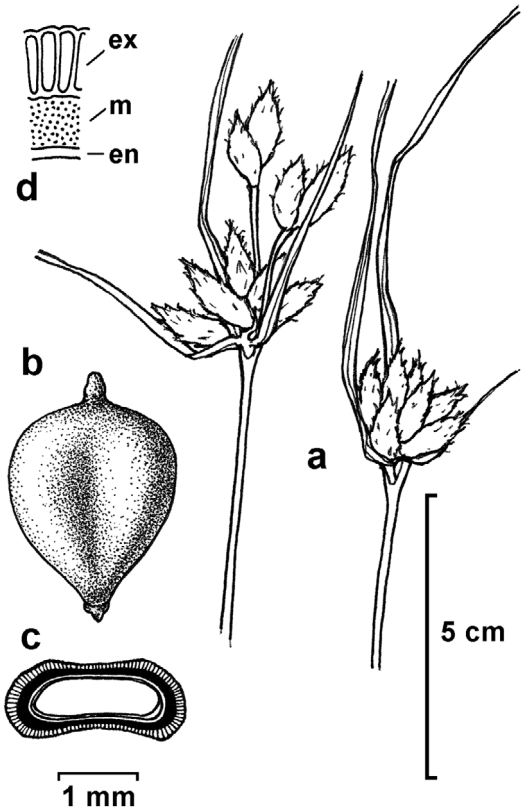

Fig. 7. *Bolboschoenus planiculmis* (from Zdice, Czech Republic, 1987 *Z. Hroudová & P. Zákravský*, PRA.). — **a**: Inflorescence. — **b**: Achene (abaxial view). — **c**: Achene cross-section. — **d**: Pericarp layers (ex = exocarp, m = mesocarp, en = endocarp).

Bolboschoenus planiculmis (F. Schmidt) T.V. Egorova (Fig. 7)

Rast. Centr. Azii 3: 20. 1967.

Scirpus planiculmis F. Schmidt Reis. Amur-Land., Bot.: 190. 1868. — Lectotype (selected by Egorova & Tatanov 2003: 140): Ssussuia Mündung auf schlamingen Boden *F. Schmidt s.n.*, 10.VIII.1861 (LE!). Epitype (designated by Egorova & Tatanov 2003: 140): Yuzhnyi Sakhalin, Anivskii zaliv, kolo sel. Sinba (Dachnoe), primorskie plavni, *M. G. Popov s.n.*, 12.IX.1948 (LE!).

Scirpus koshewnikowii Litv. *ex* Kots, Bull. Soc. Nat. Mosc. 57: 220. 1882. — *Bolboschoenus koshewnikowii* (Litv. *ex* Kots) A.E. Kozhevn., Sosud. Rast. Sovet. Dal'negoVostoka 3: 189. 1988. — Type locality: "Oblast' Voiska Donskago bliz stantsii Uryupinskoi" [type not traced]. Neotype (designated by Egorova & Tatanov 2003: 141): Novotscherkassk, ad ripam fluvii Axaj, *A. Jakuschev s.n.*, 9.VI.1911 (LE!).

Scirpus biconcavus Ohwi, Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B 18: 110. 1944. — Holotype: Japan. Nishiwada, prope Nemuro, Yeso, *J. Ohwi s.n.*, 10–11.IX.1931 (KYO!).

Perennial plants with a richly branched underground rhizome bearing spherical or elongated tubers. Tubers mostly small, 0.5–1.5 cm in diameter. Stems erect, trigonous, plants (0.2–)0.5–0.9(–1.1) m tall. Upper leafless part of flowering shoots usually 1/3 to 1/2 (even more) of total stem length. Inflorescence either head-like, consisting of only sessile spikelets, or poorly branched, formed of a central group of 3–7(–11) sessile spikelets and of 1–2(–4) rays bearing single spikelets or fascicles of 2–3(–5) spikelets. Rays 5–30(–45) mm long, spikelets (5–)10–20(–28) mm long. Frequently inflorescence formed by a solitary spikelet. Floral scale light to rust-brown; styles bifid, rarely also trifid in same inflorescence. Achenes obovate to broadly obovate in outline, 3.1–3.8 mm long, 2.2–2.5 mm wide, with a short beak on summit, concave (rarely flattened) on abaxial side (in flowers with trifid styles achenes rarely convex to subtrigonous on abaxial side), in cross section biconcave to flat-concave with rounded angles radially elongated. Achenes ochre, light- to rust-brown, with a highly visible polygonal network on surface (cell wall outlines depressed). Perianth bristles caducous. Pericarp with a well developed exocarp formed by one layer of cylindrical cells radially elongated and air-filled, a sclerenchymatic mesocarp and a thin sclerenchymatic endocarp; exocarp layer approx. of same thickness as mesocarp, thicker over rounded angles than on concave faces.

Ecology: *Bolboschoenus planiculmis* is well adapted to temporarily flooded terrestrial habitats (field depressions, wet ditches); it is able to survive long-term (even several years) dry periods only in the stage of dormant underground tubers. The tubers are small and numerous, enabling

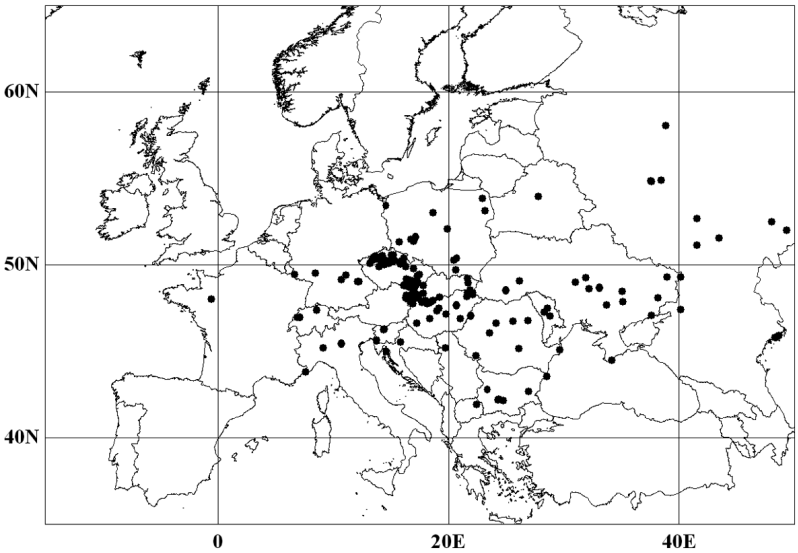

Fig. 8. Distribution of *Bolboschoenus planiculmis* in Europe.

very intensive vegetative reproduction. These characteristics have supported the recent expansion of *B. planiculmis* (similarly to *B. laticarpus*) in the Czech Republic as an undesirable weed on arable lands, namely in maize fields. Plants are usually smaller than *B. yagara* and *B. laticarpus*, and so they are suppressed by high water levels — consequently, they occur only rarely in the littoral of fishponds or streams and, in this case, only as a belt along the shoreline. *Bolboschoenus planiculmis* occurs on mineral-rich grounds and alkaline soils; it is also able to survive in saline habitats, but not as well as *B. maritimus* (P. Zákravský & Z. Hroudová unpubl. data). Salt content in saline habitats in the Czech Republic and Slovakia is mostly lower than in those in the Hungarian steppe region (Hroudová *et al*. 1999a) — this is probably why *B. planiculmis* is rarer than *B. maritimus* in the salt steppes in Hungary. Fruits are floatable, and thus spreading by floods is one possible means of distribution (Hroudová *et al*. 1997). Seeds germinate best after cold wet stratification and under fluctuating day/night temperatures (similarly to other *Bolboschoenus* species); temperature day/night differences do not need be as high as for *B. yagara* or *B. laticarpus* (Moravcová *et al*. 2002). This indicates easier germination, probably due to the thinner sclerenchymatic mesocarp, which may be more frequent in natural habitats.

Distribution: The distribution of *B. planiculmis* in Europe is concentrated in the centre of the continent (Hungary, southern Slovakia, southern Moravia, northeastern Austria) (Fig. 8). Because *B. planiculmis* has not yet been recognized in most of European countries, no literature data on its distribution are available; it was recognized only in Russia (Egorova 1976), and now in the Czech Republic (Hroudová *et al*. 2001, Ducháček 2002, Ducháček *et al*. 2006), Poland (Hroudová *et al*. 2005) and Austria (Fischer *et al*. 2005, Hroudová *et al*. 2006). The species is distributed mainly in warm lowlands (southern and eastern Slovakia, southern Moravia, northwestern and central Bohemia, Polabí lowland, steppe regions in Hungary, and Burgenland and Marchfeld in Austria). In the Czech Republic, the area of distribution of *B. planiculmis* overlaps with that of *B. maritimus*; *B. planiculmis* is the more frequent. In the Hungarian steppe region, however, *B. planiculmis* is rarer than *B. maritimus*.

Around this central distribution area, localities of *B. planiculmis* are scattered to rare; the westernmost localities are in France (Sarthe), Switzerland (Lake Neuchâtel), Germany (near Saar river) and Italy (Nervia), the northern border of its distribution area in Europe extends through northern Poland to Russia. *Bolboschoeneus planiculmis* is also sparsely distributed in southeastern Europe (Bulgaria, Romania, Moldova) from where it extends to southern Ukraine and Russia (frequently in steppe zones), forming a continuous belt through Russia to the Far East approx.

within 40° and 60° northern latitude (Egorova & Tatanov 2003). The distribution of *B. planiculmis* in Eurasia is of continental character, and it is rare along the seacoast.

Bolboschoenus yagara (Ohwi) Y.C. Yang & M. Zhan (Fig. 9)

Acta Biol. Plateau Sin. 7 (1987): 14. 1988.

Scirpus yagara Ohwi, Mem. Coll. Sci., Kyoto Imp. Univ., Ser. B 18: 110. 1944. — *Bolbochoenus fluviatilis* subsp. *yagara* (Ohwi) T. Koyama, Acta Phytotax. Geobot. 31: 140, 1980. — Holotype: Japan. [Kyoto Imperial University, cultivated in the Botanical Garden], *J. Ohwi*, 3.VII.1931 (KYO!).

Bolboschoenus maritimus var. *desoulavii* Drobov, Trudy Bot. Muz. Akad. Nauk 11: 91–92, 1913. — Holotype: Russia. [Primorskaya obl.] Post' Sanzhan' na Sungari, *N. Desoulavy 510*, 27.VI.1903 (LE!)

Perennial plants with a branched underground rhizome bearing elliptical to spherical tubers. Tubers up to 3–4 cm in diameter. Stems erect, trigonous, plants 0.8–1.3(–1.6) m tall. In flowering shoots leaf-bearing part of stem highly prevails — upper leafless part is usually (1/10–)1/5–1/4(–1/3) of total stem length. Inflorescence branched, consisting of a central group of (1–)2–4(–8) clustered, sessile spikelets and of (1–)3–7(–12) rays (branches) bearing usually 1–3(–5) spikelets. Rays bearing only a single spikelet frequently present in inflorescence. Rays mostly more than two times longer than sessile spikelets; rays 2–5(–7) cm long, spikelets usually short, (4–)8–15(–19) mm long. Styles always trifid; floral scales light to rust-brown. Achenes narrowly obovate to elliptic in outline, 3.2–4 mm long and 1.6–1.8 mm wide, with elongated beak on summit and with a well-developed edge on abaxial side; dark-brown to black at maturity. Achene in cross section markedly nearly equilaterally trigonous. Perianth bristles persistent at maturity, longest usually as long as achene or longer. Achene surface smooth (at 20× magnification). Pericarp with very thin outer layer (exocarp), consisting of one layer of isodiametric cells only partly air-filled. Sclerenchymatic mesocarp thick; ratio of exocarp:mesocarp thickness approx. 1:10 to 1:15.

Ecology: Among European *Bolboschoenus*, *B. yagara* is best adapted to littoral habitats due to the following reasons: (i) the plants can grow well and be fully fertile at a water depth of 60 to 80 cm; (ii) a great proportion of underground tubers remain alive, dormant during long-term high water levels, enabling the plant to survive unfavourable conditions (Zákravský & Hroudová 1994). Consequently, *B. yagara* nearly exclusively inhabits fishponds and other reservoirs with standing water. The fishpond basins may be characterized by a high concentration of water birds, which use some isolated fishponds where *B. yagara* occurs as resting places during their migrations (fishponds in northern Moravia and southern Poland, Velké Dářko fishpond in Bohemian-Moravian Highland, etc.). Evidently water birds play an important role in the dispersal of *B. yagara* over great distances (endozoochory).

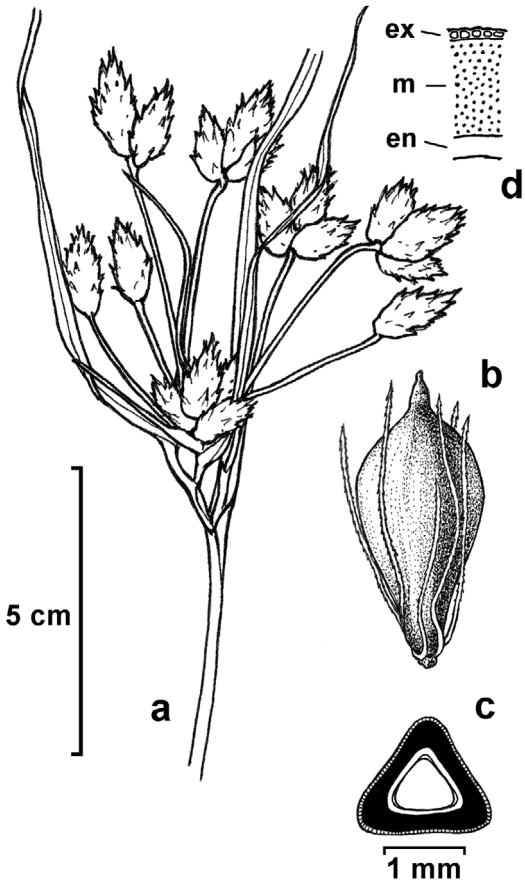

Fig. 9. *Bolboschoenus yagara* (from Göbeln, Germany, 23.VIII.2004 *Z. Hroudová & P. Zákravský*, PRA). — **a**: Inflorescence. — **b**: Achene (abaxial view). — **c**: Achene cross-section. — **d**: Pericarp layers (ex = exocarp, m = mesocarp, en = endocarp).

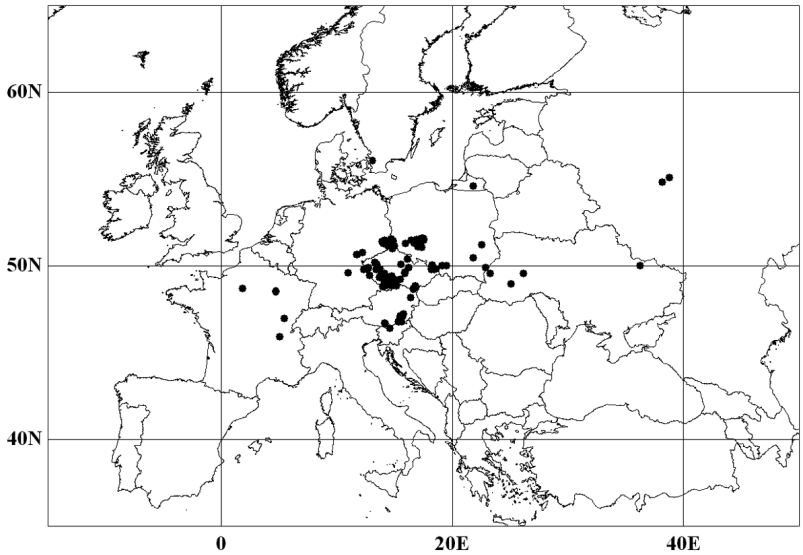

Fig. 10. Distribution of *Bolboschoenus yagara* in Europe.

Bolboschoenus yagara is the most sensitive species to increasing trophic levels and increasing salinity compared with the other European species. This is in accordance with its occurrence on nutrient-poor, acid grounds (Hroudová *et al*. 1999a). Salinity and eutrophication negatively influence the growth and development of young plants derived vegetatively from tubers (P. Zákravský & Z. Hroudová unpubl. data), and also decrease seed germination (L. Moravcová unpubl. data) and increase seedling mortality (Z. Hroudová unpubl. data). Seedlings successfully establish only on emerged pond bottoms; a long period of low water level (two summer seasons) is apparently necessary for establishment (Hroudová *et al*. 1996). Because mineral ion concentration in soil water increases during summer months, only mineral-poor, acid habitats appear to be suitable for seed establishment in new localities. This may be the main cause of absence of *B. yagara* in lowland warm regions on mineral-rich grounds.

Distribution: In Europe, the occurrence of *Bolboschoenus yagara* is concentrated to the centre of the continent (Austria, Czech Republic, Germany, Poland) (Fig. 10). Browning *et al*. (1996) recorded the first occurrence of *B. yagara* in Germany; the species was further mentioned by Kiffe (1997, 1998, 2000), Senghas and Seybold (2000), and Jäger and Werner (2002). Its distribution was mapped in Poland (Hroudová *et al*. 2005), studied in Austria (Hroudová *et al*. 2006) and included in the determination key of Austrian flora (Fischer *et al*. 2005). *Bolboschoenus yagara* was also included in the determination key of the flora of the Czech Republic (Hroudová 2002), and Hroudová *et al*. (2001) and Ducháček (2002) mapped its distribution in the Czech Republic.

In Europe *B. yagara* typically occurs in flat fishpond areas. Most localities are in South Bohemian fishpond basins and other regions of similar landscape character: Upper Lusatia in Sachsen (Oberlausitzer Heide- und Teichlandschaft, Teichgebiete Niederspree-Hammerstadt), surroundings of the village of Plothen in Thüringen (Plothener Teiche), Upper Silesia in Poland (fishpond area near the town of Milicz north of Wrocław), Styria and Carinthia in Austria (Wundschuh-Teiche near Graz and the fishpond area near the town of Klagenfurt). However, *B. yagara* is absent in the Pannonian region (Hungary, Slovakia), and has only one locality in southern Moravia. This absence may be caused either by the lack of suitable landscape type (flat fishpond areas) e.g., in Slovakia or, by the effect of warmer climate combined with alkaline grounds (*see* above) as in southern Moravia or Hungary.

In Europe *B. yagara* extends westwards to France (near Paris), and the northernmost locality is in southern Sweden. The southern border of its European distribution (except some localities in

France) is in southern Austria (near Klagenfurt). To the east, the distribution continues through southern Poland (north of Carpathian Mountains) to the forest zone in Ukraine. The connection with the area of distribution in the European part of Russia and through Siberia to the Far East (*see* Tatanov 2003a) is probable through Ukraine and Belarus. In general, *B. yagara* appears to be distributed throughout Eurasia within the belt between 40°N and 60°N.

Discussion

Our results for Austria, Hungary and the Czech Republic have at least partly filled the gaps in the map of overall distribution of *Bolboschoenus* species presented by Browning and Gordon-Gray (2000), and are complementary to investigations by Tatanov (2003a, 2003b, 2003c, 2004a) and Egorova and Tatanov (2002, 2003) in the area of the former Soviet Union. New data on the distribution of *Bolboschoenus* species in some other countries (e.g., Baltic countries, Bulgaria, Croatia, Serbia, Montenegro) may bring novel information on the occurrence of the studied species, leading to an additional more detailed study. For the genus *Bolboschoenus*, Central Europe appears to be a region where the distributions of individual species overlap. This is due to the region's considerable habitat diversity. Three different areas of distribution overlap here:

1. *Bolboschoenus yagara* and *B. planiculmis*, with distribution throughout Eurasia within a belt limited approx. by 40°N and 60°N, north of the Himalayan Mountains (Egorova & Tatanov 2002, Tatanov 2003a). Within this area, both species inhabit different niches, which is especially apparent in some central European countries: *B. yagara* in fishpond basins, *B. planiculmis* in more terrestrial habitats in warmer regions.
2. *Bolboschoenus maritimus* and *B. laticarpus*, with distribution concentrated to Europe and only marginally extending to Asia (*see* also the localities by Tatanov 2004). Also these two species occupy different niches within the same area of distribution: *B. maritimus* on seacoasts and in inland saline habitats, *B. laticarpus* in freshwater inland habitats along rivers.
3. *Bolboschoenus glaucus* with the area of distribution mainly in southern Europe, eastwards continuing to Asia south of the Himalayan Mountains; reaching central Europe only marginally.

Human activity has undoubtedly enhanced the dispersal of some *Bolboschoenus* species throughout history: most of the fishponds in Upper Silesia (Poland), Upper Lusatia (Germany) and South Bohemia (Czech Republic) were constructed in the 15th to 16th centuries. As original natural habitats (pools, river oxbows) were gradually dried and destroyed, secondary habitats (fishponds, arable land) provided the possibility of persistence or spread of *Bolboschoenus* populations. At present, secondary habitats represent a considerable proportion of the localities of *B. yagara*, *B. laticarpus* and *B. planiculmis*.

The development of *Bolboschoenus* populations on crop fields in central Europe concerns especially *B. planiculmis* and *B. laticarpus*. Although *Bolboschoenus* species have been found on fields since the 19th century (e.g., the specimen of *B. planiculmis* found near Marchegg, Austria, 1895 *K. Fritsch*, GZU 14120), *Bolboschoenus* as a weed was mentioned only much later in literature (as *B. maritimus s. lato*; Hejný 1960 from southern Slovakia, Zahlheimer 1969 from Germany). Hilbig (1994) summarized the data on the spread of *B. maritimus s. lato* on crop fields in Bavaria since the 1980s, and first emphasized the necessity to limit crowded development of *Bolboschoenus* populations in fields. Recently, *B. maritimus s. lato* was listed among the weedy species in Austria (Ries 1992) and Germany (Kläge 1999), and Schröder (1998) presented the results of its control with herbicides. In the Czech Republic, the recent expansion of populations of *B. planiculmis* and *B. laticarpus* on arable land was enhanced by changes in field management stemming from the changing economy.

Intensive landscape management (fish production, tourist industry), however, may limit the development of *Bolboschoenus* populations and lead to a decrease in their frequency of

occurrence (e.g., cutting and scraping of fishponds). The difference in frequency of localities of *Bolboschoenus* (especially in non-saline habitats) is still evident between former "west" countries with the landscape intensively used and very carefully managed, where suitable wetland habitats are rare (e.g., Bavaria, Hessen in Germany, Austria), and former "east" countries (e.g., Czech Republic, Slovakia, Hungary) with more natural habitats and prevailing unmanaged places and abandoned fields, with more numerous localities of *Bolboschoenus*.

Further questions have arisen: the question of the identity of *B. planiculmis* growing in Europe and *Scirpus biconcavus* from Japan; the possible relationship between *B. laticarpus* and the Japanese "*B. fluviatilis* subsp. *yagara*, type B" (Hayasaka & Ohashi 2002); and the possible parentage of *B. laticarpus* — the species supposedly of hybrid origin (Marhold *et al*. 2004). Experimental work and/or genetic analyses may be useful in solving these problems, which will be the subjects of further studies.

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Appendix

List of selected localities of species of the genus *Bolboschoenus* from European countries. Centres of distribution as well as individual isolated localities were included. Full list of localities is available on request from the first author.

Bolboschoenus glaucus

Portugal. Coimbra. Adémia, 1888 *A. Moller* (BRNM 08178/38); Adorigo, 1941 *P. Lopes & G. Pedro* (LISI); Paúl do Boquilobo Natural Reserve, 1998 *Z. Hroudová & P. Zákravský* (PRA); Azambuja, Rascoa, 1958 *J. de Vasconcelos* (LISI); Faro (Caminho de Ferro), 1923 *A. Guimarães* (WU). **Spain**. Solloccia: Tuy [Túy], 1912 *F. Taist* (W); Huelva: Cartaya, 1981 *P. Weickert* (BRNM 1465902); Andalucia: Coto de Doñana, 1967 *B. Pawlowski* (KRAM 56026); Córdoba, 1926 *H. Lindberg* (B); Logroño: Sajo, 1912 *Hno H. Elias* (BP 34384, GLM 108262); Catalogne: Fortiá á Fortianell, 1906 *Fres. Sennen et Septimin* (W). **France**. Toulouse, 1877 *Timbal-Lagrave* (B); Montpellier, 1812 *L. Q. Mouthginon* (B); Canaux à Arles, 1864 *J. Duval* (P 250063); Avignon, [18]72 *coll. ?* (BP 34269); Aix. [Aix-en-Provence], s. d. *s. coll.* (PRC). **Italy**. Bordighera, *Vaccini* (WU); La baseine di Pisa, s. d. *coll. ? herb. Hinterhuber* (LI); Am Arno in Florenz, 1969 *E. Dörr* (M 80370); Modena, 1886 *A. Mori* (M 80364); Verona, prope Peschiera, [19]10 *Rigo* (GZU 4123); Fusina, 1860 *Lambert* (PR); Lido di Venezia, 1821 J. Kellner (PR); Monfalcone, (18)97 s. coll. (BP 710993); Noghera bei Muggia, 1890 *R. Beyr* (B); Der Senigallia, 1958 *s. coll.* (GZU 14202); Ostia (Roma), 1953 *A. Casciato* (B); Calabria: Catanzaro, 1896 *Michalett* (BP 34281); Sizilien: E Camporeale, 1981 *H. Malicky* (W); Palermo, 1860 *Citarda* (JE); Termini [Termini Imerese], 1860 *Citarda* (JE); Cefalu, 1960 *H. Roessler* (M 80369); Girgenti [Agrigento], 1926 *Andreánszky* (BP 710780, 34356); Montedo [Montedoro], 1860 *Citarda* (JE). **Czech Republic**. Prague, 1925 *J. Rohlena* (PRC), 1967 *J. Polívka* (PR), 1983 *Z. Hroudová & P. Zákravský* (PRA). **Croatia**. Orsera [Vrsar], 1924 *G. Cufodontis* (W); Pola [Pula], s. d. *H. Wawra?* (BRNM 08146/38, 08147/38); Fianona, 1899 *Evers* (GZU 013715, 13716); Fiume [Rijeka], s. d. *Noë* (BP 17181); Buccari [Bakar], 1881 *D. Hirch* (BRNM 08161/38); Novi, 1909 *Sántha L. ?* (BP 422393); Vinodol, 1922 *K. Domin* (PRC); Insel Veglia [Krk], s. d. *Noë* (BP 34265); Darda, 1873 *Simkovics L.* (BP 17139); Dubrovnik (Ragusa), 1912 *A. Latzel* (BRNU); Slano, 1967 *s. coll.* (BRNM 598390); Kupari – Srebrno, 1918 *R. Dvořák* (BRNM 06210/32). **Bosnia**. Bosn.-Brod [Bosanski Brod], 1889 *Vandas* (PR). Mostar, 1876 s. coll. (PRC), 1886 *J. Bornmüller* (PRC), 1887 *E. Formánek* (BRNM 08144/38); Modor [Domaševo], s. d. *Chaubari* (PRC). **Montenegro**. Teodo [Tivat], 1894 *Beck* (PRC); Danilovgrad, 1903 *Rohlena* (PRC); Bar, 1900 *J. Rohlena* (PRC); Virpazar, 1967 *J. Dvořák* (BRA); Godinje, 1900 *J. Rohlena* (PRC). **Albania**. Scutari (Skutari) [Shkodër], 1871 *Grimburg* (W); Inter opp. Prizren et Debra, 1918 *J. B. Kümmerle* (BP 34274); Tirana, [19]18 *J. Schneider* (W); Elbassan, 1917 *V. Stöhr* (PR). **Hungary**. Szeged, 1856 *Joan. Nep. Bayer* (SLO); Kalocsa, 1876 *S. J. Menyárth* (BP 34258); Tiszaroff, 1891 *Karkovány Ákos* (BP 17215); Szolnok, 1953 *Csapody V.* (BP 197247); Tiszasüly, 1999 *L. Felföldy* (BP 448474). **Serbia**. Polanka [Backa Polanka], 1844 *Wierzbicki P.* (BP 384061), (18)81 *Wierzbicki P.* (BP 34323); Beočin, 1913 *S. Kupčok et pater* (PR 60644, BP 17237); Karlócza [Sremski Karlovci], 1909 *G. Lengyel* (BP 340294), 1910 *S. Kupčok et pater* (PR 60677), 1910 *S. Kupčok* (BP 475410); Kamenica, 1924 *s. coll.* (BP 262986); Óbeose [Bečej], 1918 *A. Boros* (BP 410651); Zenta [Senta], 1901 *Z. Szabó* (BP 17207); Belgrad, 1887 *Bruml ?* (B); Versecz

[Vršac], 1898 *Bernátsky* (BP 17220); Jassenowa [Jasenovo], 1890 *Wurm* (BRNM 08174/38); Kragujewatz [Kragujevac], date ? *M. J. Dimitrijev* (WU). **Macedonia**. Jastoff, 1917 *J. Bornmüller* (B, BP 34260, JE); Skopje, 1964 *J. Šmarda* (BRNM 544169); Katlanovska Baňa, 1937 *M. Deyl* (PR); Gradsko, 1891 *Formánek* (PR). **Greece**. Saloniki (Salonique) [Thessaloniki], (19)65 *E. Feichtinger* (LI 79/654); Agathoupolis, 1996 *s. coll.* (PRA); Delta of Axios river, 1996 *s. coll.* (PRA); Lake Lisimakhia [Sikia], 1974 *L. Koumpli-Sovantzi* (B); Zakynthos: Kalamaki, 2005 *L. Moravcová* (PRA); Achaia: Kalavryta, 1926 *J. Bornmüller* (B); Phaleron, 1845 *Orphanides* (M 80415); Mykonos: Anomera, 1901 *Heldreich* (WU); Kreta: Gortys, Odeon, (19)81 *H. Kalheber* (M 80413). **Romania**. Arad, 1885 *L. Simkovics* (BP 17211); Felvac, 1999 *Gh. Groza* (LI 367876); Banat. Timisoara, 1984 *Gh. Groza* (LI 161997); Alcarolina (Albae-carolinae) [Alba Iulia], 1857 *Haynald* (BP 34259); Ulma, s. d. *Haynald* (BP); Dobrogea: Galati, 1972 *F. Dvořák* (BRNU 463885); Braila, 1972 *J. Vorel* (BRNM 638700). **Bulgaria**. Lom. Polanka, 1908 *I. K. Urumov* (BP 34337); Kozloduje, 1947 *N. Stojanov* (SO 08955, 08954, 08961); Lukovit, 1925 *I. K. Urumov* (BP 35075); Zlatna Panega, 1949 *B. Achtarov* (SOM 95487); Čerkovica, 1946 *N. Stojanoff* (SO 8969); Somovit, 1946 *N. Stojanoff* (SO 8970); Novgrad, 1899 *A. Javašeff* (SOM 8662); Batin [Ruse], 1901 *A. Javašeff* (SOM 8651); Brešlen, 1924 *D. Jordanov* (SO 8963); Letnitza [Letnica], 1890 *Urumoff* (PRC); Gabrowo, 1963 *J. Mądalski* (KRAM 465467); Ichtiman, 1900 *I. K. Urumov* (SOM 8641); Veličkovo, 1961 *G. Gančev* (SO 8967); Plovdiv, 1986 *C. M. Denchev* (LI 308090); Ribarnika, 1954 *H. Vihodcevsky* (B, BRNM 544158, KRAM 21415, SOM 111878), [in all sheets mixed with *B. planiculmis*]; Hisar, s. d. *I. Urumov* (BP 35074); Karlovo, 1972 *Fr. Černoch* (BRA); Mezek, 1940 *B. Kitanov* (SOM 90433); Razgrad, 1886 *A. Javašeff* (SOM 8650); Šumla [Sumen], 1890 *Fr. Mild* (PRC); Novi-Pasar [Novi Pazar], 1901 *B. Davidoff* (SOM 8655); Varna, 1930 *K. Ronniger* (W); Aitos, 1963 *Sl. Petrov & B. Kuzmanov* (B, BP, BRNM 598367, JE, KRAM 63258, PR, SO 8966, SOM 25446); Sozopol, 1961 *N. Vichodcevski* (SO 8974). **Turkey (in Europe)**. Enez, 1967 *K. Bauer & F. Spitzenberger* (W), 1984 *Seçmen & Leblebici* (B); Kirklareli: Igneada, 1985 *Seçmen & Leblebici* (B); Gallipoli [Gelibolu], 1921 *Gr. Iv. Širjajev* (BRNU 344561); Rodosto [Tekirdag], 1913 *T. Nikolov & N. Stojanov* (SO 8979). **Cyprus**. Nord-Zypern: S Kozan, 1990 *W. Lang* (M 80464); Kidhasi [Paphos], 1991 *G. Alziar et coll.* (B); Pr. opp. Larnaca, 1939 *H. Lindberg* (W). **Ukraine**. V. Chapelskii [Chapelsk depression, Askania Nova Reserve], 1938 *I. Osadcha* (KW); Krym, bl. Simferopola, 1926 *V. Transhel* (LE); Krym: Nikita kolo Jalty, 1965 *J. Mądalski* (KRAM 465466). **Russia (in Europe)**. Bl. st. Konstantinovskoi [Konstantinovsk], 1917 *N. Ivanov* (BRNU 170823); U s. Zagotushinskogo, 1926 *M. M. Ilin & Yu. S. Grigoriev* (LE); Prope Astrachan, s. d. *Krassnow* (LE); Volzhskii zapovednik, 1928 *V. L. Nekrasova* (LE); Ostr. Chetyre Bugra, s. d. *S. Korzhinskii* (LE).

Bolboschoenus laticarpus

France. Chambellay (M. et L.), s. d. *Le Châtelier* ? (P 250069); St.Denis d' Anjou (Moyenne), 1878 *L. Chevallier* (P 250071); Précigné, 1878 *L. Chevallier* (P 250075); L' Epau: Bords de l' Huem, 1871 *L. Chevallier* (P 250074); Brou-Salé, 1909 *A. et E. G. Camus* (P 250082); Sucy-en-Brie, 1918 *H. Debaire* (P 250087); Hir. Paris: à montmorency Ebboe (?), s. d. *Camus ?* (P 250059); Bonneuil, 1932 *J. Arenes* (P 250089); Charenton, 1840 *M. A. Weddell ?* (P 250086); Vigneux – rie d' Oly, 1910 *H. Debaire* (P 250085); L' Isle Adam, 1906 *G. Hibon* (P 250088); Chaville, 1906 *G. Hibon* (P 250088); Compiègne, s. d. *Boivin* (P 250073); Vimpelles, 1913 *s. coll.* (P 250078); Lent, Chalamont, 183? *Ch. Marlet* (P 250060); Nancy, s. d. *Godron* (P 250072); Jarville, [19]04 *s.coll.* (P 250056); Munchhausen, 1995 *A. Schneider* (LI 308805). **Belgium**. Visé, 1886 *P. Hardy* (P 250093); Fossi (Ossenavey) Neerlinter, 1912 *Rec. Jacq. de T'serelaes* (BP 34294). **The Netherlands**. Milingerwaad, 1989 *O. Clevering* (PRA). **Germany**. Oberblockland, 1970 *H. Kuhbier* (M 80324); Elbufer b. Hamburg, 1891 *coll.?* (BP 34283); Pommern: Cöslin, 1882 *W. Lackowitz* (WA); Berlin-Spandau, 1999 *Royl* (B); Ketzin, 1977 *D. Benkert* (B); Sachsen: Pirna, 2003 *K. -F. Günther* (Herb. K.-F. Günther); Flora lusatica: Guttau, 1986 *H.-W. Otto* (GLM 31477); Sachsen-Anhalt: Bleddin, 2000 *M. Krusche* (GLM 157506); Trotha, 1943 *H. Merxmüller* (M 80318); Rogätz, 1998 *H. Kowal* (JE); Erfurt: bei den 3 Quellen, 1880 *Carl Reinecke* (JE); Hessen: Frieda, 1985 *Ketelhut-Hofmann* (B), 2003 *Z. Hroudová, P. Zákravský & T. Gregor* (PRA); Frankfurt a./Main: Offenbach, 2003 *Z. Hroudová, P. Zákravský & T. Gregor* (PRA); Baden-Württemberg: Heidelberg, [19]67 *K. P. Battler* (M 80320); Bonn, 1868 *Fr. Körnicke* (B); Aschaffenburg, 1905 *Rubner* (BP 710999, M 80191); Prope Bamberg, 1908 *K. Harz* (B, BP 34339, BRNU 350997, 6377, JE, LI, M 80221, PRC, WA); Adelsdorf b. Höchstadt, 1958 *Paul Seibert* (M 80206); Ries. Huisheim, 1989 *N. Müller* (M 80195); Gmünd, 1978 *W. Zahlheimer & F. Schuhwerk* (M 80196); Starnberger See bei Starnberg, 1935 *F. Vollman* (M 80240). **Denmark**. Bornh.: Soseodde, 1896 *Otto R. Holmberg* (LD, PR 207231); Bornholm: Dammebaek, 1896 *Otto R. Holmberg* (LD). **Italy**. Botzen. Sabern, 1833 *Hausmann* (M 80355); Gardasee, s. d. *P. Rehst ? Herb. W. Lackowitz* (WA); Venetia dit. Patavina in Eugeneis, [18]67 *Porto* (JE). **Austria**. Mehrnbach, Gigling, 2002 *M. Hohla* (LI 506728); Mühlheim am Inn, Gimpling, 2001 *M. Hohla* (LI 460906, 459902); Enns-Insel westl. Haudestufer, 1993 *F. Essl* (LI 136985); Zwischen Poysdorf und Herrnbaumgarten, 2003 *Z. Hroudová, J. Danihelka, M. A. Fischer & G. Fischer* (PRA) [growing together with *B. planiculmis* and *B. yagara*]; Marchtal: oberhalb Stillfried, 1922 *Korb* (W); Tulln, 1873 *Fürst* (PR); Bei W. Neustadt, 1912 *A. Fröhlich* (BRNU 191106); [Bad] Fischau, N[ieder]oe[sterreich], 1905 *J. Schneider* (W). **Czech Republic**. Podbořany, 2001 *M. Ducháček* (PRA); Mariaschein [Bohosudov], 1880 *A. Dichtl* (M 80433), 1881 *A. Dichtl* (JE); Dolní Žleb, 2004 *J. Rydlo* (ROZ); Liběchov, 2003 *J. Rydlo* (ROZ); Blevice, Slatinský fishpond, 2001 *M. Ducháček* (PRC); Kaiserwiese (Prag), 1877 *L. von Boresch* (JE, WA), 1877 *Lausch* (LI); Prague: Běchovice, 2000 *Z. Hroudová & P. Zákravský* (PRA); Čelákovice, Grado, 2003 *Z. Hroudová* (PRA); Poděbrady, 2002 *J. Rydlo* (ROZ); Hasina, Kněžský fishpond, 2004 *M. Ducháček* (HK, PR); Nový Bydžov, 1998 *J. Rydlo* (ROZ 81075); Rozkoš dam reservoir near Česká Skalice, 1986 *F. Krahulec* (PRA); Bukovka, Jílovka fishpond, 1992 Z. *Hroudová & P. Zákravský* (PRA), 2002 (PRA – typus), 2001 *M. Ducháček* (CB, HR, PRA, PRC, ROZ, herb. Příbram); Dolní Jelení, 2000 *Z. Hroudová & P. Zákravský* (PRA), 2001 *M. Ducháček* (CB, HR,

PRA, PRC, herb. Příbram); Golčův Jeníkov, 1995 *L. Čech* (MJ 28531); Lišany u Rakovníka, 2001 *M. Ducháček* (PRC, ROZ); Plzeň, 1924 *F. Maloch* (BP 1927, BRNU 178838); Zbečno, 1973 *J. Havlíčková* (ROZ 7634); Tchořovice, 2001 *K. Šumberová* (CB, PRA, PRC); Hvězdáře, 2000 *M. Ducháček* (CB, PRA); Třeboň, Opatovický fishpond, 1992, 1994, 1996, 2004 *Z. Hroudová & P. Zákravský* (PRA); Kobeřice u Brna, Horáček fishpond, 2002 *K. Šumberová* (PRC), [growing together with *B. planiculmis*]; Kuřim, 1976 *J. Dvořák* (BRA); Mikulov, Mušlovský Střední fishpond, 2000 *M. Ducháček* (CB, HR, PRA, PRC, ROZ), [growing together with *B. planiculmis*]; Ivaň, the middle Nové Mlýny reservoir, 1982 *V. Grulich* (MMI), 1982 *Z. Hroudová* (PRA); Kostelany n. Mor., 1987 *R. Řepka* (PRA); Přerov, 1984 *Z. Hradílek* (OLM 124530); Studénka n. O., 2002 *M. Sedláčková* (NJM). **Poland**. Štětín [Szczecin], 1948 *Reitmayerová* (BRNM 78179); Miedzywodzie pow. Wolin, 1951 *J. Mądalski* (KRAM 465468); Pobrzeże Kaszubskie, Rewa, 1971 *M. Jończak* (UGDA); Tiegenhof [Nowy Dwór Gdański], 1913 *R. Gross* (B); Marienburg, [Malborg SW of Elblag], [18]91 *R. Gross* (?) (B); Mierzeja Wiślana, 1976 *M. Michel* (UGDA); Krotoschin: Tomnitz [Krotoszyn, Tomnice], 1912 *H. Bothe* (B); Rąbin k. Inowrocławia, 1959 *J. Wilkoń-Michalska* (TRN); Kulin, 1963 *M. Ceynowa* (TRN); Urbis Torunium (Toruń), Rybaki, 1973 *Gugnacka* (BRNM 544174, KRAM 216373, LBL, LOD 58592, PRC, WA 68148); Warszawa, 1967 *Z. Podbielkowski* (WA 64649); Żmigród, Sanie, 2003 *Z. Hroudová & P. Zákravský* (PRA); Wrocław, 1952 *St. Marek* (KRAM 357900, 357899, 357898, 357897); Kazimierza Mala, 1972 *Tacik & Palkova* (BP 600881, BRNU 469759, GZU, JE, W, WRSL); Pławowice, 1969 *A. Sendel* (KRA 137051); Skawina, 1949 *B. Pawłowski* (KRAM 373064); Lublin, 1999 *E. Golińska* (LBL); Slawatycna, 1963 *D. Fijalkowski* (LBL); Ostrów Dolny, 1988 *J. Kędzierska* (KRAM 394923); Hurko (k. Przemyśla), 1973 *J. Piórecki* (KRA 72882). **Slovakia**. Jakubov, 1990 *Z. Hroudová & P. Zákravský* (PRA); Bodíky, 1986 *Berta & Bertová* (SAV); Čalovec, 1989 *Berta & Bertová* (SAV); Komárno, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Verebély [Vráble], 1910 *Moesz G.* (BP 17209); Starý Tekov, 1941 *J. Futák* (SLO); Garam [Hron] prope Geletnek [Hliník nad Hronom], 1908 *J. Tuzson* (BP 429871); Zvolenská Slatina, mineral water spring, 2002 *Z. Hroudová & P. Zákravský* (PRA); Somotor, 2002 *Z. Hroudová & P. Zákravský* (PRA); Strážne, 1985 *Z. Hroudová & P. Zákravský* (PRA); Velké Raškovce, 1985 *Z. Hroudová & P. Zákravský* (PRA); Zemplínska Šírava dam reservoir, Klokočov, 2002 *Z. Hroudová & P. Zákravský* (PRA). **Hungary**. Pápa, Marcal river, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Alt Ofen [Budapest], 1866 *J. Dorner* (BP 235931); Erzsébetfalva [Budapest], 1909 *A. de Degen* (BP 358060, 17189, BRNM 544163, GZU 98183, JE, LI 131163, PRC, SO 8985, SOM 8600); Szigetszentmiklós, 1919 *A. Boros* (BP 409644); Szigetcsép, 1919 *A. Boros* (BP 409642); Gávavencselló, 1990 *L. Felföldy* (BP 552774); Tiszabercel, 1990 *L. Felföldy* (BP 552771); Tisza oxbow near Tiszalök, 1995 *Z. Hroudová & P. Zákravský* (PRA); Tokaj, Tisza river, 1995 *Z. Hroudová & P. Zákravský* (PRA); Miskolcz, 1904 *J. Budai* (BP 17175). **Serbia**. Temeskubin [Kevevára=Kovin], 1911 *J. Tuzson* (BP 422410). **Romania**. Banat, Distr. Arad, Zâdâreni, Romania. Süsswasser, 1999 *Gh. Groza* (LI 367884); Albae Carolinae [Alba Iulia], 1858 *Haynald* (BP 384077); Sibiu, 1970 *coll. ?* (LI 216124); Bosanci südl. von Suceava, 1965 *H. Heltmann* (LI 474280); Comana, 1882 *D. Grecescu* (PRC). **Bulgaria**. Mezdra, 1960 *Iv. Penev* (SO 8972); Rezovo, 1921 *B. Achtaroff* (SOM 8627, 8661). **Moldavia**. Kopanka, 1959 *Proskurina* (LE). **Ukraine**. Babina k. Sambora, 1932 *J. Mądalski* (BP 34264, BRNU 357329, KRA 210888, KRAM 465481, PRC, WA 39518); Prov. Kharkov, distr. Starobielsk, 1905 *I. Schiraevsky* (BP 578751). **Lithuania**. Kowno [Kaunas]: Njemenufer, 1899 *O. von Moellendorf* (GLM 108264). **Estonia**. Arensburg, s. d. *W. von Bruttau* (LE). **Russia**. Königsberg i. Pr. [Kaliningrad], 1870 *C. Baenitz* (BP 34278, W), s. d. *C. Baenitz* (BP 34267); Okr. Pskov, ovrag u Barshovits, [18]96 *Shtolc ?* (LE); Voronezhskaia gub., Pavlovskii uezd, 1914 *F. Dingelshtadt* (LE); Novocherkassk, u r. Aksaia, 1911 *A. Jakushev* (LE); Bl. Orenburga, 1893 *D. Litv.* (LE).

Bolboschoenus maritimus

Great Britain. Ayrshire, 1837 *J. Verange* (M 80432); Aberystwyth, Aberdyfi, 2003 *F. Krahulec, C. Stace, A. Chater & A. Agnew* (PRA); Oxwich Bayreut [Bayrett?], 1903 *H. J. Riddelsdell* (B); Wales: Glamorgan, Weobley Castle, 1992 *I. Růžička* (BRNM 608311); Norfolk: Wolferton, 1943 *A. Środoń* (KRA 210821); Woolwich (part of London), 1887 *Eyrr Ayrspegrup[?]* (B). **Portugal**. Ria de Aveiro, 1933 *Tavares de Souza* (LISI); Vagos, na estrada Ilhavo-Mira, 1961 *J. Paiva* (PR 240655); Aveiro, Ilhavo, Ponte Velha da Vagueira – Costa Nova, 1979 *A. Marquez* (B); Caldas da Rainha in fossis l. Aquas Santas, 1938 *W. Rothmaler* (JE); A Costa de Caparica, environs de Lisbonne, 1877 *J. Daveau* (PRC); Prope Trafaria, 1840 *Welwitsch?* (P 250090); Grandola: Melides, 1981 *J. D. Fernandes* (LISI); Alcácer do Sal, 1960 *J. de Vasconcelos* (LISI); Almansil, Garrao, 1964 *J. Martins Farrajota* (LISI); Algaria, 1883 *J. d´A. Gimes* (BRNM 08166/38); Tavira: Perto do Forte do Rato, 1988 *J. C. Costa* (LISI); Castro Marim, Reserva, 1978 *Sonsa & Monjardino* (LISI). **Spain**. Los Cabezudos, Arrojo de la Canada river, 2000 *J. Štěpánková & V. Jarolímová* (PRA); Trebujena, near the Guadalquivir river, 2000 *J. Štěpánková & V. Jarolímová* (PRA); Monteagudo de las Vicarías (Soria), 1969 *A. Segura Zubizaretta* (M 80384); Las Penas de Riglos, Triste, 1970 *P. Chouard, P. Montserrat & L. Villar* (B, BRNM 445217, M 80385, MSB 1600); Bei Lerida, 1951 *W. Rauh* (M 80382); Costas de Barcelona, 1929 *F. Sennen* (KRA 210889); Roda de Bara kolo Tarragona, 1970 *J. Mądalski* (KRAM 465458); Rosas, under a citadel, 2000 *L. Moravcová* (PRA). **France**. Watt bei Plounéour-Trez nördlich Lesneven, 1962 *Leuze & Doppelbaur* (M 80352); Laita estuary (near Concarneau), 2002 *É. Collias* (PRA); Pontorson, versus Mt. St. Michel, 1926 *K. H. Rechinger fil.* (BP 34265); Cherbourg, 1887 *L. Corbière* (M 80351); Chemin des hespignieux Ruissaux, 1900 *H. Slink* (M 80349); Près de Caen (Calvados), 1842 *V. Preising* (BRNU 300915); Honfleur, s. d. *Lechevallier-Lejumel* (P 250077); Somme: à Noyelles-s-Mer, 1910 *É. Bécourt* (BP); Pt. Walde bei Calais, 1940 *H. Merxmüller* (M 80353); Sarreguemines (Moselle), 1840 *F. G. Schultz* (JE, W); Verthmil nordwestl. Bordeaux, 1941 *K. Preis* (PRC); Layrac, 1881 *C. Arnaud* (B, BP 34386, PR); Puy-de-Dôme, 1893

Herb. S. E. Lassimonne (WA); Perpignan, à Canet, 1878 *O. Debraux* (P 250057), 1933 *D. Noecz* (BP 34261); Fitou (Aude), 1891 *A. Respaud* (P 250061, 250062, 250053, JE); Lac de Salegon, au NW de Clermont-l' Hérault, 1982 *J. Lambinon* (BRNM 415210); Montpellier, s. d. *Herb. Petit* (PRC); Nimes, s. d. *Herb. Petit* (PRC); Canaux à Arles, 1864 *Duval* (P 250064); Camarque, Tour du Valat Wild Reserve, 1995 *A. Charpentier* (PRA); Toulon: Castignoux, 18? *Augerde* (M 80342). **Belgium**. Dunes à Knocke, 1879 *herb. O. de Dieudonné* (GZU 14141). **The Netherlands**. Hulst (Flandre zélandaise), 1970 *J. Duvigneaud* (B, BRNM 445214, M 80425, MSB 1601). Kwade Hoek, 1989 *O. Clevering* (PRA); Grevelingen, 1989 *O. Clevering* (PRA); N-Beveland, 1989 *O. Clevering* (PRA); Dijkwater, 1989 *O. Clevering* (PRA); Willemstad, 1989 *O. Clevering* (PRA); Goeree – Overflakee, 1980 *D. Podlech* (MSB 1587); Insel Texel, 1977 *H. Becker* (LI 867477); Lauwersmeer (between Groningen and Friesland), 1989 *O. Clevering* (PRA). **Germany**. Spikeroog, 1955 *A. Ludwig* (JE); Borkum, 1893 *F. Wirtgen* (B); Hauke-Haien-Koog NW of Bredstedt, 1969 *K. Larsen, L. Holm-Nielsen & S. Jeppesen* (BP no. illegible, GZU 14107, JE, KRA 66229, LD, M 14107, PR, W); Bremenhaven, 1957 *I. Straus* (B); Cuxhaven, 1883 *K. Fritsch* (GZU 14125); Flensburg, 1877 *G. Weidemann* (JE); Am Strande des Kieler Hafens, 1908 und 1910 *Ohl* (B, BRNU 10870, 477799, GZU 013708, 13698, M 80493, PR 10801, PRC); Hiddensee, 1986 *O. Skácelová* (BRNM 506979); Wismar: Ostufer des Boiensdorfer Werder, 1985 *H.-J. Zündorf* (herb. Zündorf); Rügen: Binz, 1904 *G. Hirte* (PR 60814); Usedom: Mölschow, Zecherin, 1985 *H.-J. Zündorf* (herb. Zündorf); Darss: In ports ad Saaler Bodden, 1956 *Chrtek & Soják* (PR); Salzdahlum, 1885 *E. Krummel* (M 80259); Nauen, 1901 *F. F. Schulz* (JE); Rüdersdorf b./ Berlin: Minitzsee, 1942 *W. Lemke* (JE); Saalkreis bei Benkendorf, u. Halle/S., 1994 *Kästner* (WU); Leipzig, in Hafengelände Lindenau, 1952 *J. Duty* (JE); Artern, 1906 *Sagorski* (JE); Bei Sömmerda, 1940 *E. Bradler* (JE); Laubenheim, Mainz, 1956 *M. Steiner* (MSB 1594); Wisselsheim (Bad Nauheim), 2003 *Z. Hroudová*, *P. Zákravský & T. Gregor* (PRA); Bahngelände westlich Buchloe, 1975 *Glöggler & Dörr* (M 80228); Kreis Regensburg, Tegernheim, 1906 *Zinsmeister* (M 80241). **Denmark**. Ostseekiste bei Kolbog (?) [Kolding], 1994 *Kästner* (WU); Ishoj, SW of Copenhagen, 1980 *A. Hansen* (B, BRNM, M 80408); Zealand: W of Nykobing, 1964 *N. Jacobsen & J. Svendsen* (M 80497, W); Insel Mon, S Hegningen, 1998 *Dürby & Meyer* (B); Bornh.: Soseodde, 1896 *O. R. Holmberg* (PR 207231); Bornholm: Olea, 1896 *O. R. Holmberg* (LD). **Norway**. Am Fjord 20 km hinter Oslo, 1980 *M. Meyer* (B); Vid Kristiania, 1845 *N. Noe?* (BP 34280); Isle Tjøme, Ormelet, 2003 *P. Koutecký* (CBFS). **Sweden**. Bahusia. Prope „Fjällbacka", 1910 *E. Almqvist* (B, PRC); Hallandslän, Falkenberg, Skrea Strand, s. d. *Weber* (B); Viken, 1947 *R. Dahlgren* (LD); Landskrona, 1902 *O. J. Hasslow* (BRNU 310548, LD), 1918 *F. H. Ander* (LD), 1925 *B. Lindquist* (LD); Barsebäck-hamn, 1990 *Z. Hroudová & M. Vidén* (PRA); Lund. Bjärred, 1908 *C. M. Rydén* (LD); Par. Steninge, Steningebruk, 1969 *S. Snogerup* (LD); Par. Halmstad, 1948 *H. Anderson* (LD); Kullaberg-Mölle, 1980 *E. Koziol* (WRSL 8883); Lomma, 1924 *J. Linders* (LD); Ven, 1948 *B. Bohlin* (LD); Burlöv, 1951, 1953 *J. Johansson* (LD); Malmö, 1892 *O. R. Holmberg* (LD), 1899 *O. R. Holmberg* (B, BP 34397, KL 95553, KRA 210814, LD, LI, M 80388, 80393, PR, PRC), 1901, 1906 *D. Hylmö* (LD), 1906 *H. Granvik* (LD), 1924 *R. von Steijern* (LD), 1930 *S. S. Forsell* (LD); Tygelsjö, 1893 *R. Herlitz* (BRNU 6379, LD, PR 220076, W), 1895 *R. Herlitz & M. Lorenzen* (WA); Hvellinge [Vellinge], 1887 *N. Svensson* (LD), 1888, 1889 *G. Johansson* (LD), 1898 *Hj. Möller* (LD), [18]98 *C. Jacobaeus* (LD); Trelleborg, 1995 *V. Žíla* (LI 237638); St. Hammars sn., Häleviken [Höllviken], 1941 *Th. Lange* (LD); Övad: vid Vombsjön, 1939 *H. Weimarck* (LD); Kivik, 1896 *O. R. Holmberg* (B, LD, WA 105915); Karlskrona, 1917 *B. Holmgren* (LD); Ramdala 1905 *J. Erikson* (LD); Öland. Borgholm, 1921 *Hj. Holm* (LD); Öland. Böda, 1933 *I. Jungstedt* (LD); Ö. G.: Jonsberg sn. Munkholmen, 1885 *F. Elmqvist* (M 80396); Ex insula Muskö, s. d. *Levin* (BP 34316); Gotland: Klentehamn, 1914 *E. Th. Fries* (LD). **Switzerland**. Roche, Valais, s. d. *Mermod* (M 80376); Sion im Kanton Wallis, 1900 *F. O. Wolf* (BRNU 10655, JE, WA). **Italy**. Venetia, Lazise provinc. Veronae, [18]86 *Rigo* (JE); Südlich San Giorgio di Nogaro in Ausa Corno, 1992 *H. Melzer* (GZU, KL 83685, LI 115840, herb. Melzer); Kanaltal (Val Canale), bei Pontebba (früher Pontafel), 1992 *Melzer* (GZU, LI 115832, herb. Melzer); Tyrrhenia [Tirrenia], s. d. *R. Wagner* (GJO 26232/1478); Fiumicino, 1866 *Haynald* (BP 34373); Ravenna, s. d. *R. Wagner* (GJO 26232/1471, 26232/1474); Santo Giuliano kolo Wenecji, 1967 *J. Mądalski* (KRAM 465453); Cavallino, [18]55 *Jw. (herb. J. Eggler)* (GZU 87605); Caorle, s. d. *R. Wagner* (GJO 26232/1479, 26232/1473); Bei Gut Fontana n. Ligniano-Sabb., 1959 *R. Düll (Doll?)* (JE); Grado, [18]56 *E. Dechant* (LI); 1937 *V. Nábělek* (SAV); Zw. Rojans u. Miramare, 1886 *Beck* (PRC); An der Straße von Triest nach Miramare, [18]85 *V. Engelhardt* (B); Straße von Barcola nach Miramare, 1892 *Nezouri?* (B); Trieste, ad Zaule, 1886 *G. Arend?* (B); 1906 *H. Laus* (BRNU 18173); Triest, bei Bariola, 1906 *coll. ?* (M 80361). **Austria**. Kufstein, 1912 *L. Keller* (PRC); Schönauer Teich [Schönau a./d. Triesting], [19]63 *R. Schiefermair* (GJO 25343); Am See von Breitensee, 1888 *Beck* (PRC); Moosbrunn, 1935 *R. Wagner* (GJO 26232/1469); Zwischen Mödling und Laxenburg, 1923 *K. Ronniger* (W); Oberwaltersdorf, WSW vom Grillenbühel, 1998 *W. Till* (WU); Untere Lobau, 1996 *Potter Dods* (LI 389539); Neusiedlersee bei Neusiedel, 1864 *J. Kerner* (GZU 3800); Neusiedlersee-Westufer bei Rust, 1983 *A. Aron & E. Bregant* (GJO 25509/6); Podersdorf a. Neusiedlersee, [19]50 *R. Schiefermair* (GJO 25343), 1960 *A. Ruttner* (LI), 1961 *A. Lonsing* (LI 51145); Bei Apetlon, Mosado Lacke, 1954 *H. Melzer* (Herb. Melzer); Illmitz, Kirchsee, 1992 *L. Mucina* (LI 367582, WU); Breitenbrunn, 1996 *F. Grims* (LI 256546, 256547, 256548); St. Andrä am Zicksee, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Lange Lacke, [19]67 *E. Feichtinger* (LI 79/113); Seewinkel, Schwarzseelacke vor Wallern, 1993 *A. Aron* (GJO 26270/3). **Czech Republic**. Františkovy Lázně, Soos, 1999 *E. Zamazalová* (PRA), 2001 *M. Ducháček* (CB, HR, PRA, PRC, ROZ); Teplice, 1987 *K. Šotola* (CHOM 19717, PRC); Bečov [near Most], 1983 *L. Hrouda* (PRA); Nový Dvůr, near the road from Lenešice to Břvany, 2000 *Z. Hroudová, P. Zákravský & M. Ducháček* (PRA), [growing together with *B. planiculmis*]; Písty near Budyně nad Ohří, 1998 *J. Sládek* (CHOM 26757); Koštice bei Libochovice, 1995 *K. Kubát* (LI 247182); Prague: Štěrboholy, 1999 *Z. Hroudová & P. Zákravský* (PRA), 2001 *M. Ducháček* (CB, HR, PRA, PRC, ROZ, herb. Příbram), [growing together with *B. laticarpus*]; Všechlapy, Nivice fishpond, 2002 *J. Rydlo* (ROZ); Metličany, 2000 M. Ducháček (CB, HR, PRA, PRC, ROZ), 2001 *M. Ducháček* (PRA, PRC, herb. Příbram); Mikulovice u Znojma, 1993 *R. Řepka* (PRA); Sedlec near Mikulov, 1961 *J. Chrtek & B. Křísa*

(PRC); Starovice, 1996, 1998 *Z. Hroudová & P. Zákravský* (PRA), 2001 *M. Ducháček* (CB, HR, PRA, PRC, ROZ, herb. Příbram); Vacenovice u Kyjova, 1996 *R. Řepka* (PRA). **Poland**. Swinemünde, Swineufer, 1893 *R. Ruthe* (B, LI, WA), 1894 *R. Ruthe* (BP 34400, JE, PR, PRC, WA 102197), 1896 *R. Ruthe* (KRA 210835, WA), 1901 *A. Lüderwaldt* (B, GZU 014111, 014152, PR, PRC, W); Wyspa Uznam, k. Bożyc, 1956 *H. Piotrowska* (UGDA); Štětín [Szczecin] 1948 *Reitmayerová* (BRNM 78179); Dziwnów, pow. Kamien Pomorski, 1949 *J. Mowszowicz* (LOD 132416); Kolobrzeg, 1947 *J. Mądalski* (KRAM 465473); Leba, Leba Lake, 1983 *P. Zákravský* (PRA); Danzig [Gdańsk], [18]72 *C. Baenitz* (BP 34370, 34376, 34407, W); Thorn [Toruń], 1885 *G. Froelich* (JE); Kórnik, shore of the lake, 1983 *P. Zákravský* (PRA); J. Borzymowskie, [19]83 *L. Samosiej* (LOD 84588); Ciechocinek, 1973 *L. Fagasiewicz* (LOD 89292); Łęczyca-Leszne, 1961 *R. Olanek* (LOD 132413); Breslau: Oltaschin [Oltaszyn], s. d. *coll ?* (B); Militsch: Bahnhof [Milicz], [18]89 *Callier* (WA 81020); Striegau [Strzegom N of Walbrzych], 1870 *J. Zimmermann* (GLM 115474); Kapelanka [Kraków], 1910 *A. Żmuda* (WA 39520); Owczary k. Buska, 1974 *R. Ochyra* (KRAM 226836). **Slovakia**. Záhorie: Kúty, 1978 *Josef Dvořák* (BRA); Sekule, 2002 *Z. Hroudová & P. Zákravský* (PRA); Šúr pri Bratislave [Šúr near Sv. Jur], 1942 *Dr. Fr. Nábělek* (SAV), 1956 *J. Berta* (SLO); Bratislava – mokriny za Dynamitkou, 1972 *Feráková* (SLO); Pri Okánikove, 1980 *Májovský* (SLO); Pag. Iža, 1987 *V. Žíla* (LI 220939); Patince, 1963 *Šomšák* (SLO); Žitný ostrov, Šuľany pri Dunaji, 1951 *Hejný* (SLO); Palárikovo 1960 *M. Manica* (ZV 6759); Kamenín, 1965 *Májovský* (SLO); Luboreč dam reservoir, 2002 *Z. Hroudová, P. Zákravský & R. Hrivnák* (PRA); Malý Kiarov, Kiarovský močiar, 2002 *Z. Hroudová, P. Zákravský & R. Hrivnák* (PRA); Lučenec, 2002 *Z. Hroudová, P. Zákravský & R. Hrivnák* (PRA); Vojany, 1985 *Z. Hroudová & P. Zákravský* (PRA). **Hungary**. Dorog, Sátorkö-puszta, 1998 *N. Bauer* (BP 622738); Dunaszeg, 1995 *L. Felföldy* (BP 244480); Balf, 1949 *A. Károlyi* (BP 289626); Tihany, 1955 *L. Felföldy* (BP 500416); Gárdony, lacus Velence, 1953 *A. Borhidi* (BP 615106); SE Fonyod, 1975 *F. Krendl* (W); Szikszó, 1909 *L. de Thaisz 544164* (BRNM), *403319* (BP), *98184* (GZU); Nyíregyháza, 1926 *Á. Boros* (BP 409638); Szabolcsveresmart, 1995 *Z. Hroudová & P. Zákravský* (PRA); Pr. opp. Szolnok, 1956 *A. Károlyi* (BRNU 405236); Farmos, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Erzsébetfalva infra Budapest, 1913 *J. B. Kümmerle* (BP 17157, 403322, GZU 13707, JE, M 80498, PR 12173, PRC, W, WU); Apaj, 1996 *L. Felföldy* (BP 590203); Kün-szent-Miklós, 1912 *S. Jávorka* (BP 17153); Inter Izsák et Ágasegyháza, 1980 *J. Szujkó-Lacza* (BP 498666); Szabadszállás, Kis-Rét lake, 1995 *Z. Hroudová & P. Zákravský* (PRA); Büdöszék, 1995 *Z. Hroudová & P. Zákravský* (PRA); Mindszent, 1952 *A. Boros* (BP 409640); Szatymaz, channel near Fehér-tó lake, 1995 *Z. Hroudová & P. Zákravský* (PRA); Békéscaba, 1926 *S. Jávorka* (BP 17134). **Slovenia**. Pirano u Terstu [Piran], 1905 *Fr. Nábělek* (BRNU 54147); Salinen v. Santa Lucia b. Pirano, 1914 *H. Laus* (BRNU 18213). **Croatia**. S Novigrad, 2000 *Ch. Schröck* (LI 455560); Pola, Val Marecchio, 1893 *K. Untchj* (GZU 14147); Fiume [Rijeka], s. d. *Noë* (BP 387154); Pag isle, Metajna, 2002 *L. Moravcová* (PRA); Obrovac, 1913 *Degen* (BP 17150); Ad Jamnica acidulas [Jamnicka Kiselica], 1859 *L. Farkaš-Vukotinovič* (BP 34326, 34329, M 80434, WU); Spalato [Split], 1886 *Brunell* (B); Ston veliki (Stagno grande), 1910 *A. Latzel* (BRNU 320594). **Montenegro**. Ad Igalo (Sutorina), 1891 *Vandas* (PR). **Serbia**. Siebenburgen. Torda, 1893 *Sagorski* (JE), [19]15 *F. Pap* (BP 17199), s. d. *Herb. P. Hora* (PRC)` Deliblat, 1913 *S. Mágocsy Dietz* (BP 403306). **Albania**. Laco Martina prope fl. Vojussa, 1894 *A. Baldacci* (PR). **Greece**. Peloponnisos: Papas lagoon [Mesolongi], 1988 *L. Koumpli-Sovantzi* (B); Achaia. Psatopyrgos ad sinum Corinthiacum, 1893 *Halácsy* (WU); Euboea: Kato Potamia (Platana) prope Kyumi, 1969 *Rechinger* (B 10 0108636); Korfu (Kerkyra), Halbinsel N von Kontokali, 1991 *P. et H. Wittmann* (LI 87161); Kreta, Hania, 1983 *H. Risse* (B). **Romania**. Nikolincze, [Nicolint], 1903 *Bernatsky* (BP 17164); Cioroboren: kolo Flăminda, 1974 *J. Mądalski* (KRAM 465455); Albae Carolinae [Alba Iulia], 1858 *Haynald* (BP 384077); Someseni, 1992 *Gh. Groza* (LI 161998); Cojocna, 1995 *Gh. Groza* (LI 230152, 230153); Mezözáh, 1910 *Jul. Butujás* (GZU 98185); Monora [Donnersmarkt=Manarade], 1881 *J. Barth* (JE),1889 *J. Barth* (M 80444); Langenthal [Valea Lunga], 1874 *J. Barth* (BP 348461); Bahlui, Reserv. Valea lui David, 1979 *H. Lippold* (JE); Pag. Filipeşti, prope vicum Oruşcari, 1971 *D. Mititelu, N. Barabaş & L. Mititelu* (PR); Wäldchen/Flugplatz von Buzau, 1954 *Heltmann* (LI 474279); Ursiceni, ad stat. viae ferreae Halta Barbulesti, 1969 *M. Deyl* (PR); Sulina, 1971 *T. Şesan-Frăţilescu* (B, WA, SO 85436); Constanţa Moor, 1995 *Gh. Groza* (LI 229312); Mamaia, na břehu jezera, 1961 *J. Reitmayer* (BRNU 410312, 410315), 1967 *J. Šmarda* (BRNM 544171, 544172, 544173). **Bulgaria**. Circa urbem Novi-Pasar [Novi Pazar], 1901 *B. Davidoff* (SOM 8655); Prope urbem Balčik, 1907 *B. Davidoff* (SOM 8601), 1936 *J. Berger* (BRNU 291950); Albena, na břehu Černého moře, 1971 *O. Jakeš* (BRNM 544180); Inter lacum Šabla et Pontum prope Varnam, 1901 *B. Davidoff* (SOM 8595), 1920 *B. Davidoff* (SOM 8605), 1922 *B. Davidoff* (SOM 8622); Prope urbem Pomorie ad Pontum, 1967 *E. Božilova* (SO 8977); Prope urb. Nesembria, [Messembria=Nesebar], 1906 *B. Davidoff* (SOM 8653); Sozopol, 1938 *G. Brižický* (BRNU 297507); Burgas, Atanasovské jezero, 1963 *J. Šmarda* (BRNM 544161, 544177); Dobrugea, Blatnitsa, 1965 *Vicherek* (BRA); Burgasko, Vajakojskoto blato, 1928 *D. Jordanov* (SO 18950). **Ukraine**. Zakarpat'e. Bliz Mukacheva, 1954 *K. N. Igoshina* (LE); S. Bzov, Borisiovskii r--n, Kievsk. okr., 1928 *I. Zoz* (KW); M. Bila Cerkva, 1924 *M. Prodzoichts* (KW); Kiivska okr., Barishevsk. r., s. Liinski, 1930 *G. Chernogolovko & N. Litveienko* (KW); Melitopolskii okr., Novotroitskii r--n., s. Novomikhailovka, 1927 *Levin* (KW); Ostrov Biriuchii v Azovskom more, 1927 *coll. ?* (KW); Novo-Troickii okrug, Overianovskoe, 1927 *Kotov* (KW); Tauria [Krym]: Eupatoria, lacus Sasyk, 1977 *V. Vašák* (M 80429, W); Distr. Mariupol, Bilosaraiskaia kosa, 1927 *S. Poltichan* (KW). **Finland**. Satakunta, Pori, Tahkoluoto, 1967 *R. Alava, K. Alho & U. Laine* (BRNU 533056, M 80402); Askainen, Lempisaari estate in Lemsjöholmen, 1972 *S. Hinneri & U. Laine* (BRNU 476131, JE, M 80406, W); Katrinedal prope Aboam [Aboa=Turku], 1885 *H. Hollmén* (M 80397); Uusimaa (U/N). Tammisaari: Björknäs, 1939 *H. Luther* (M 80409); U. Helsinki. Munkkiniemi, near Tarvo-island, 1936 *O. Seppänen* (JE). **Estonia**. Ostr. Ezel, bl. Arensburga, 1898 *F. Buze* (BRNU 92018, LE, W). **Russia (in Europe)**. Uryupinskii raion, Khutor Gramlenovskii, 1830 *A. I. Aliushin* (LE); Districtus Frolovo, prope Guliaevka, 1963 *A. K. Skvortsov* (M 80452); Flora Donskoi oblasti. Ilovlinskaya st. [Ilovlia], 1883 *D. Litvinov* (LE); Saratovsk. gub. Okr. g. Khvalynska, 1924 *K. Ju. Gross* (LE); Ufimskaya gub., Sterlitamakskii uezd, bliz d. N.-Aburakhmanova, 1915 *I. V.*

Novopokrovskii, E. S. Zaicev & P. Ch. Michailov (LE); Orenburgskii okrug, vodorazdel rek M. i V. Churana, 1930 *Ju. D. Suchova* (LE).

Bolboschoenus planiculmis

France. Circa „Bazougei" Sarthe. [Bazougers ?], 1901 *Chevallier* (B). **Germany**. Am Saarufer bei Merzig a/Saar, s. d. *F. Winter* (M 80285); Im Mannheimer Flußhafen, 1889 *F. Förster* (M 80317); Altmühlsee bei Muhr am See, 1995 *Th. Schauer* (M 80210); Sumpf bei Hummelstein [Nürnberg], 1901 *O. Prechtelsbauer* (BRNM 08167/38, PR 12847); Prope Ratisbonam auf dem Bruderwörth (s. d. *s. coll., herb. E. Ritzberger* (LI), s. d. *Saxinger* (LI); Kreis Regensburg. Am Fuße der Schwabelweiser Berge, 1897 *F. Vollmann* (M 80201); Amtgerichtsbezirk Stadtamhof, Tegernheim, 1906 *L. Gerstlauer* (M 80217). **Switzerland**. Lac de Neuchâtel à Auvernier, 1876 *E. Gardy* (BP 34287); Cudrefin (Canton de Vaud), 1874 *s. coll.* (BP 710968, BRNM 08159/38, W); Kr. Freiburg: Sugiez, bei Le Péage, 1951 *E. Berger* (M 80378); Wassertümpel zw. Zürich u. Alt-Stütten, 1888 *F. Käser* (B); Vorbahnhof Zurich, [18]89 *Wilizek* (JE). **Italy**. Nervia, s. d. *R. Wagner* (GJO 26232/1167); Pavia (Lombardia), 1879 *O. Penzig* (B, JE); Venetia. Prope Peschiera, 1882 *Rigo* (JE); Triest, s. d. *M. Veth* (B). **Austria**. Zwischen Poysdorf und Herrnbaumgarten, 1994 *H. Melzer* (herb. Melzer), 2003 *Z. Hroudová, J. Danihelka, M. A. Fischer & G. Fischer* (PRA), [growing together with *B. yagara* and *B. laticarpus*]; Hohenau, E des Ortes Bernhardsthal, 1992 *J. Walter* (LI 394930, 394929); Austrian border (between Bernhardsthal and Lanžhot), 2004 *W. Lazowski* (PRA); Bei Marchegg, 1895 *K. Fritsch* (GZU 14120); Bei Lassee, 1921 *J. Vetter* (W); Moosbrunn, 1997 *W. Till* (WU); Sieveringer Teiche [Wien], 1878 *G. Beck* (PRC); Wien, s. d. *J. Ortmann* (BP 34343, 34967, BRNU 336051), s. d. *J. v. Kovács* (BP 34301, 34303, 34312), 1878 *Fleischer* (PR); Oggau, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA), [growing together with *B. maritimus*]; Seewinkel, Wallern, 2001 *H. Melzer* (LI 447860), (KL 102282). **Czech Republic**. Zdice, 1987 *Z. Hroudová & P. Zákravský* (PRA); Zaječice, 2000 *M. Ducháček* (CB, PRA, PRC); Dobroměřice, 1991, 1996 *Z. Hroudová & P. Zákravský* (PRA); Černiv, 1987 *K. Kubát* (LIT 68259); Inter vicos Chlumín et Obříství, 1962 *J. Soják* (BP 596434, BRNU 422286, GZU, M 80426, W); Vinoř (Prague), 1986 *Z. Hroudová & P. Zákravský* (PRA); Čečelice, 1997 *J. Rydlo* (ROZ 72421); Český Brod, 1998 *Z. Hroudová & P. Zákravský* (PRA), [growing together with *B. laticarpus*]; Dolní Rokytňany, 1999 *Z. Hroudová & P. Zákravský* (PRA), 2000 *M. Ducháček* (PRA, PRC), [growing together with *B. laticarpus*]; Česká Skalice, Rozkoš dam reservoir, 1991 *F. Krahulec* (PRA); Vysoká nad Labem, 2004 *P. Zákravský* (PRA); Rousínov, Dolní Jelení – Újezd u Chocně, 2001 *M. Ducháček* (HR, PRA, PRC, ROZ); Olbramkostel, Vlašňov fishpond, 1992 *A. Jordánová* (MZ 13004); Moravičany, Moravičanské jezero, 1994 *Z. Hroudová & P. Zákravský* (PRA); Kobeřice u Brna, Horáček fishpond, 2002 *K. Šumberová* (PRC), [growing together with *B. laticarpus*]; Kojetín, 1947 *J. Reitmayer* (BP 684219, BRNM 135002, GZU 42067, JE, M 80499, OLM 73328, OP 70477, PRC, SAV, SLO, W, WA); Želetice, 1996 *Z. Hroudová & P. Zákravský* (PRA); Mitterteich bei Eisgrub in Mähren, 1910 *H. Zimermann* (BP 34394, JE), [mixed sheet with *B. maritimus*] (GZU 14130); Dobré Pole, 1982 *Z. Hroudová & L. Hrouda* (PRA); Sedlec, Mlynářka fishpond, 1995 *Z. Hroudová & P. Zákravský* (PRA), 1995 *J. Danihelka* (MMI), [growing together with *B. laticarpus*]; Kobylí, Kobylské jezero, 1995 *M. Rigasová* (MMI); Lanžhot, 1996 *Z. Hroudová & P. Zákravský* (PRA), [growing together with *B. laticarpus*]. **Poland**. Štětín [Szczecin], 1948 *Reitmayerová* (BRNM 78180); Toruń, 1922 *s. coll.* (WA 39532); Kaszyce Wielkie, 2003 *Z. Hroudová & P. Zákravský* (PRA); Zielony Dąb pow. Milicz, 1965 *Ciacura* (KRAM 357891); (---) bei Oslau (Schlesien) [Osła near Bolesławiec], 1835 *Winkler* (PR); Glumbowitz a. Wohlau [Glebowice, Wolow], 1891 *Schwarz* (M 80439); Bialystok Centralny, 1972 *Sokolowski* (BIL 48159); Pilaszków, b. pow. Pruszków, 1966 *K. Nowak* (WA 77332); Kazimierza Wielka, 2003 *Z. Hroudová, P. Zákravský & J. Wójcicki* (PRA); Zbiornik Rożnowski. Tęgoborze, 1973 *Loster* (KRA 128173). **Slovakia**. Brodské, 1990 *Z. Hroudová & P. Zákravský* (PRA); Záhorská nížina: Jakubovský rybník, 1983 *Kmeťová & Peniašteková* (SAV); Medzi Lábom a Plaveckým Štvrtkom, 1965 *J. Májovský* (SLO); Chotín, 1958 *J. Májovský* (SLO); Dolný Štál, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Komárno, Parížske močiare, 1988 *V. Žíla* (LI 220940); Priehrada Domaša, 1972 *L. Dostál* (SAV); Koláre, 2002 *Z. Hroudová, P. Zákravský & R. Hrivnák* (PRA); Somotor, Mrtvy Bodrog, 1958 *Val. Pospíšil* (BRNM 460350); Örös, Zemplin [Strážne], 1928 *A. Margittai* (BP 17168); Velký Kamenec, Veľká Karčava, 1985 *Z. Hroudová & P. Zákravský* (PRA); Benkovce: okolo Ondavy (Karchovik), 1972 *Králik* (SLO). **Hungary**. Balatonszentgyörgy, 1937 *Jávorka & Zólyómi* (BP 17154); Between Enying and Simontornya, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Budapest X. in campis „Felsörákosirétek", 1990 *L. Felföldy* (BP 552773); Csepel, ad pag. Tökol, 1891 *G. Perlaky* (BP 387142); Sátoraljaújhely, 1997 *G. Pelles* (BP 618465); Ad ripas rivi Karcsa, 1927 *Egey A.* (BP 403325); Gávavencselló, 1990 *L. Felföldy* (BP 552772); Cegléd, Gerje river, 1999 *Z. Hroudová, P. Zákravský & L. Moravcová* (PRA); Pr. Poroseló [Poroszló], 1911 *E. Jablonszky* (BP 403200); Békés, Kövöstarcsa, 1928 *Riegler* (KO 7927). **Slovenia**. Ober-Ležeče prope pagum Britof, s. d. *Justin* (BP 34391, 34403, GZU 14153, 14154). **Croatia**. Veglia [Krk]. Porto Allegro (?), 1839 *Noë* (BP 34285); Säuerlings b. Jamnica (Javnica) [Jamnicka Kiselica], 1859 *Schlosser* (BP 340201), s. d. *Schlosser* (BP 17133, BRNM, JE). **Serbia**. Prope pag. Beocsin, 1912 *Jávorka* (BP 17156). **Macedonia**. Prope urbi Kocani, 1947 *B. Kitanov* (SO 8990). **Romania**. Gross-Wardein [Oradea], 1910 *Missbach* (JE, PRC); Ad Albam-Carolinam [Alba Iulia], s. d. *Haynald* (BP 34252); Mezözáh, 1910 *J. Butujás* (BP 17212, BRNM 673520, JE, LI 131161, W); Györgyfalva in Transilvania [Gheorghieni], 1863 *Cretz* (B); Pag. Filipeşti, prope vicum Onişcani, 1971 *D. Mititelu, N. Barabaş & L. Mititelu* (B); Distr. Gorj. Tulburea, 1965 *I. Zaharia* (KRAM 96283, M 80446); B. Orsowa [Orsova], 1917 *F. Buxbaum* (W); Sulina, 1971 *T. Şesan-Frăţilescu* (PR). **Bulgaria**. Sofijsko, s. Gniljane, 1929 *D. Jordanov* (SO 8957); Pazardžiško, s. Veličkovo, 1961 *G. Gančev* (SO 8967), [mixed sheet with *B. glaucus*]; Gr. Pazardžik, 1960 *H. Vihodcevsky* (SO 32514); Ribarnika prope urb. Plovdiv, 1954 *H. Vihodcevsky* (BP 491983, BRNM 544158, JE, PRC, SO 8973, W), [mixed sheet with *B. glaucus*]: (B, KRAM 21415, SOM 111878); Gr. Karnobat, 1929 *D. Jordanov* (SO 8963) [mixed sheet with *B. glaucus*]; Šabla, 1901 *A. Javašeff* (SOM 8594). **Belarus**. Minskaia obl., Minskii r--n, zh. d. st. Kolodishchi [Kalodzisci], 1982 *N. V. Kozlovskaia & V. S. Bulat* (KRAM 407467). **Ukraine**. Między Sopowem i Peczenyżynem, 1874 *A. Ślędziński* (KRA 68957); Kamibušce (Kciubnice?) pow. Husi-

atyński [Gusjatyn], 1878 *A. Ślędziński* (KRA 68958, WA 39519); Zvenigorodskii povit, s. Lukivka, [Zvenigorodka], 1923 *M. Pidoplichka* (BP 538894); Kievskaia gub. Cherkasskii u. Okr. m. Smely, 1916 *G. Nevodovskyi* (LE); Mezh. s. Usivka [Oleksandrija] ta i St. Bukiv, Nips. okrug, 1928 *D. Zerov & K. Zerov* (KW); Der. Mamaika, vblizi Ingula, 1920 *Oksner* (KW); Apostolivetskii raion, Bazavlertski plavni [Apostolovo], 1931 *s. coll.* (KW); Provinzia Jekaterinoslav, Trituznovo, 1918 *D. Langyel* (BP503375); Zaporozhskii okr., s. Julievka, dolina r. Konki, 1930 *Dziubenko* (KW); Jekaterinoslav [Dnepropetrovsk], s. d. *Sredinsky* (LE); Krim: bei Jalta, 1943 *Rauh* (JE); Mariopol [Mariupol] (Asovo-Meer), bei Kaltschik, 1943 *Rauh* (B, JE); Donbas, Makivskii raion, s. Verkhnia Krinka, 1932 *G. Nakonechna* (KW); Khark. gub., Starobels. u., Streletskii zavod, 1910 *G. von Ettingen* (LE); Luganska obl., Milovskiy raion. Zapovednik Streletskii step, 1957 *Z. Saricheva, T. Shanrinska & O. Dubovik* (KW). **Moldavia**. Nisporenskii raion, u sel. Goregit, 1949 *A. G. Borisova & Sidorov* (LE); Kolorash [Calarasi], s. d. *Rozen* (LE); Ryshkanovka u Kishineva, 1947 *Ivanov A. T.* (LE). **Russia (in Europe)**. Jaroslavskaia obl., Rybinskii raion, d. Seltso-Makarovo, 1994 *Bobrov & Chemeris* (LE); Moskovskaia obl., Serpukhovskii raion, mezhdu Luzhkami i Respublikoi, 1959 *Shtamm* (LE); Moskovskaia obl., Serpukhovskii r--n. G. Pushchino, 1975 *L. P. Kuleshova* (B); Moskovskaia obl., Ozerskii raion. Belye Kalodezi, 1957 *G. Zagorodnaia, E. Kurchenko, Ya. Starobogalov, B. Tikhomirov & N. Shvedchikova* (LE); Vershetskaia obl., Khoperskii zapovednik, 1980 *Tsvelev ?* (LE); Peschanaia otmel r. Tsny pod Tambovom, 1921 *E. K. Kardo-Sysoevaia* (LE); Novopokrovskii raion, okr. sela Bliava, 1929 *W. Grebner* (LE); Novocherkassk, ad ripam fluvii Axaj, 1911 *A. Jakushev* (BP 34353, LE, M 80442, WA); Tishkovskie ostrovy: ostr. Staro-Vatadinskii, 1915 *K. Kosinskii* (LE); Ostr. Chetyre Bugra, s. d. *S. Korzhinskii* (LE). Saratovsk. gub., okr. g. Chvalynska, 1924 *K. Ju. Gross* (LE); Pugachevskii raion, s. Novo-Spasskoe, 1932 *L. Kuprianova* (LE); Buzulukskii uezd Samarskoi gub., reka Buzuluk, 1914 *D. Janishevskii* (LE); Orskii uezd, Orenburg. gub., mezhdu Kamenovym (Kalinovym?) i Trukmenovym, 1912 *K. A. Kosmovskii* (LE); Ilekskii rayon, u pos. Sukhorechinskoe, 1928 *A. Borisova* (LE); Zilairskii kanton. Zilairskii zernosovchoz, 1929 *S. Kucherovskaia & S. Nevskii* (LE).

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France. Le Perray (Seine et Oise): étangs St. Hubert, 1885 *D. Luizet* (P 250083); Eclaron (Der) dans la Droye, s. d. *de H'édouville* (P 250070); Dép. Ain: Cordieux, Romagne, 1984 *J. Lambinon* (M 80338); S. Baraing près Chaussin (Jura), 1854 *C. Michalet* (P 250066). **Germany**. Hoyerswerda: bei Laubusch, 1898 *H. Schäfer* (GLM 14163); Königswartha, 1953 *W. Hempel* (B); Guttau, Kr. Bautzen, 1969 *J. Dunger* (GLM 14148); Niesky: Quitzdorfer Stausee, 2001 *P. Gebauer* (GLM 45334); Deutschbaselitz, 2004 *Z. Hroudová & P. Zákravský* (PRA); Ronneburg: Wismut- Halde nordöstlich Großkundorf, 1983 *H.-J. Zündorf* (herb. H.-J. Zündorf); Plothen: Klemmteich, 1964 *H. Manitz* (herb. H. Manitz); Schleiz, Hausteich, 1986 *W. Rothmaler* (JE); Bucha, 2003 *Z. Hroudová & P. Zákravský* (PRA); Regnitzufer b. Erlangen, 1894 *Münsch* (BP 711000, PR 12549); Geisleithen, Weiher am Geisbach, s. d. *Weigend & Schätl* (M 80209). **Sweden**. Skane. Södarasen, 1907 *C. Gustafson* (PR). **Austria**. Schwarzenberg, Winklauer Teich, 2005 *Z. Hroudová & P. Zákravský* (PRA); Steinbruckhäuser, Steinbruckteich, 2005 *Z. Hroudová & P. Zákravský* (PRA); Zwischen Poysdorf und Herrnbaumgarten, 1994 *Melzer* (herb. Melzer), 2003 *Z. Hroudová, J. Danihelka, M. A. Fischer & G. Fischer* (PRA) [growing together with *B. planiculmis* and *B. laticarpus*]; Teiche bei Waltendorf bei Graz, 1909 *Fröhlich* (BRNU 189915); Schielleiten, Badeteich, 1971 *Pittoni* (GZU); Wundschuh, 1931 *B. Fest* (GZU 13699, 104107, W); Rabenhofteiche östlich von Leibnitz, 1976 *Mayrhofer & Teppner* (GZU 225093, 225092); Südwestl. Preding, 1986 *H. Otto* (GJO 25698/1); Bei St. Andrä im Sausal, 1991 *W. Holzinger* (GJO 26159/116); Hohenberg b. Gleisdorf, Meierteich, 1925 *Toncourt (herb. Eggler)* (GZU 78944), s. d. *Toncourt* (GZU 87816); Klagenf. Becken: bei Tigring nördl. Moosburg, 1972 *Leute* (KL 18265, W). **Czech Republic**. Lipno dam reservoir, Nová Pec, 1999 *J. Sádlo* (PRA); Křemže, Křemžský fishpond 2000 *M. Ducháček* (PRA); Plzeň, Velký Bolevecký fishpond, 2001 *M. Ducháček* (PRC); Nepomyšl, Velký Rohozec fishpond, 2001 *M. Ducháček* (PRA); Čimelice, Zhoř fishpond, 1973 *Z. Hroudová & L. Hrouda* (PRA); Piscina Tálínský apud Tálín, 1941 *S. Hejný* (PRC); Málkov Lnářský, V. Kuš fishpond, 1953 *J. Vaněček* (CB); Kardašova Řečice, Frajmarek fishpond, 1984 *Z. Hroudová & P. Zákravský* (PRA); Lomnice nad Lužnicí, Koclířov fishpond, 1988 *Z. Hroudová & P. Zákravský* (PRA); Jindřichův Hradec, Kačležský fishpond, 1983 *Z. Hroudová & P. Zákravský* (PRA); Přelouč, Černý Nadýmač fishpond, 2003 *Z. Hroudová, P. Zákravský & M. Ducháček* (PRA); Česká Skalice, Rozkoš dam reservoir, 1992 *F. Krahulec* (PRA); Žďár nad Sázavou, Velké Dářko fishpond, 1989 *Z. Hroudová & P. Zákravský* (PRA); Polanka nad Odrou, Velký Vaček fishpond, 1994 *Z. Hroudová & P. Zákravský* (PRA); Ostrava-Martinov, Štěpán fishpond 1990 *Z. Prymusová* (OSM). **Poland**. Görlitz: bei Hennersdorf [Jedrzychowice], 1893 *E. Barber* (GLM 45986); Haynau, Schlossteich [Chojnów NW of Legnica], 1884 *Rakete* (GLM 105696); Wolów, 1976 *E. Koziol* (WRSL 93586); Przychowa gm. Ścinawa, 1993 *E. Koziol* (WRSL); Militsch [Milicz], [18]89 *Callier* (JE); Nowy Zamek kolo Milicza, 1982 *E. Koziol* (W, WRSL); Gąski, Staw Sieczkowski, 2003 *Z. Hroudová & P. Zákravský* (PRA); Ruda Milicka, 2003 *Z. Hroudová & P. Zákravský* (PRA); Gadkowice, 2003 *Z. Hroudová & P. Zákravský* (PRA); Nieboczowy, oxbow of Odra river, 2003 *Z. Hroudová & P. Zákravský* (PRA); Wola near Miedźna, 1996 *Rostański* (B), 2003 *Z. Hroudová, P. Zákravský & J. Wójcicki* (PRA, KRAM); Lublin, Wrotków, dolina Bystrzycy, 1998 *Panasiuk* (LBL); Buda Stalowska k/Tarnobrzegu, Staw Cyranki I., 1995 *M. Wrzesień* (LBL); Sośnica okolice Przemyśla, 1993 *Zarzycki* (KRAM 424500). **Ukraine**. Babina k. Sambora, 1929 *J. Mądalski* (KRAM 465479); Sopranówka pod Podwoloczyskami, 1878 *A. Śledziński* (KRA 212881); Nižniów, 1934 *J. Mądalski* (KRAM 465462); Khhark. gub., bl. Starodnivska, 1913 *S. N. Miliutin* (LE). **Russia (in Europe)**. Insterburg. Ententeich an dem Stadtwalde, 1882 *H. Kuehn* (M 80309); Am Ufer der Oka. Kreis Kolomna, 1890 *A. N. Petuninov* (WU); Moskovskaia obl., raion Kaschira, prope Kropotova, 1969 *A. K. Skvortsov* (M 80451).