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A Taxonomic Revision of *Stuckenia* (Potamogetonaceae) in Asia, with Notes on the Diversity and Variation of the Genus on a Worldwide Scale

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Abstract A taxonomic revision of the Asian species of *Stuckenia*, a segregate of *Potamogeton*, is presented. Six species are recognized and their morphological descriptions, nomenclature and typification of relevant names are given. Distributions of all species are described and lists of representative specimens and distribution maps provided. Lectotypes are designated for 24 names and nomenclatural types are listed for 22 additional names. The correct name for the species known as *Potamogeton recurvatus* is *Stuckenia pamirica* (Baagöe) Z. Kaplan, comb. nova. Morphological variation at different levels within the genus is described and compared with different concepts of its taxonomic interpretation. Instructions on examination of key characters are given, together with a key to species. Colour photographs illustrate the general appearance of species as well as many identification details. The pattern of variation and taxonomic validity of the Siberian morphotypes *S. subretusa* and *S. austrosibirica* are analyzed. The plasticity of diagnostic characters of *P. juncifolius* and of *P. helveticus* from the European Alps, the infraspecific classification of *S. filiformis* in North America, and the taxonomic status of *S. punensis* described from Peru are also discussed.

Keywords Determination key · Distribution · Monograph · Nomenclature · *Potamogeton* · Taxonomy

Introduction

Stuckenia is a genus of Potamogetonaceae characterized mainly by the presence of long leaf sheaths, characteristic leaf and peduncle anatomy and a higher ploidy level

Dedicated to the memory of Leoš Klimeš (1960–2007) who disappeared during his last expedition to Ladakh.

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(hexaploidy) than in *Potamogeton* s. str. (generally diploids or tetraploids) (e.g., Les and Haynes 1996; Holub 1997; Haynes et al. 1998).

The first supraspecific delimitation of species now treated as *Stuckenia* appeared (under *Potamogeton*) in the first half of the 19th century in the works of several botanists. First, Fries (1828) published *Potamogeton* "tribus" *Pectinati*, which was soon followed by an unranked *Pectinati* (Reichenbach 1830), then sect. *Coleophylli* (Koch 1837), and finally unranked *Coleogeton* (Reichenbach 1845). The last name was later elevated to subgenus *Coleogeton* by Raunkiaer (1896) and when this rank was adopted by Hagström (1916) in his worldwide treatment of *Potamogeton*, this concept was widely accepted.

Approximately at that time, Börner (1912a, b) distinguished the same group as a distinct genus *Stuckenia*. The name remained neglected by botanists for a long time until it was reinstated by Holub (1984), who noted that *Stuckenia* was the correct generic name for *Coleogeton* invalidly published by Dostál (1982). This fact was overlooked by Les and Haynes (1996) who validated *Coleogeton* and so introduced a superfluous name for *Stuckenia*. A summary of the generic nomenclature is given on p. 170.

The genus *Stuckenia* has only recently been recognized by other researchers (e.g., Tzvelev 1999; Crow and Hellquist 2000; Haynes and Hellquist 2000; Ceska 2001; Haynes and Holm-Nielsen 2003). The acceptance of *Stuckenia* as a separate genus differs among authors. Although this group is indeed well defined morphologically and karyologically, and is a compact monophyletic group, arguments were also given for maintaining it at the level of subgenus (Wiegleb and Kaplan 1998). Recent molecular studies (Les et al. 1997; Chen et al. 2004; Iida et al. 2004; Lindqvist et al. 2006; Wang et al. 2007) indicate that *Potamogeton* in the broad sense represents two separate lineages, corresponding to *Potamogeton* s. str. and *Stuckenia*. However, these studies do not provide evidence for a separate generic status and neither provided a detailed comparison of *Potamogeton* s. str. and *Stuckenia* with the only other genus of *Potamogetonaceae*, which is *Groenlandia*. A molecular comparison of an extensive sample of *Potamogetonaceae* (Fehrer and Kaplan, unpubl.) indicates that *Stuckenia* is considerably divergent from the rest of the family. The *Groenlandia* lineage branches off between *Stuckenia* and *Potamogeton* in phylogenetic analyses based on the internal transcribed spacer. Genetic distances between *Groenlandia* and both *Potamogeton* and *Stuckenia* are roughly the same (16.2%–18.2% and 16.4%–18.7% P-distance, respectively). The difference between *Stuckenia* and *Potamogeton* is even larger and ranges from 16.3%–20.1%. In contrast, intrageneric variation is 0%–4.3% in *Stuckenia* and 0%–9.0% in *Potamogeton*. These facts warrant treatment of *Stuckenia* as a separate genus.

The genus includes seven species and three confirmed hybrids. The centre of diversity is in the mountains of Central Asia and the adjacent lowlands of Siberia and Kazakhstan, where six species of *Stuckenia* occur, all of which are reviewed in this paper. The remaining species, *S. striata* (Ruiz & Pav.) Holub, occurs in North and South America. The lowest diversity is in Africa and Australia, where this genus is represented by a single and the only cosmopolitan species of *Stuckenia*, *S. pectinata*.

Material and Methods

Distribution records were largely collected from herbarium specimens determined by the author. The following herbaria were studied thoroughly (acronyms follow Holmgren and Holmgren 1990): B, BM, BP, BR, BRA, BRNM, BRNU, BRVU, C, CGE, E, FR, G, GOET, H, K, L, LAE, LD, LE, LINN, M, MSB, NASC, OL, OLD, OLM, P, PR, PRA, PRC, ROZ, S, SAV, SLO, SZU, U, UPS, W, WAG, WU, Z, ZA and ZT, additional large sets were examined from IRKU, KRA, LISU, LIV, LY, MIN, TAA, TU, TUB and WRSL, selected specimens were seen from A and GH, and photographs of herbarium specimens were seen from BSD, DD and TI. Special collections kept in some herbaria separately from the main collections are for convenience designated with ad hoc acronyms here: separate Baagöe herbarium in Copenhagen as C-Baagöe and that from the later travels of Hedin in Stockholm as S-Hedin. Similarly, the recent collections of B. Dickoré, Z. Kaplan and L. Klimeš not yet incorporated into the main collections are cited as GOET-Dickoré, PRA-Kaplan and PRA-Klimeš, respectively. The original sites for Hedin's collections labelled only with the number of the camp (e.g. "Lâger LXXVIII. Jure Tibet, 11 september 1901") were identified from Hedin's itineraries and maps (Hedin 1898, 1922).

Because the genus *Stuckenia* has only recently been widely recognized, the annotation labels that I attached in 1990–2007 to the herbarium vouchers for the records cited here bear corresponding names under *Potamogeton*, not *Stuckenia*.

A revised distribution of all species is given. Only selected representative specimens are listed for each species, usually several of them for each country. Whenever possible, well-preserved and often flowering or fruiting specimens are cited. All specimens cited in the text were seen unless otherwise indicated. Lists of representative specimens are arranged according to the World Geographical Scheme for Recording Plant Distributions (Brummitt 2001), adapted to list basic regions from the north to the south and countries within the regions geographically in sequence from the west to the east rather than alphabetically. In contrast to the citation of herbarium specimens, the maps are more or less up-to-date with all reliably identified specimens included. The boundaries between Europe and Asia follow Euro+Med Data Standards: the eastern boundary of Europe as defined in Euro+Med PlantBase Secretariat (2002b), the southern boundary of Europe between the Caspian and Black Seas as in Euro+Med PlantBase Secretariat (2002a).

Because the material from the northern part of Asia was recently reviewed in Flora of Siberia (Kashina 1988) and Flora of Russian Far East (Tzvelev 1987), particular emphasis was given to the Asian material from outside of this area. Some of the distribution records from these two publications were used here to construct the distribution maps of the three best recognized species, *S. pectinata*, *S. filiformis* and *S. vaginata*, if they corresponded to my own observations. The maps for *S. macrocarpa*, *S. pamirica* and *S. amblyphylla* are based exclusively on examined and reliably identified specimens. Preference is given in the lists of representative specimens to recent collections not used in the preparation of the two Russian Floras cited above.

Only brief descriptions, consisting mainly of diagnostic characters, are given. The "stipular sheaths" that occur at the base of the leaves of *Stuckenia* species are, for the

sake of comparability with *Potamogetonaceae* literature, called leaf sheaths in this paper. Although this term is morphologically inexact, no better one is available. Lengths of fruit given in the text refer to fully developed mature fruits and include the beak. Lengths of spikes were scored only on spikes at anthesis or at fruiting. Colours of leaves and stems and all sizes refer to dry herbarium material. Sizes of main-stem sheaths were taken from the lower (but not basal) to middle region of the stem; the uppermost sheaths, from which the peduncle emerges and which are often larger and inflated, were not measured.

For the investigation of the structure of leaf sheaths of herbarium material, young sheaths were cut from the upper parts of (preferably) side branches, soaked in hot water for one or two minutes and then transversally sectioned with a razor blade to thin slices. Observations on the slices of the sheaths were made under a stereomicroscope at a magnification 20–60×.

A more or less complete nomenclature is provided for most of the species. Because of the extensive synonymies of *S. pectinata* and *S. filiformis* (see also Wiegleb and Kaplan 1998), only the most important synonyms are cited here, especially if they are frequently used in the literature, based on material from Asia or adjacent territories, published in the rank of species or proposed recently.

Results and Discussion

Patterns of Morphological Variation

All *Stuckenia* species show a wide range of morphological variation. This variation is a result of the interaction of several independent factors. The basic principle in contemporary taxonomy is that only genetically fixed variation associated with major evolutionary changes should be used for formal classification. However, identification of the actually existing evolutionary structure may be obscured by various morphological modifications.

Cultivation experiments demonstrated that phenotypic plasticity in *Potamogetonaceae* is responsible for most of the observed variation (Kaplan 2002). The features most dependent on environmental conditions are general appearance, length and width of leaves, shape of leaf apex, length of internodes, distances between whorls in a spike and effective fruit production. The factors most influencing a plant's phenotype include current velocity, amount and composition of nutrients, light intensity, and water depth.

River phenotypes are probably most conspicuous and therefore also best described in the literature. *Potamogetonaceae* have markedly different phenotype in running water (e.g., Kaplan 2002, 2005; Kaplan and Zalewska-Gałosz 2004). In contrast to broad-leaved *Potamogeton* species, which often produce narrow-leaved phenotypes in rivers, the linear-leaved plants of *Stuckenia* tend to have wider leaves in running water compared to the same genotype growing in standing water (Kaplan 2002 and this paper below). The same pattern of phenotypic plasticity was noted also in *Zannichellia*, of the related family *Zannichelliaceae*, by van Vierssen (1982). Plants in running water also much less frequently produce fruit, which is sometimes incorrectly interpreted as evidence of sterility. Tests made on river forms of

S. pectinata and *S. filiformis* showed that many plants that appear to be sterile in running water produce normal well-formed fruits when grown in standing water (Kaplan, unpubl., see also Figs. **1** and **2**). Environmental modifications are also described for several other taxa of *Potamogetonaceae* (e.g., Jupp and Spence 1977; Spence and Dale 1978; Spencer 1987; Spencer and Ksander 1990; Maberly 1993; Idestam-Almquist and Kautsky 1995; Preston 1995; Kaplan and Wolff 2004; Kaplan and Fehrer 2006).

Other morphological variation apparently is associated with ontogenetic variation. Variation due to individual development is most conspicuously expressed in young pioneer shoots, which in all *Stuckenia* species tend to be unbranched, and compared to upper parts of mature shoots or side branches bear more robust leaf sheaths and broader leaves, which have a more obtuse (often to rounded or even truncate) apex. Examples of rapid change of appearance of newly developed shoots in *Stuckenia* species are described by van Wijk (1988, 1989) and Kaplan (2002), and recorded in the field by Preston et al. (1998).

Some forms may represent ecotypes adapted to local conditions such as deep water or fast running water. Because analogous forms are often found in similar habitats they may rise independently and repeatedly under suitable conditions in various parts of the range of a species.

Aquatic plants usually have extensive distribution ranges, which provide more opportunity for the development of unique local morphological variants. Some of these extreme forms are conspicuously different from the usual phenotypes. However, if large sets of specimens are considered, intermediate forms are usually found and there is no clear demarcation between the phenotypes.

Adopted Principles of the Taxonomic Evaluation of Variation

Using characters affected by environmental conditions for delimiting taxa (see the recent literature review by Kaplan 2002) necessarily results in mere classification of phenotypes. Attention was therefore paid in this study to more appropriate characters.

Delimitation of taxa in this paper is based on a set of characters that proved to be stable over large geographical areas and a wide range of environmental conditions. The most constant features are the structure of leaf sheaths and size of fruits. The sheath structure was also found to correspond to major clades within *Stuckenia* when defined by molecular markers (Kaplan and Fehrer, unpubl.). Additional characters, such as shape and size of spikes, the branching pattern, length of ligules, size of leaves, and shape of the leaf apex can be used only in certain cases.

Because aquatic plants are easily transported from site to site by aquatic birds, it is suggested here that species status should not be granted to forms known only from a single site or from a limited number of localities within a small area, even though they may sometimes be markedly different from the more usual phenotypes. Herbaria preserve hundreds of such singular forms of *Potamogetonaceae* from various parts of the world. Their formal taxonomic recognition would only obscure the actual taxonomic structure as in many cases it is often not possible to identify an additional specimen as belonging to one or the other of these forms. As a result of this approach, each of the species recognized in this paper is

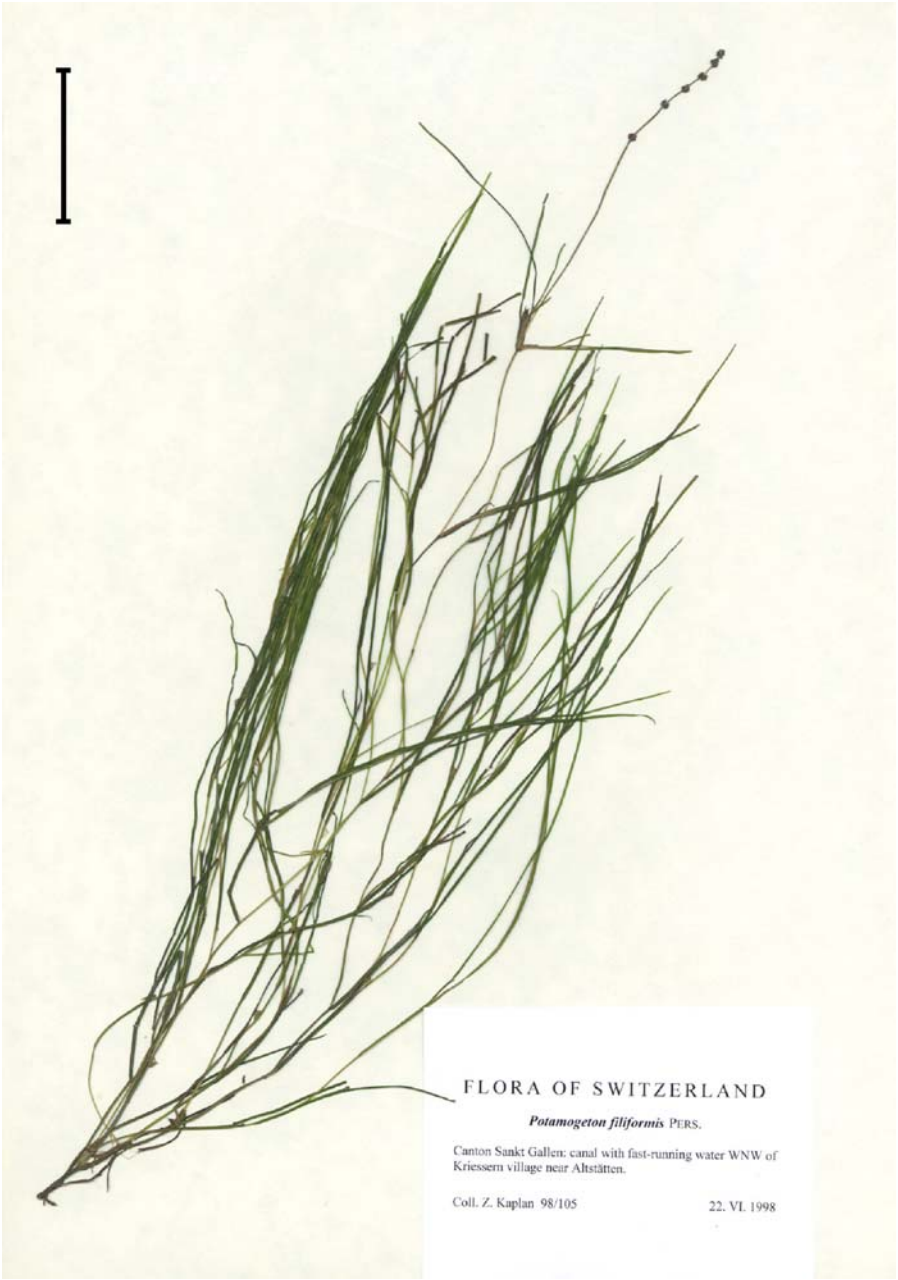

Fig. 1 An apparently sterile phenotype of *Stuckenia filiformis* collected in running water, producing spikes but no fruit in an entire population. The leaves are up to 1.2 mm wide and the plant corresponds to "*Potamogeton juncifolius*" (*Z. Kaplan 98/105*, PRA-Kaplan); scale bar=5 cm

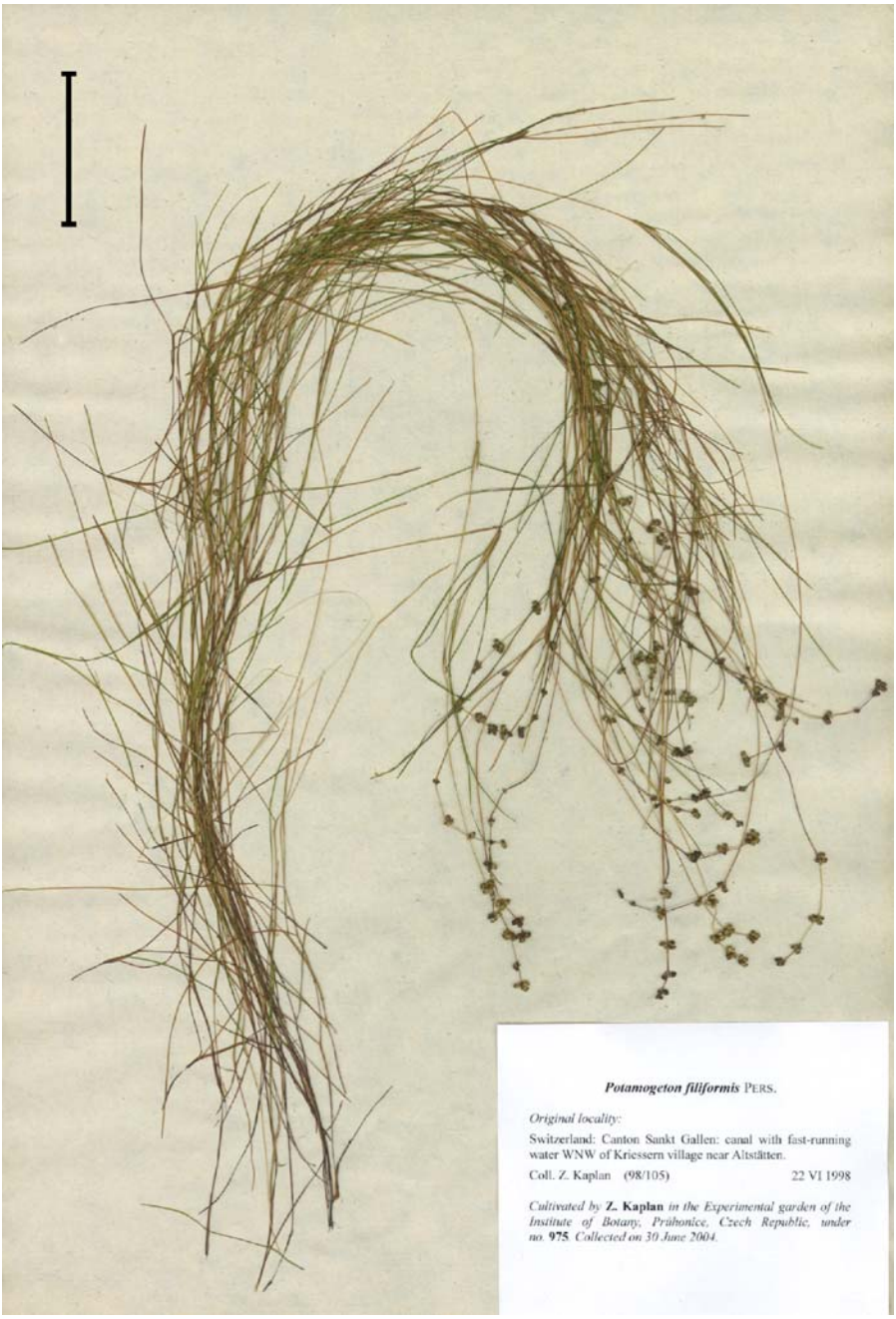

Fig. 2 Genetically identical plants to that shown in Fig. 1 from clonal material after being transplanted and cultivated in standing water simulating common habitat of the ordinary forms of *S. filiformis*. These newly produced plants set fruit readily and produced leaves only 0.2–0.3 mm wide (cult. *Z. Kaplan 975*, PRA-Kaplan); scale bar=5 cm

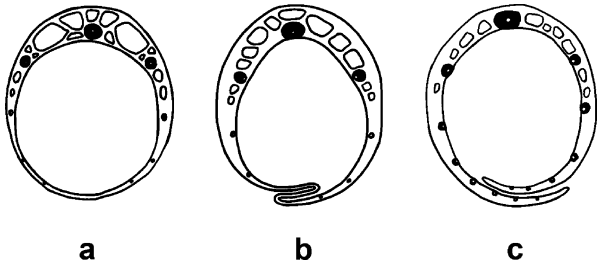

Fig. 3 Transversal sections of leaf sheaths; **a** closed sheath; **b** closed sheath, plicate on the side opposite from the leaf blade; **c** sheath open to the base on the side opposite from the leaf blade, with shortly overlapping edges

represented by a large set of specimens from an area not smaller than 2400 km across.

Similarly, no taxonomic status is given to ecotypes with a polytopic origin. Rather than macroevolutionary lineages they seem to be microevolutionary developments within recognized species.

It cannot be excluded that some widely distributed and morphologically highly variable species, such as *S. pectinata* and *S. filiformis* as currently understood, consist of several distinct evolutionary lineages. However, their existence is highly unlikely to be revealed solely by morphological studies because their uniqueness is poorly, if ever, expressed in terms of their morphology. Even if delimited by specific molecular markers, their practical acceptance in formal taxonomy is questionable because it is not advisable to recognize evolutionary species that cannot be determined morphologically in most of their phenotypes.

Examination and Interpretation of Key Characters

As pointed out already by Hagström (1916), the structure of stipules and leaf sheaths is of key importance in the taxonomy of *Potamogeton* s. l. The shape of leaf sheaths was also proved to be a basic character in the identification of *Stuckenia* hybrids (Preston 1995; Hollingsworth et al. 1996; Preston et al. 1998, 1999). Recent molecular studies (Kaplan and Štěpánek 2003; Iida et al. 2004) indicate that species delimitation based on these characters is perfectly correlated with molecular markers. The shape of the stipules is also associated with macroevolutionary lineages that define groups of species (Hettiarachchi and Triest 1991; Kaplan and Fehrer, unpubl.).

The structure of leaf sheaths is the most reliable vegetative character for identification. There are two basic character states: either the sheath is closed and tubular at the base ("connate") or it is open at the base on the opposite side from the leaf ("convolute"). Accordingly, a transversally sectioned sheath has the form of either a closed ellipse (Fig. 3a, which may occasionally be plicate on the side opposite from the leaf blade, see Fig. 3b) or a short spiral with one edge rolled inwards and enveloped by the opposite edge (Fig. 3c), respectively.

Unfortunately, the examination of sheaths is difficult (see Material and methods). Sectioning must be conducted carefully under a stereomicroscope to avoid

Fig. 4 Variation of the shape of leaf apex within a single plant of *S. pectinata* (*E. H. Walker & S. Tawada 6830*, L)

mechanical damage, which could lead to an incorrect interpretation of the structure of the sheath. It is helpful to section more than one sheath to be sure that the structure is interpreted correctly. This is even more important when identifying hybrids whose parental species have different types of sheaths. Also, care must be taken to examine only young and intact sheaths. A proper interpretation of the structure requires experience. Edges of an open sheath tightly pressed together may appear to be closed, whereas a sheath recorded as open may actually be closed but secondarily split. Similarly, a closed sheath that is plicate on the side opposite from the leaf blade may be misinterpreted as an open sheath if observed only superficially.

The inconvenience of dissecting sheaths may be the main reason why this principal feature is rarely used for identification and why many herbarium collections are incorrectly identified. Using unreliable characters, such as shape of leaf apex, sometimes necessarily leads to incorrect identifications. To give one recent example, Haynes and Holm-Nielsen (2003) used the shape of the leaf apex as a primary character for distinguishing *S. pectinata* and *S. filiformis*. As a result, 24% of the multiple collections they cited were annotated differently between herbaria, i.e., one specimen was assigned to one species but a duplicate from the same collection preserved in another herbarium was identified as another species. My observations based on the examination of fruit characters and/or the structure of leaf sheaths resulted in a much higher percentage of identification correspondence between duplicates preserved in different herbaria and only 3% of these collections actually contained mixtures of two species. It should be stressed therefore that forms with acute or obtuse leaves occur in both *S. pectinata* and *S. filiformis*. The shape of leaf apex often varies greatly even within a single plant (see Fig. 4). Nuclear and chloroplast DNA molecular markers are correlated with the structure of leaf sheaths

Table 1 Selected quantitative and basic structural diagnostic characters of Asian *Stuckenia* species

	S. pectinata	*S. macrocarpa*	*S. pamirica*	*S. vaginata*	*S. amblyphylla*	*S. filiformis*
Structure of leaf sheaths	open	open	open	open	closed	closed
Branching pattern	mostly richly branched, mainly above	mostly densely branched above, particularly on terminal parts	unbranched or moderately to richly branched near base and sparingly above	richly branched mainly above	moderately branched near base and sparingly above	mostly richly branched near base and unbranched above (mainly in standing-water plants) or sparingly branched to middle
Number of branches emerging from main-stem sheaths	1(−2)	1	1	1–5	1	1
Length of leaves (mm)	(28–)40–125 on main stem, 30–90 on branches	18–65 on main stem, 9–46 on branches	80–260 on main stem, 70–110 on branches	11–57 on main stem, 37–125 on branches	77–145	33–180
Width of leaves (mm)	0.3–4.0 on main stem, 0.2–2.8 on branches	0.8–2.5 on main stem, 0.3–2.5 on branches	0.5–1.7 on main stem, 0.3–0.8 on branches	0.7–2.7 on main stem, 0.2–0.8 on branches	0.7–2.4	0.2–1.6
Length:width ratio of leaves	(18–)40–275 on main stem, (25–)35–170 on branches	9–55 on main stem, 10–90 on branches	60–290	8–60 on main stem, 55–490 on branches	35–145	(40–)95–450
Length of leaf sheaths (mm)	10–65 on main stem, 7–28 on branches	9–27 on main stem, 6–20 on branches	18–47 on main stem, 11–16 on branches	20–73 on main stem, 13–28 on branches	6–37	6–44
Width of leaf sheaths (mm)	0.5–2.5(−5.5) on main stem, 0.2–2.1 on branches	0.6–2.1 on main stem, 0.6–2.2 on branches	1.2–2.5 on main stem, 0.7–1.4 on branches	1.4–7.1 on main stem, 0.5–3.1 on branches	0.8–3.5	0.3–1.8
Length of ligule (mm)	1–9(−14) on main stem, 0.4–6(−10) on branches	0–1.2 on main stem, 0–1.1 on branches	5–19 on main stem, 3–6 on branches	0–1.5(–2.9) on main stem, 0–1.8 on branches	2–16	2–13
Length of spike (mm)	at anthesis: 10–31, at fruit: 19–63	at anthesis: 12–26, at fruit: 19–36	at anthesis: 10–17, at fruit: 16–30	at anthesis: 17–73, at fruit: 33–62	at anthesis: 9–28, at fruit: 23–72	at anthesis: 12–36, at fruit: 17–65
Length of peduncle (mm)	18–190(−350)	30–132	12–38	19–190	10–225	38–205
Number of flower whorls	3–6(−8)	3–4(−5)	4–6	(5–)7–9	4–6(–8)	3–6(−7)
Length of fruit (mm)	3.4–4.2	(4.1–)4.3–5.8	3.8–4.2	2.6–3.4(−3.8)	(2.7–)2.9–3.3	2.1–2.6(−3.0)

Additional features are given in descriptions and in the determination key

but not always with the shape of the leaf apex (Kaplan and Fehrer, unpubl.). For this reason, in addition to floral and fruit characters (see Table 1), the structure of the leaf sheath is considered a key character, and the only reliable vegetative structure for delimiting and defining these two species.

Within the limits of this study, *Stuckenia* specimens from the area of highest diversity between Afghanistan, eastern Kazakhstan, southern Siberia and central China are particularly difficult to identify and many collections from there cannot be reliably determined without examining the structure of the leaf sheath. However, once the structure of the sheath is ascertained, identification of the well-preserved and sufficiently complete specimens is often unambiguous.

The size of the fruits is another important character (see Table 1). Unfortunately, fruits are not available in most *Stuckenia* collections. Although they often cannot be used for identifying a given specimen, fruit size is one of the fundamental characters in delimiting species. For example, *S. amblyphylla* is primarily delimited from the related *S. filiformis* on the basis of fruit size. The other characters distinguishing these two species, such as the width of the leaves or branching pattern, are secondary characters, although they are frequently used to identify specimens in the absence of fruit. Similarly, the species *S. macrocarpa* is delimited from the highly variable *S. pectinata* mainly by fruit size.

Hybridization

Species of *Stuckenia* are known to hybridize but practically all the information on these hybrids comes from a few well-studied areas in Europe. *Stuckenia* hybrids are best known from the northern half of Europe, specifically the British Isles, Scandinavia and northern parts of European Russia (see e.g. Hagström 1916; Hollingsworth et al. 1996; Preston et al. 1998, 1999; Bobrov and Chemeris 2006). They are also likely to occur in northern Siberia. However, because of their sterility and similar vegetative characters, *Stuckenia* hybrids are extremely difficult to distinguish from their highly variable parental species. It is necessary to identify the structure of the leaf sheath by means of careful examination under a binocular microscope. Because some *Stuckenia* hybrids have both sorts of sheath (i.e. open as well as closed) on the same shoot, sectioning of numerous (at least five as absolute minimum but preferably about ten) young leaf sheaths of a suspected hybrid is necessary for an accurate interpretation of the pattern.

The material that I examined contained no convincing *Stuckenia* hybrids. Although some specimens may have been intermediate, I decided not to section even the few sheaths available in these poor collections. Also, as pointed out by Preston et al. (1999), hybrids are more likely to be detected by a combination of thorough observation of populations in the field and a careful examination under a binocular microscope rather than by the examination of randomly collected herbarium specimens, which are often inadequate for reliable identification. The level of hybridization between *Stuckenia* species in Siberia will only be determined by extensive fieldwork, detailed comparison of local phenotypes of parental species with morphologically intermediate plants, collecting of representative sets of herbarium specimens and, as in Europe, the molecular confirmation of the identity of putative hybrids.

Generic Nomenclature of Stuckenia

Stuckenia Börner, Bot.-Syst. Not. 258. 1912.
Type: *Stuckenia pectinata* (L.) Börner

Potamogeton [unranked] *Coleogeton* Rchb., Icon. Fl. Germ. Helv. 7: 10. 1845.
Type: *Potamogeton pectinatus* L. (lectotype designated by Les and Haynes 1996).
≡ *Potamogeton* subg. *Coleogeton* (Rchb.) Raunk., Dan. Blomsterpl. Naturh. 1/1: 108. 1896.
– *Coleogeton* (Rchb.) Dostál, Sezn. Cévn. Rostl. Květ. Československ. 309. 1982, nom. inval. [Vienna ICBN Art. 33.4; McNeill et al. 2006]
– *Coleogeton* (Rchb.) Dostál, Nová Květ. ČSSR 1187, 1989, nom. inval. [Vienna ICBN Art. 33.4; McNeill et al. 2006]
≡ *Coleogeton* (Rchb.) D. H. Les & R. R. Haynes, Novon 6: 389. 1996.

Note 1: The generic name *Stuckenia* first appeared in April 1912 in a preprint of a publication ultimately published in Abh. Naturwiss. Vereine Bremen 21: 258, which was issued in March 1913. In the meantime, the name appeared also in Börner's Fl. Deutsche Volk p. 713, published in July or August 1912.

Note 2: Although *Coleogeton* (Rchb.) D. H. Les & R. R. Haynes is a superfluous name for *Stuckenia*, it is not illegitimate because it is based on a legitimate basionym (see Art. 52.3 and Ex. 15 of the Vienna Code; McNeill et al. 2006).

Key to Species

1a Leaf sheaths closed and tubular at base (connate) at least when young, appearing as a closed ellipse when transversally sectioned (Fig. **3**a and b) ... 2
1b Leaf sheaths open at base even when young, often with shortly overlapping edges (convolute), appearing as a short spiral when transversally sectioned (Fig. **3**c) ... 3
2a Fruit 2.1–2.6(−3.0) mm long; leaves mostly filiform, 0.3–1.2(−1.6) mm wide, (40–)95–450 times as long as wide; standing-water plants mostly richly branched near base of stem and unbranched above; leaf sheaths on vegetative branches 0.3–1.8 mm in diameter; spikes mostly distinctly remote at least basally ..... 6. *S. filiformis*
2b Fruit (2.7–)2.9–3.3 mm long; leaves narrowly linear, 0.7–2.4 mm wide, 35–145 times as long as wide; plants moderately branched near base of stem and sparingly so above; leaf sheaths on vegetative branches 0.8–3.5 mm in diameter; spikes mostly contiguous to shortly remote ..... 5. *S. amblyphylla*
3a Spikes with (5–)7–9(−11) flower/fruit whorls, pairs of flowers/fruits on axis of spike ± evenly spaced 1–4 mm apart; leaf sheaths on main stem markedly robust particularly towards stem base, 1.4–7.1 mm in diameter, conspicuously wider than sheaths on branches, main-stem sheaths truncate at apex, with a low hyaline upper edge united with and rather abruptly contracted to an indistinct ligule 0–1.5(−2.9) mm long; leaf blades on the main-stem sheaths short and broad, 11–57 mm long, mostly shorter or ± as long as the sheaths, markedly dissimilar to conspicuously narrow leaves on branches, the terminal leaves markedly longer than the leaves on

main-stem sheaths; stem mostly richly branched, mainly above, with 1–5 branches from each node; fruit 2.6–3.4(−3.8) mm long ..... 4. *S. vaginata*

3b Spikes with 3–6(−8) flower/fruit whorls, the spike contiguous to markedly interrupted, with pairs of flowers/fruits on axis of spike often unevenly spaced, the basal two pairs often 2–12(−38) mm apart in fruit and often more spaced than the others; leaf sheaths on main stem mostly only indistinctly wider than sheaths on branches (if rarely distinctly wider, then ligule at least 4 mm long), usually (0.2–)0.4–2.5(−5.5) mm in diameter, at apex mostly projecting into a ± distinct ligule 1–19 mm long (although this sometimes disappears with time); leaf blades on the main-stem sheaths 18–260 mm long, longer than the sheaths, mostly similar in shape to leaves on branches, the terminal leaves shorter than the leaves on main-stem sheaths; stem unbranched to richly branched, generally with one branch from each node but sometimes two branches from one node of the main stem; fruit 3.4–5.8 mm long 4

4a Leaves and leaf sheaths dark green or mostly conspicuously dark brown to blackish when dried, older ones discoloured, creamy whitish or greyish to bright white, hyaline edges of leaf sheaths creamy yellowish, markedly contrasting with the dark sheaths; plants unbranched or moderately to richly branched near base and sparingly so above; leaf blades on the main-stem sheaths 80–260 mm long, occasionally recurved towards apex, sometimes even twisted spirally when dried, the apex obtuse to rounded; ligules on main-stem sheaths 5–19 mm long ..... 3. *S. pamirica*

4b Leaves and leaf sheaths usually olive green to dark green, sometimes brownish green to light brown, rarely brown but then leaf blade less than 80 mm long and plants richly branched above, hyaline edges of leaf sheaths greenish to pale brownish, not conspicuously contrasting with the sheaths; plants usually richly branched throughout or only above; leaf blades on the main-stem sheaths 18–120 mm long, mostly ± straight, only rarely recurved towards apex when dried, the apex mostly acute to acuminate, occasionally subacute to obtuse or rounded with short mucro; ligules mostly 1–9 mm long, rarely up to 14 mm long but then the plants robust and richly branched 5

5a Fruit (4.1–)4.3–5.8 mm long; plants often heavily branched above, main-stem leaves decay early, the foliage concentrated mainly on terminal parts of branches, the internodes of branches short, often only 1–7 mm long, consequently the branches and leaves densely crowded and compact ..... 2. *S. macrocarpa*

5b Fruit 3.4–4.2 mm long; plants branched all along the stem or only above, main-stem leaves mostly persistent and stem more evenly foliated, the internodes of branches mostly more than 5 mm long, leaves sparse or dense but not conspicuously compact ..... 1. *S. pectinata*

Description, Nomenclature, Distribution and Variation of Species

1. *Stuckenia pectinata*

Stuckenia pectinata (L.) Börner, Fl. Deutsche Volk 713. 1912.

≡ *Potamogeton pectinatus* L., Sp. Pl. 127. 1753. (“pectinatum”)

Type: "Potamogeton gramineum ramosum Bauh., In Austria" (lectotype: UPS [herb. Burser X: 124, sheet 1], designated by Haynes 1986)[1].
≡ *Buccaferrea pectinata* (L.) Bubani, Fl. Pyren. 4: 17. 1901.
≡ *Spirillus pectiniformis* [L.] Nieuwl., Amer. Midland Naturalist 3: 18. 1913, nom. illeg. [Vienna ICBN Art. 51.1; McNeill et al. 2006]
– *Coleogeton pectinatus* (L.) Dostál, Sezn. Cévn. Rostl. Květ. Českosl. 309. 1982, nom. inval. [Vienna ICBN Arts 33.4 and 43.1; McNeill et al. 2006]
≡ *Coleogeton pectinatus* (L.) D. H. Les & R. R. Haynes, Novon 6: 390. 1996.
– *Potamogeton pectinatus* f. *vulgaris* Cham. & Schlecht., Linnaea 2/2: 165. 1827, nom. inval.
– *P. pectinatus* var. *typicus* Fiori, Fl. Anal. Ital. 1: 152. 1896, nom. inval. ("typica") [Vienna ICBN Art. 24.3; McNeill et al. 2006]
– *P. pectinatus* var. *vulgaris* Aschers. & Graebn., Synops. Mitteleur. Fl. 1: 350. 1897, nom. inval. [Vienna ICBN Art. 24.3; McNeill et al. 2006]

= *Potamogeton marinus* L., Sp. Pl. 127. 1753. ("marinum")

Type: "marinum, 175.13" (lectotype: LINN 175.13, designated by Haynes 1986).
≡ *P. pectinatus* var. *marinus* (L.) Roem. & Schult., Syst. Veg. ed. 15. 3: 513. 1818.
≡ *Stuckenia marina* (L.) Tzvelev, Bot. Zhurn. 84(7): 111. 1999.

= *Potamogeton borealis* Raf., Med. Repos., Hexade 3, 2: 409. 1811.

Type: [label 1:] "~~Zanichellia~~ Potamogeton marinum?, 21–1. Quebec" [label 2:] "Herb. Mus. Paris., Herbier de l'Amérique septentrionale d'André Michaux" (**lectotype designated here**: P-MICH)[2].
– *P. borealis* Raf., Med. Repos., Hexade 2, 5: 354. 1808, nom. inval. [Vienna ICBN Art. 34.1(b); McNeill et al. 2006]
≡ *P. filiformis* var. *borealis* (Raf.) H. St. John, Rhodora 18(210): 134. 1916.
≡ *Stuckenia borealis* (Raf.) Holub, Preslia 69: 364. 1997.

= *Potamogeton interruptus* Kit. in Schult., Oesterr. Fl. ed. 2. 1: 328. 1814.

Type: [label 1:] [Hungary:] "Potamogeton verticillatum, P. interruptum mihi. In stagno salso ad Királytelek in Co[mi]t[a]tu Szabolesensi" [label 2:] "Herbar. Kitaibel. 2185. Mus. nat. hung. fasc. VII. N°. 238." (**lectotype designated here**: BP [herb. Kitaibel]; isolectotypes: B-W 3204: fol. 5, M).
≡ *P. pusillus* var. *interruptus* (Kit.) J. Presl & C. Presl, Fl. Čech. 37. 1819.
≡ *P. pectinatus* var. *interruptus* (Kit.) Aschers., Fl. Brandenb. 1: 666. 1864.
≡ *P. pectinatus* proles *interruptus* (Kit.) Graebn. in Engl., Pflanzenr. 31 (IV.11): 124. 1907.
≡ *Spirillus interruptus* (Kit.) Nieuwl., Amer. Midland Naturalist 3: 18. 1913.

[1] The label text "Celsius 29" cited by Haynes (1986) and Haynes & Holm-Nielsen (2003) is not given on this sheet (see also Juel 1936).

[2] The name *P. borealis* Raf. was proposed for the name "*P. marinum* L. ?" misapplied by Michaux (1803). Since St. John (1916) it has been believed that the name refers to a form of *S. filiformis*. However, the type consists of two fruiting plants that with their open sheaths and big fruits undoubtedly belong to *S. pectinata*, not to *S. filiformis*.

Fig. 5 General appearance of *S. pectinata* (cult. *Z. Kaplan 1838*, PRA-Kaplan); scale bar=5 cm

≡ *P. pectinatus* f. *interruptus* (Kit.) Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 48. 1916.

= *Potamogeton angustissimus* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. Pl. 1, ed. quarto: 370 [et ed. folio: 297]. 1816 ("1815"). ("angustissimum")

Type: [label 1:] "Potamogeton angustissimum, n. 4294" [label 2:] "Herb. Mus. Paris., Herbier Humboldt & Bonpland. Amérique équatoriale." (**lectotype designated here**: P-Bonpl.; isolectotypes: B-W 3206: fol. 4, P)[3].

= *Potamogeton tenuifolius* Kunth in Humb., Bonpl. & Kunth, Nov. Gen. Sp. Pl. 1, ed. quarto: 370 [et ed. folio: 297]. 1816 ("1815"), nom. illeg. ("tenuifolium"), non Raf. 1811.

Type: [label 1:] "Potamogeton tenuifolium, n. 1104, Laguna Valenciae, (Valles de Aragua.)" [label 2:] "Herb. Mus. Paris., Herbier Humboldt & Bonpland. Amérique équatoriale." (**lectotype designated here**: P-Bonpl.; isolectotypes: B-W 3207, P)[4].

= *Potamogeton vaillantii* Roem. & Schult., Syst. Veg. ed. 15. 3: 514. 1818. ("Vaillantii")

Type: [illustration in] Vaillant, Bot. Par. tab. 32, Fig. 5. 1727. (**lectotype designated here**).

≡ *P. pectinatus* var. *latifolius* G. Mey., Chloris Han. 526. 1836.

≡ *P. pectinatus* var. *vaillantii* (Roem. & Schult.) Lojac., Fl. Sicul. 3: 189. 1909.

= *Potamogeton pectinatus* var. *dichotomus* Wallr., Sched. Crit. 1: 68. 1822.

Type: unknown; no type cited in the protologue, no Wallroth specimen with this name preserved in PR or located in other herbaria known to preserve Wallroth's authentic material.

≡ *P. pectinatus* f. *dichotomus* (Wallr.) Hagstr. in Neuman, Sverig. Fl. 795. 1901.

= *Potamogeton pectinatus* var. *protensus* Wallr., Sched. Crit. 1: 67. 1822.

Type: unknown; no type cited in the protologue, no Wallroth specimen with this name preserved in PR or located in other herbaria known to preserve Wallroth's authentic material.

≡ *P. pectinatus* var. *diffusus* f. *protensus* (Wallr.) Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 48. 1916.

= *Potamogeton pectinatus* var. *scoparius* Wallr., Sched. Crit. 1: 68. 1822.

Type: unknown; no type cited in the protologue, no Wallroth specimen with this name preserved in PR or located in other herbaria known to preserve Wallroth's authentic material.

≡ *P. pectinatus* f. *scoparius* (Wallr.) Hagstr. in Neuman, Sverig. Fl. 795. 1901.

≡ *P. pectinatus* proles *scoparius* (Wallr.) Graebn. in Engl., Pflanzenr. 31 (IV.11): 125. 1907.

[3] Type citation given in the protologue: "in Regni Mexicani regione temperata, aquia innatans lacus Yurirapundari, in convalli Sancti Jacobi, inter Puert de Andaracuas et Valladolid de Mechoacan, alt. 914 hexap., Humb. et Bonpl."

[4] Type citation given in the protologue: "in Provincia Caracasana in lacu Tacariguæ prope urbem Novæ Valenciæ, alt. 226 hex., Humb. et Bonpl."

≡ *P. pectinatus* var. *diffusus* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55 (5): 46. 1916, nom. illeg. [Vienna ICBN Art. 52.1; McNeill et al. 2006][5]
≡ *P. interruptus* var. *diffusus* [Hagstr.] Druce, Hayward's Bot. Pocket-Book. ed. 19. (Druce) 288. 1930, nom. illeg. [Vienna ICBN Art. 52.1; McNeill et al. 2006]
≡ *P. diffusus* [Hagstr.] Herter, Revista Sudamer. Bot. 6/5–6: 132. 1940.

= *Potamogeton zosteraceus* Fr., Novit. Fl. Suec. ed. 2. 51. 1828.

Type: [Sweden:] "Potamogeton marinum L., zosterac.?, Södermanland, Skären mellan Utön och Ornön, Hartman" (**lectotype designated here**: UPS; isolectotype: UPS).
≡ *P. pectinatus* var. *zosteraceus* (Fr.) Casp., Schriften Phys.-Ökon. Ges. Königsberg 29: 89. 1888.
≡ *P. pectinatus* f. *zosteraceus* (Fr.) Almq. in Krok, Hartmans Handb. Skand. Fl. ed. 12. 1: 56. 1889.
≡ *P. pectinatus* proles *zosteraceus* (Fr.) Graebn. in Engl., Pflanzenr. 31 (IV.11): 126. 1907.
≡ *Stuckenia zosteracea* (Fr.) Tzvelev, Bot. Zhurn. 84(7): 111. 1999.

= *Potamogeton pectinatus* var. *caespitosus* Mert. & W. D. J. Koch ex Fieber in Bercht. & Opiz, Oekon.-Techn. Fl. Böhm. 2/1: 281. 1838.

Type: [label 1:] [Czech Republic:] "Potamogeton filiformis Pers., Rozkož, Opiz" [label 2:] "Potamogeton pectinatus caespitosus fieber fl. boh. 2 pag. 281., Teich Rozkož bei Pardubitz, 1818, Opiz" (lectotype: PR [herb. typ. 11464a], designated by Kaplan 1997; isolectotype: PR [herb. typ. 11464b]).

= *Potamogeton pectinatus* var. *foliosus* Mert. & W. D. J. Koch ex Fieber in Bercht. & Opiz, Oekon.-Techn. Fl. Böhm. 2/1: 280. 1838.

Type: [Czech Republic:] "1812, b. Potamogeton pectinatus L., Teiche um Tauschin. [F. I. Tausch (Herbarium florae bohemicae no. 1812b)]" (lectotype: PR [herb. typ. 11465a], designated by Kaplan 1997; isolectotypes: LE, PR [herb. typ. 11465b]).

= *Potamogeton pectinatus* var. *tenuis* G. Mey., Fl. Hanov. Exscurs. 537. 1849.

Type: [illustration in] Reichenbach, Icon. Fl. Germ. Helv. 7: tab. 19. 1845, the right-hand plant annotated: "β. scoparius Wallr." (**lectotype designated here**).

= *Potamogeton flabellatus* Bab., Man. Brit. Bot. ed. 3. 343. 1851.

Type: [United Kingdom:] "Potamogeton zosteraceus Bab., flabellatus, Canal, Stoke Heath, Warwick, T. Kirk, 26 May 1849." (lectotype: CGE, designated by Preston 1998).
≡ *P. pectinatus* var. *flabellatus* (Bab.) Crép., Notes Pl. Rar. Belgique 4: 47. 1864.
≡ *P. pectinatus* subsp. *flabellatus* (Bab.) Hook. fil., Stud. Fl. Brit. Isl. 374. 1870.
≡ *P. pusillus* subsp. *flabellatus* (Bab.) Hook. fil., Stud. Fl. Brit. Isl. ed. 3. 436. 1884.

[5] When published by Hagström (1916), the name *P. pectinatus* var. *diffusus* included several previously published names and by this also their types. According to the present rules, the name has to be considered superfluos and illegitimate. The following three name are the earliest of those included, all with equal priority: *P. pectinatus* var. *dichotomus* Wallr. 1822, var. *protensus* Wallr. 1822, and var. *scoparius* Wallr. 1822. Among them the nomenclatural base for *P. pectinatus* var. *diffusus* has to be chosen. Wiegleb and Kaplan (1998) selected the most frequently adopted name of the three, var. *scoparius*.

= *Potamogeton pectinatus* var. *mongolicus* A. Benn., J. Bot. 32: 203. 1894.

Type: [China, Inner Mongolia:] "358, Herbarium horti Petropolitani, Pl. a N. M. Przewalski collectae. Potamogeton pectinatus L. Mongolia occidentalis. Terra Ordos. [= Ordos Desert] Valle fl. Hoangho [= Huang He], in stagnis haud profundis fundo limosis ... [1871]" (**lectotype designated here**: LE; isolectotypes: BM, P, S).

≡ *P. pectinatus* proles *mongolicus* (A. Benn.) Graebn. in Engl., Pflanzenr. 31 (IV.11): 125. 1907.

≡ *P. pectinatus* subsp. *mongolicus* (A. Benn.) Volob., Sibir. Biol. Zhurn. 1991/5: 75. 1991.

= *Potamogeton pectinatus* var. *coronatus* Hagstr., Bot. Not. 1905: 141. 1905.

Type: unknown, possibly lost[6].

≡ *P. pectinatus* f. *coronatus* (Hagstr.) Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 46. 1916.

≡ *P. pectinatus* var. *ungulatus* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 45. 1916, nom. illeg. [Vienna ICBN Art. 52.1; McNeill et al. 2006][7]

≡ *P. interruptus* var. *ungulatus* [Hagstr.] Druce, List Brit. Pl. ed 2. 118. 1928, nom. illeg. [Vienna ICBN Art. 52.1; McNeill et al. 2006]

≡ *P. pectinatus* f. *ungulatus* [Hagstr.] Soó, Magyar Biol. Kutatóint. Munkái, 8 (1935–1936): 235. 1936, nom. illeg. [Vienna ICBN Art. 52.1; McNeill et al. 2006]

= *Potamogeton pectinatus* f. *subdrupaceus* G. Fisch., Ber. Bayer. Bot. Ges. 11: 125. 1907.

Type: [Germany:] "569. Flora exsiccata Bavarica ..., Potamogeton pectinatus Linné var. scoparius Wallroth f. subdrupaceus Fischer, Oberfranken: Regnitz-Altung bei Gaustadt (Bamberg), Meereshöhe: 220 m., leg. Dr. G. Fischer, Fundzeit: Juli 1901." (**lectotype designated here**: M; isolectotypes: BP, E, G, G-BU, M, PR).

= *Potamogeton pectinatus* f. *zosteroides* G. Fisch., Ber. Bayer. Bot. Ges. 11: 125. 1907.

Type: [Germany:] "Potamogeton pectinatus L. var. interruptus Asch. f. juv. zosteroides F., mit 5 nervigen Blättern, Regnitz-Altung bei Bughof, 3. XI. 1903, Lg. Dr. Fischer" (**lectotype designated here**: M).

= *Potamogeton vaginatus* var. *helveticus* G. Fisch., Ber. Bayer. Bot. Ges. 11: 134. 1907.

Type: [Switzerland:] [label 1, which is a letter of E. Bauman to G. Fischer:] "[Untersee by Ermatingen, near Konstanz] ... E. Baumann, Constanz, 4/III/[19]07" [label 2:] "Potamogeton helveticus (Fischer) Baumann" (**lectotype designated here**: M).

≡ *P. filiformis* subvar. *helveticus* (G. Fisch.) Aschers. & Graebn., Synops. Mitteleur. Fl. ed. 2. 1: 545. 1913.

[6] The type was cited in the prologogue as "Muntjokk-ott 23 juni Mapiek-köll". The reference was later (Ostenfeld and Paulsen 1922) refined as "East Turkestan, Mapik-köll, a part of Kara-koshun, 816 m, 23rd June 1900" and the voucher indicated to be preserved in "hb. Stockholm Univ." (Hagström 1916). I was unable to locate any specimen identified as var. *coronatus* or from this place in the herbarium S in spite of twice searching through all collections. Also I failed to find a corresponding specimen in the separately kept collection of specimens from later Hedin travels (S-Hedin) or in Hagström's personal herbarium now preserved in LD.

[7] The protologue of *P. pectinatus* var. *ungulatus* included the earlier name *P. pectinatus* var. *coronatus* Hagstr.

≡ *P. vaginatus* f. *helveticus* (G. Fisch.) G. Fisch., Mitt. Bayer. Bot. Ges. 3/5: 110. 1914.
≡ *P. vaginatus* subsp. *helveticus* (G. Fisch.) Schinz & Thell., Fl. Schweiz ed. 4. 1: 32. 1923.
≡ *P. helveticus* (G. Fisch.) W. Koch in W. Koch & G. Kummer, Mitt. Naturf. Ges. Schaffhausen 1923–1924/3: 38. 1924.
≡ *P. pectinatus* var. *helveticus* (G. Fisch.) Glück in Pascher, Süsswasserflora 15: 62. 1936.
≡ *P. pectinatus* subsp. *helveticus* (G. Fisch.) Bertsch & F. Bertsch, Fl. Württ. Hohenz. ed. 2. 48. 1948.
≡ *Stuckenia helvetica* (G. Fisch.) Holub, Preslia 69: 364. 1997.

= *Potamogeton helveticus* var. *balatonicus* Gams, Arch. Balaton. 1: 30. 1926.

Type: [label 1:] "Potamogeton marinum, In littore Balatonis lectum. A P. pectinato non diversum sec. Smith Fl. brit. I. 198." [label 2:] "Herbar. Kitaibel. 2178. Mus. nat. hung. fasc. VII. N^{o}. 232." [label 3:] "P. helveticus var. balatonicus Gams, revid. Jáv[orka]" (holotype: BP [herb. Kitaibel]; isotype: M).
≡ *P. balatonicus* (Gams) Soó, Arch. Balaton. [= Magyar Biol. Kutatóint. Munkái] 2: 136. 1928.
≡ *P. pectinatus* subsp. *balatonicus* (Gams) Soó, Magyar Biol. Kutatóint. Munkái 8(1935−1936): 235. 1936.
– *Coleogeton pectinatus* subsp. *balatonicus* (Gams) Dostál, Sezn. Cévn. Rostl. Květ. Českosl. 309. 1982, nom inval. [Vienna ICBN Arts 33.4 and 43.1; McNeill et al. 2006]
– *Coleogeton pectinatus* subsp. *balatonicus* (Gams) Dostál, Folia Mus. Rer. Natur. Bohem. Occid., Bot., 21: 15. 1984, nom. inval. [Vienna ICBN Art. 43.1; McNeill et al. 2006]

= *Potamogeton pectinatus* var. *gracilis* Kuzmin & Skvortzov in Baranov & Skvortzov, Diagn. Pl. Nov. Min. Cogn. Mandsch. 1. 1943.

Type: not seen, not preserved in LE; type citation: [China:] "Mandshuria: in lacus stagnalis prope Harbin, 10/7 1935, B. Skvortsov"

– *Potamogeton intramongolicus* Y. C. Ma, Acta Bot. Bor.-Occid. Sin. 3/1: 8. 1983, nom. inval. [Vienna ICBN Art. 34.2; McNeill et al. 2006][8]
– *P. acifolius* Y. C. Ma, Acta Bot. Bor.-Occid. Sin. 3: 10. 1983, nom. inval. [Vienna ICBN Art. 34.2; McNeill et al. 2006]

Authentic material: not seen; "type" citation: [China:] "Wulanchabumeng, Chabaeryouuiqiangi, Huangqihai, alt. 1200 m, in the lake, 3 Jul 1982, Y. C. Ma & C. Y. Cao 82–1 (NMU)".

[8] The protologue of *Potamogeton intramongolicus* (Ma et al. 1983) included also the name *P. acifolius*, obviously referring to the same species. It appears that the author while writing the paper changed his mind, abandoned the epithet "acifolius" and intended to replace it by "intramongolicus" (or vice versa). Unfortunatelly, he failed to correct the name throughtout the protologue. Thus, the name *P. intramongolicus* appears in the paper on pages 2, 3 and 8, whereas the name *P. acifolius* is given for the same species on pages 10, 11, 16 and 17 (there is also identical species number 10 often given in front of these two names). By this unfortunate mistake, he created alternative names according to the Code (Vienna ICBN Art. 32.2; McNeill et al. 2006) and none of them is validly published.

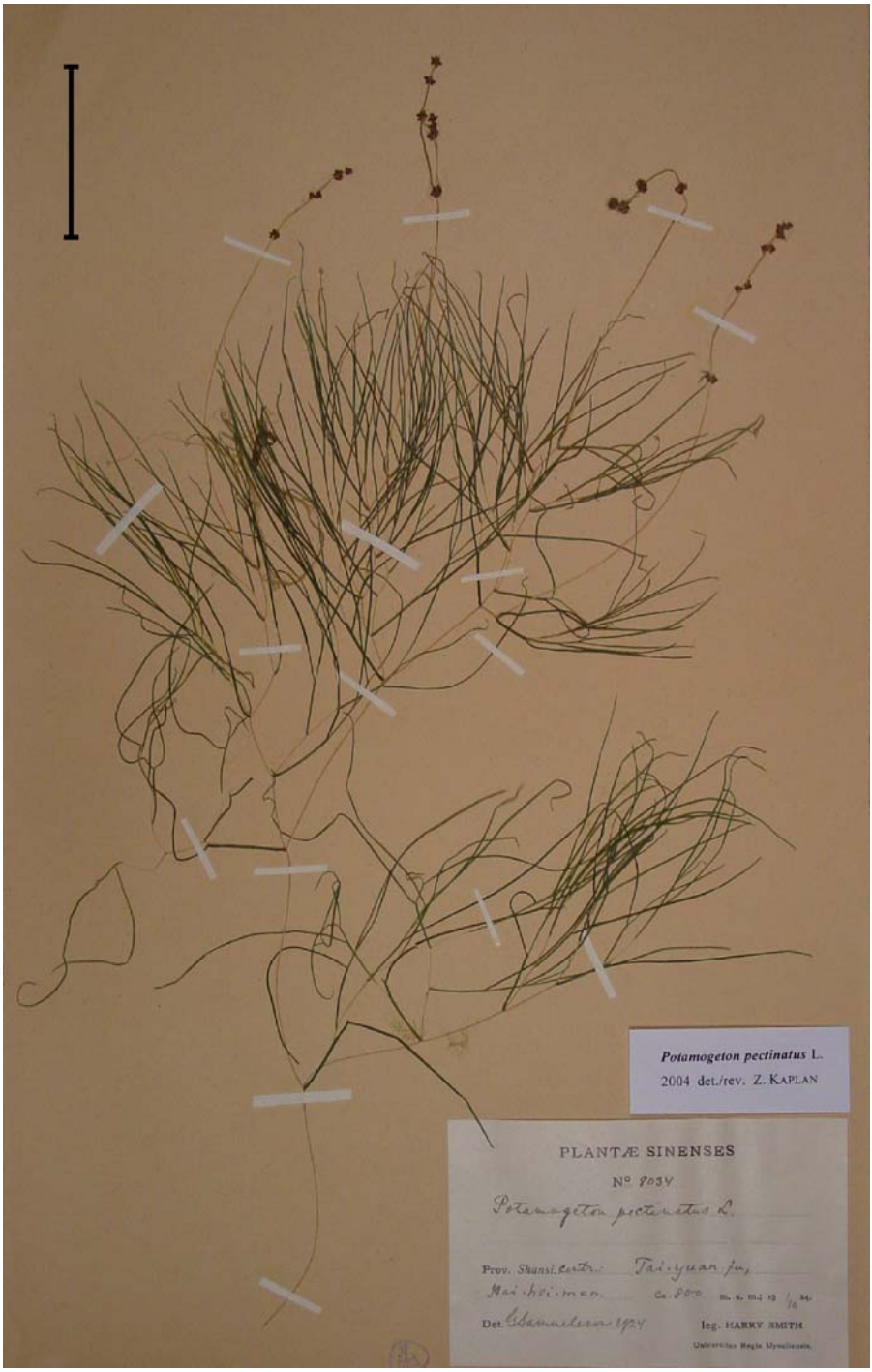

Fig. 6 General appearance of *S. pectinata* (*H. Smith 8034*, LD); scale bar=5 cm

Fig. 7 Shape of leaf apex of *S. pectinata* (**a** + **b**: cult. *Z. Kaplan 1838*, PRA-Kaplan); scale bar=0.5 mm

= *Potamogeton pectinatus* subsp. *chakassiensis* Kaschina in Krasnob. & Safonova, Novoe o Fl. Sibiri 245. 1986.

Type: not seen; type citation: [Russia:] "Regio autonoma Chakassia, distr. Schirinskij, in viciniis pagi Kljuczi, lacus Beljo, 9 Aug 1968, E. Neufeld & G. Vlassova (holotype: NS)".

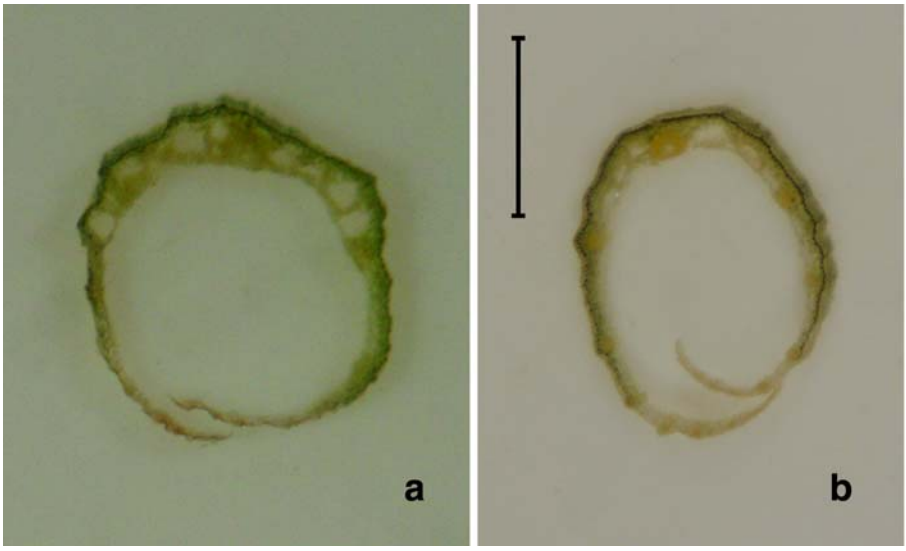

Fig. 8 A transversal section of open leaf sheaths of *S. pectinata* (**a** cult. *Z. Kaplan 1838*, PRA-Kaplan; **b** *A. Dieterle 793*, G); scale bar=0.5 mm

≡ *P. chakassiensis* (Kaschina) Volob., Sibir. Biol. Zhurn. 1991/5: 75. 1991.
≡ *Stuckenia intramongolica* Tzvelev, Bot. Zhurn. 84(7): 111. 1999, nom. illeg. [Vienna ICBN Art. 52.1; McNeill et al. 2006][9]

= *Potamogeton chakassiensis* var. *tenuior* Volob., Sibir. Biol. Zhurn. 1993/3: 57. 1993.

Type: not seen; type citation: [Russia:] "Chakasia, Schira distr. Lacus Itkul. 20. 09. 1990, P. Volobaev & A. Marikoda (holotype: KEM)".

Stem mostly richly branched, mainly above, generally with one branch emerging from each node but sometimes two branches from one node of main stem. Leaves on main stem narrowly linear, (28–)40–125 mm long, 0.3–4.0 mm wide, (18–)40–275 times as long as wide, mostly persistent, usually ± straight, only rarely recurved towards apex when dried, usually olive green to dark green, sometimes bright green, brownish green to light brown, rarely dark brown, the apex mostly acute to acuminate, occasionally subacute to obtuse or rounded with a short mucro; mature leaves on branches 30–90 mm long, 0.2–2.8 mm wide, (25–)35–170 times as long as wide, the apex finely acuminate to acute, sometimes subacute to obtuse, rarely rounded and mucronate. Leaf sheaths open, usually olive green to dark green, sometimes light brown, rarely dark brown, with narrow hyaline edges and ligules not conspicuously contrasting in colour with sheaths; sheaths on main stem mostly slender, rarely (particularly in rivers or on pioneer shoots) robust, 10–65 mm long, (0.2–)0.4–2.5 (–5.5) mm in diameter, gradually projecting above into a ligule 1–9(–14) mm long, the ligule persistent or disappearing with time, the hyaline edges often indistinct, whitish to greyish or brownish; sheaths on branches 7–28 mm long, 0.2–2.1 mm in diameter, with ligules 0.4–6(–10) mm long. Peduncles 18–190(–350) mm long. Spikes 10–31 mm long at anthesis, 19–63 mm long at fruit, the whorls contiguous to distinctly remote, with pairs of flowers/fruits on axis of spike often unevenly spaced, when fruiting the basal two pairs often more apart than the others. Flowers 5–12(–15), in 3–6 (–8) whorls. Fruits 3.4–4.2 mm long. Figures **4**, **5**, **6**, **7** and **8**.

Russia: Chelyabinsk: stagnus in fl. Sinara ad pag. Ust'-Karabolka, 11 Jul 1906, *O. Kler & G. Kler* (Gerb. Fl. SSSR no. 6808) (BM, BP, C, E, G, H, K, LE, M, S, W). – **Tyumen':** In viciniis oppidi Tobolsk, v staritse u g. Gashkovoi, v 15 v. k severu ot g. Tobol'ska, 2 Jul 1910, *S. Mameev 414* (K). – **Omsk:** Omsk, gegenüber dem Lager auf der Uferinsel in einem Kanale, 9 Sept 1879, *J. Killomann* (TAA). – **Novosibirsk:** Baraba, okolo Seliklinskogo, v' ozere, 3 Aug 1912, *P. Krylov'* (S); Distr. Kainsk, W. shore of B. Topolnoe Lake at the river Burly, 12 Jun 1913, *L. Utkin* (S); ad stationem viæ ferræ Tebisskaya ca. 254 km. ab oppido Omsk ad

[9] Tzvelev (1999) intended to transfer *Potamogeton intramongolicus* into the genus *Stuckenia*. However, he actually did not produce the proposed combination "*Stuckenia intramongolica* (Ma) Tzvelev" because the intended basionym was invalid. In spite of this, Tzvelev created a new name, because he cited in the synonymy *Potamogeton chakassiensis* and thus he made a full and direct reference to an effectively published description (Vienna ICBN Art. 32.5; McNeill et al. 2006) and to the corresponding type (Art. 10.3). The new name should be attributed solely to the validating author, Tzvelev. Nevertheless, because *P. chakassiensis* is validly published and legitimate name, epithet "chakassiensis" should have been adopted on the species level (Art. 52.1). The name *S. intramongolica* is therefore nomenclaturally superfluous when published and is ilegitimate according to the rules.

orientem, 2 Jul 1913, *S. J. Enander* (S). – **Altay:** distr. Krasnogorskoe, prope rivum Biya, in vicinitate pagi Saydyp, 300–310 m, 19 Aug 1972, *V. Vašák* (BRA). – **Taymyr:** Jenisei [= river Yenisey], Nikandrovskij ostrov [= Nikandrovskii island], 70°20′ N, 28 Aug 1875, *A. N. Lundström* (S); the same site, 14 Aug 1876, *H. W. Arnell* (S); Jenisei [= river Yenisey], Verschininskoje [= Izba Vershininskaya], 69°5′ N, 3 Sept 1876, *M. Brenner* (S). – **Krasnoyarsk:** Jenisei [= river Yenisey], Lebjedevo [= Lebed'], 62° N, 27 Sept 1876, *M. Brenner* (S); Uzhurskii r-on, oz. Uchum, okr. kur-ta "Ozero Uchum", 12 Sept [19]89, *P. Volobaev & S. Onishchenko* (LE); Ilanskii raion, 15 km k severo-vostoku ot pos. Nizhnyaya Poima (Niznyaya Poyma), pos. Kanifol'nyi, r. Reshety, 28 Jul 2006, *S. Rosbach 17809* (PRA-Kaplan). – **Khakassia:** Predgorya vostochnogo makrosklona Kuznetskogo Alatau, Shirinskii r-n, presnovodno-solenoe ozero Bele, solenaya chast' akvatorii, 24 Sept 1990, *P. Volobaev* (OLD); Shira district, small lake 1 km W of Tuz Lake, 450 m, 9 Aug 1990, *P. Volobaev S-200* (H); Mezhdu oz. Itkul' i st. Shira u oz. Kamyshevogo, bolottse po beregu i v vode ozera, 15–16 Jul 1929, *V. V. Reverdatto* (H). – **Irkutsk:** Ziminskii raion, okrest. pos. Batama, Batamiskii prud, v prudu, 10 Jul 2005, *S. Rosbach & V. Mozer 14836* (PRA-Kaplan); the same site, *S. Rosbach & V. Mozer 14837* (IRKU); Ust'-Ordynskii buryatskii avtonomnyi okrug, Alarskii raion, okrest. pos. Alyaty, oz. Alyaty, severo-zapadnyi bereg, 15 Jul 2003, *M. Ineshina & V. Chepinoga 12164* (PRA-Kaplan); Cheremkhovskii raion, 9 km k yugo-zapadu ot g. Kamenno-Angarsk, sel. Balukhar', v prudu, 6 Jul 2003, *V. Chepinoga, M. Ineshina & A. Verkhozina 11524* (IRKU); the same site, *V. Chepinoga, M. Ineshina & A. Verkhozina 11522* (PRA-Kaplan); Alarskii distr., Golumet' river near Nygda village, cult. as *Z. Kaplan 1838*, pressed 29 Aug 2006 (PRA-Kaplan). – **Buryatiya:** Baikal area, Barguzinskaya Basin, oxbow of Ina river 6 km NW of Yubileinyi (Yubileynyy) village, 495 m, 2 Aug 1993, *Z. Kaplan 93/561* (PRA-Kaplan); Ust'-Barguzin, Barguzin river near its mouth into Lake Baikal, 455 m, 8 Aug 1993, *Z. Kaplan 93/602* (PRA-Kaplan); Bichurskii raion, 7 km k zapadu ot pos. Okino-Klyuchi, gor'ko-solenoe ozero Obon u dorogi, 10 Jul 2006, *S. Rosbach & A. Frolov 16998* (PRA-Kaplan); Mukhorshibirskii raion, levyi bereg r. Khilok, naprotiv pos. Podlopatki, 1 km k yugo-vostoku ot pos. Chernoyarovo, starichnoe ozero u dorogi, 7 Jul 2006, *S. Rosbach & B. Voges 16640* (PRA-Kaplan). – **Sakhalin:** in lacis Tonaichan [= Okhotskoye], 18 Sept 1908, *U. Faurie 371* (BM, E, G, P, W). – **Kamchatka:** Krater' vulkana Uzon', 26 Aug 1909, *V. Komarov 3310* (K); Paratunka village, at the hot springs, 25°E, 17 Jun 1921, *E. Hultén 1761* (S); Bereg' Okeana bliz' ust'ya reki Teploi, 14 Sept 1909, *V. Komarov* (K); the same site, 15 Sept 1909, *V. Komarov* (TU).

Kazakhstan: Akmanskaya obl., Akmolinskii u., g. Dzhaksy-kan', 28 Jun 1904, *V. Petrovskii 45* (BM); Irtysh'ista Malo-Krasnoyarskin luona. [= Irtysh (river), Malaya Krasnoyarka], 10 Sept 1905, *J. G. Granö* (H); Southern part of Semipalatinsk district, near the mountains Ak-Dschumak, 4 verst to the south, 4 Jun 1914, *N. Schipczinsky 583* (S).

Kazakhstan/Uzbekistan: Deserta meridionalis, Jaxartica, in aquis lacus subsals stagnantibus prope p. Velikoalekseevskoë in deserto Mirza-tschul (Golodnaya Step), 8 Jul 1923, *Popov & Vvedensky* (Herb. Fl. Asiae Med., Fasc. XVII, no. 408a) (B, BR, BRNU, C, E, G, K, LE, LISU, P, PR, S, Z).

Turkmenistan: Regio transcaspica, Aschabad [= Ashgabat], in aquis prope Babuschkina-Ssad, 23 Sept 1900, *P. Sintenis 1230* (B, BM, BP, C, E, G, K, LE, MIN, P, PR, PRC, W, WU, Z, ZT); Deserta meridionalis, Kara-kum [= desert Garagum], in lacus amaro-salsi aquis stagnantibus prope urbem Kiptschak [= Kopak-Chalak] ad ripam sinistram fl. Amu-darja. [= river Amu Darya], 22 Aug 1928, *Granitov* (Herb. Fl. Asiae Med., Fasc. XVII, no. 408b) (B, BM, BP, BRNU, C, E, G, K, LE, LISU, P, PR, S, Z).

Caucasus: Georgia: Distr. Thbilissi [= Tbilisi], okr. ozera Lisi, 25 Jun 1962, *M. Kutateladze* (K, W). – **Armenia:** Gegharkunik province, Martuni district, Selim pass (Sulem pass), S of small village Agansich at river Argichi, river, 2260 m, 40°02′06" N, 45°14′29" E, 16 Aug 2005, *G. Fayvush, K. Tamanyan, F. Vitek & E. Vitek 05–1599* (PRA-Kaplan, W); Armavir province, Armavir district, ca 9 km E Armavir, S of village Aigerlich, ponds, 850 m, 40°08′23" N, 44°09′13" E, 5 Sept 2005, *M. Oganesyan, J. Hakobyan, H. Ter-Voskanyan & E. Vitek 05–2554* (PRA-Kaplan, W); Flora sevanensis (Circ. lac. Gokča) [= Lake Sevan], rip. Günei, prope Šordja [= Shorzha], lacum minor, 21 Jul 1927, *A. Sehelkovnikov & E. Kara-Murza* (E); R-n im. Kamo, pribrezhnaya polosa oz. Sevan mezhdu s. Nora-duz i Airivankom [= lake shore between Noraduz and Ayrivan], 13 Jul 1984, *N. S. Khandzhjan* (W); Okrestn. oz. Gokga [= Lake Sevan], Elenovka [= Sevan], v r. Zange, 1920 m, 5 Jul 1929, *P. Smirnov 25* (PR); N Erevan [= Yerevan], valley of river Pazdan 10 km S of Abovan [= Abovyan], in slowly mowing water, 14 Jul 1984, *U. Eggli 570* (Z). – **Azerbaijan:** raion Lenkoranskii, okrestnosti g. Port Ul'ich [= Port-Iliç], primorskie luga, okraina vodoema, 15 Jul 1963, *A. E. Bobrov & N. N. Cvelev 325* (K); in m. Caspic. pr. Baku, May 1868, *C. Haussknecht* (BM).

Turkey: A2(A) Bursa, Iznik, Iznik Gölü, ca 85 m, sheltered small ponds on shore, 21 Jul 1981, *P. Uotila 30314* (H); Prov. Antalya, lake 5 km NW of Döşemealte (± 25 km NNW of Antalya), W side of the lake (dept ± 30 cm), ± 300 m, 20 Apr 1959, *E. Hennipman, P. Nijhoff, C. Swennen, A. S. Tulp, W. J. M. Vader & W. J. J. O. de Wilde* (Fl. Turcom. Asiat. no. 501) (L, WAG); Villayet Antalya, Konyalta plaj, 5 km W of Antalya, In pool, 10 Sept 1967, *W. V. Rubers 564* (U); Antalya, freshwater outlet in E outskirts of the town of Baymalek [= Beymelek], along coastal road between Kale and Finike, in running freshwater, 36°15′ N, 30°03′ E, 13 Jul 1984, *A. Strid et al. 23552* (G); Prov. Ankara, River Sakarya, near the bridge of the road Ankara – Eskişehir (± 95 km SW of Ankara), in the river, ± 800 m, 18 Jun 1959, *E. Hennipman, P. Nijhoff, C. Swennen, A. S. Tulp, W. J. M. Vader & W. J. J. O. de Wilde* (Fl. Turcom. Asiat. no. 1994) (B, K, L, WAG); A3 Bolu, Abant Gölü, near the picnic area, drifting in the lake, ca. 1300 m, 14 Sept 1986, *P. Uotila 35598* (H); A9 Kars, SE Ufer des Çildir Sees [= lake Cildir Golu], Feuchtstellen, 1960 m, 2 Aug 1982, *Sorger & Buchner 82–102–37* (W); C2 Mugla, Dalyan, Kaunos (Caunos), hot spring area, a lake fed by hot springs, sea level, 19 V 1990, *P. Uotila 37870* (H).

Cyprus: Northern Cyprus, Kanliköy Reservoir, 120 m, 18 Aug [19]89, *KK & DV 432* (N.1122) (K).

Syria: Lac El Balouâa (ouest d'Idlib), 3 Jul [19]55, *H. Pabot* (G).

Israel: meer van Tiberias, ZW kant bÿ kinneret, 19 XI 1980, *A. J. Quené-Boterenhood* (L); Lake Hula, sea level, 23 X [19]35, *R. F. Jones 229* (BM); Hula Valley, Hula lake, 30 Jun 1933, *A. Eig, M. Zohary & N. Feinbrun* (E, K). –

Palestine: West Bank: recervoirs du Salomon près Bethlehem, Aug 1832, *Bové 536* (K); the same site, Aug 1832, *Bové 555* (BM, K).

Egypt: Sinai Peninsula: prope Suez in fontibus Ain el Mußsa [= 'Uyūn Mūsá], 9 Mar 1855, *T. Kotschy 1112* (W); Wasserlöcher der Oase Ajûn Mûsa [= 'Uyūn Mūsá], 17 Mar 1904, *A. Kneucker* (LD, Z); Suez, in d. Mosis Quellen [= 'Uyūn Mūsá], Apr 1872, *J. M. Hildebrandt 95* (L).

Iraq: Al-Majarrah 50 km SW of Falluja [= Al Fallūjah], 40 m, 30 Mar [19]76, *S. Omar, Al-Kaisi, K. Hamad & H. Hamid 44953* (K); Southern Desert, Basra distr., Huwair near Qurna [= Al Qurnah], 17 Mar 1957, *K. H. Rechinger 8485* (E, LD, W); Basra Liwa, between Qurna [= Al Qurnah] and Madina [= Madīnah], in ditch along roadside, 17 Mar 1957, *Department of Botany [= K. H. Rechinger et al.] 105* (B, BM, BR, E, G, K, L, LE, M, S, UPS, W, WAG, Z); the same site, *K. H. Rechinger 8479* (K, LD, M, W); Qurnah [= Al Qurnah, Iraq], slowly flowing roadside channel, 17 Mar 1957, *R. W. Haines 828* (E); Abul-Khassib [= Abū al Khaşīb], ditch near Shatt Al-Arab, 30 Mar 1973, *E. Weinert & A. Mousawi* (UPS); Basra Liwa, ditch 8 km east of Ashar [= Al 'Ashshār], 18 Mar 1964, *F. A. Barkley & Hikmat Abbas-al-Ani 6448* (K, W).

Iran: Prov. Khorásán, in valle fluvii Atrek, in fluvio ipso, inter Shírwan et Budjnúrd [= between Shīrvān and Bojnūrd], 25–27 Jul 1937, *K. H. Rechinger 1834* (B, G, M, W); Kuh Gelu [= Prov. Kohgiluyeh va Buyer Ahmad], in lac. Delli Bau pr. Dallun, Jul 1868, *C. Haussknecht* (G-Boiss, Z); the same site, Aug 1868, *C. Haussknecht* (BM, K, W); prov. Kerman, Kerman, in fossis, 1900 m, 30 Aug 1892, *J. Bornmüller 4715* (B, G, K, P, W, WU); prov. Farsistan, in fossis ad Servistan [= Sarvestān], ca 1600 m, 8 Oct 1892, *J. Bornmüller 4780* (B, G, K, LE, WU); ad Sinum Persicum, locis salsis ad pagum Hassan Langi, 27°22′ N, 56°52′ E, 9 May 1977, *J. Soják* (PR); prov. Balúchestán, in valle rivi Sarbáz prope vicum Bahú Kalát, ad marginem rivi, 4 Apr 1973, *J. Soják 1194* (PR); prov. Kermán, in alveo rivi siccati ad pagum Baghú (22 km ab oppido Bandar' Abbás), 27°18′ N, 56°30′ E, 16 May 1973, *J. Soják 4672* (PR); prov. Kermán, stagnum fluxus quieti 12 km versus boreo-occidentem ab opp. Mínáb, 27°14′ N, 57°01′ E, 18 May 1973, *J. Soják 4875* (PR); prov. Fars, locis stepposis prope pagum Mián Jangal, 29°09′ N, 53°27′ E, 3 Jun 1973, *J. Soják 5168* (PR).

Bahrain: Spring-fed pool near Salmabad, ca 30 m, 19 Feb 1988, *D. Phillips 112* (E).

Saudi Arabia: Layla lakes, S. of Aflag, drying-up pool, 2000 ft, 2 Mar [19]87, *J. S. Collenette 6048* (E, K); Tārūt Island, in Tārūt Bay, irrigation canal, 27 Jan [19]66, *J. P. Mandaville Jr. 524* (BM); Between Abqarq & Uqayr [= between Abqaiq and Al 'Uqayr], off the Damman [= Ad Dammām] highway, shallow saline pool among low dunes & hills, 200 ft, 23 Feb [19]87, *J. S. Collenette 6021* (E, K); 'Ayn ad-Dil', Al-Kharj, irrigation channel, 3 Jan [19]68, *J. P. Mandaville Jr. 1144* (BM); 295 km N of Jiddah, west of new Madinah [= Medina] Highway, pool of running water in lava field, 2000 ft, 5 Apr 1984, *J. S. Collenette 4884* (E, K).

Oman: W. Hajar mts, wadi al Hawasinah, near Majzi, in swift-flowing falag, 400 m, 10 Mar 1980, *J. R. Edmondson 3334* (E); Izki, near Muscat, running water in deep falaj, 500 ft, 12 Oct [19]92, *J. S. Collenette 8465* (E); East Hajar mountains, wadi behind Tiwi, permanent pond in wadi, 50 m, 29 Sept 1989, *A. G. Miller & J. A. Nyberg 9553* (E, K); Dhofar, Schwaimayah [= Shu'aymīyah], in Khor [River], ca sea

level, 17°52′ N, 55°36′ E, 28 Sept 1984, *A. G. Miller 6430* (E, K, UPS); Dhofar, Khawr Salalah, sandy coastal plain, brackish water lagoon, sea level, 28–29 Mar 1992, *S. A. Ghazanfar 1884* (BR); Dhofar, Khor Salalah, brackish water, sea level, 31 Mar [19]92, *S. A. Ghazanfar 1895* (BR); Salalah, 10 m, 13 Feb [19]73, *C. Parker 0.69* (BM); Dhofar Mountains, river mouth, coast, 1895, *W. J. Th. Bent 216* (K).

Afghanistan: Prov. Bamian, Band-i-Amir, Ufer des Band-i-Haybat, 2915 m, 26 Aug 1970, *D. Podlech 19525* (E, G, K, M, MSB); the same site, 8 Sept [19]70, *A. Dieterle 793* (G, M, MSB); Prov. Bamian, Band-i-Amir, unterer See Band-i-Panir, seichtes Ufer, 2900 m, 29 Jul 1969, *D. Podlech 16021* (E, G, K, M, MSB); Prov. Nimroz [= Nīmrūz], 32 km SW Lokhi [= Lowkhī], an der Brücke über den Kash Rud [= Khāsh Rūd], 545 m, 6 Nov 1969, *D. Podlech 17160* (G, M, MSB); Prov. Kandahar, Daman, 15 km östlich Kandahar an der Straße nach Ghazni, 1045 m, in einem Wassergräben, 2 Oct 1969, *D. Podlech 16867* (M, MSB).

Pakistan: Karachi, Khadeji ca 46 km ENE Karachi, still water below fall, 29 Apr 1965, *K. H. Rechinger 28563* (G, K, W); the same site, *J. Lamond 752* (E); near Peshawar, stream, 1120 ft, 34°N, 25 Oct 1895, *H. H. Johnston 4* (BM, E); Peshawar Valley, *B. A. Suhail 241* (K); Karakoram Mountains, Hunza Valley, a small saline lake Borit Jil, 2500 m, 31 Aug 1980, *F. A. Perrott 24* (K); Punjab, Lahore, Shalimar Gardens, tanks, 14 Feb 1953, *G. Taylor* (BM).

India: Jammu and Kashmir: Wullar Lake, 16 Jun 1959, 2000 m, *T. A. Rao 9486* (L); Srinagar, Dal Lake, 5500 ft., Jul 1924, *R. R. Stewart 7146* (K); the same site, 4 Jul 1937, *F. Ludlow & G. Sherriff 7* (BM); 10 Sept 1983, *M. Casimir* (MSB); 7 Oct 1986, *C. D. Cook & R. Frey 4530* (Z); Srinagar, Hokhhar Sar Wetland, 1584 m, 2006, *A. H. Ganie 1008* (PRA-Kaplan); Sumbal, Jhelum valley, 5200 ft, 30 Jun 1940, *F. Ludlow & G. Sherriff 7701* (BM, E, UPS); the same site, *F. Ludlow & G. Sherriff 7704* (BM, E, UPS); Anchar Lake, 34°10′ N, 74°48′ E, 5200 ft, 17 V 1940, *F. Ludlow & G. Sherriff 8071* (BM, E, UPS); Manasbal Lake, *A. P. Young* (BM); Manasbal, 5200 ft, 5 Jun [19]40, *F. Ludlow & G. Sherriff 8117* (BM). – **Uttaranchal:** Kumaon, Naini Tál, 6400 ft, R. *Strachey & J. E. Winterbottom 7* (BM, P). – **Punjab:** Phagwara, 10 Nov 1959, *T. A. Rao 10706* (L). – **Uttar Pradesh:** Saharanpur, 27 Oct [19]25, *G. O. Allen* (BM). – **Rajasthan:** Kota, swift flowing irrigation channel flowing out of Umedgung tank, 28 Oct 1970, *C. D. K. Cook & B. J. Gut 38* (K, Z). – **Delhi:** Suraj Kund, 650 ft, 10 Jan 1965, *D. Walia 546* (WAG). – **Bihar:** "Behar", regio trop., sea level [exact locality not given], *J. D. H. [= J. D. Hooker]* (BM, C, G, GOET, L, K, M, P). – **Assam:** "Assam" [exact locality not given], *Griffith 1316* (BM). – **Orissa:** Bargud, plentiful in Jatadhar Muhana & Mahanga river in semi-saline water, 15 Feb 1961, *G. Panigrahi 23852* (L). – **Tamil Nadu:** Dharmapuri Distr., Denkanikotta taluk, Anchetty Lake, 550 m, 17 Nov 1978, *K. M. Matthew & N. Venugopal* (herb. RHT no. 20339) (H); the same site, 29 Apr 1979, *K. M. Matthew & N. Venugopal* (herb. RHT no. 23154) (L).

Sri Lanka: Jaffna Distr., Elephant Pass, in the lagoon, 12 Apr 1973, *K. Bremer, L. E. Kers & L. Thorán 68* (K); Jaffna Peninsula, along Chempiyanpattu causeway, Lagoon Tandaimanar, sea level, 8 Jul 1971, *W. Meijer 783* (L); Caltura [= Kalutara], *Thwaites 3531* (BM, CGE, FR, G, K, P).

Nepal: Jomosom, Kali Gandaki Valley, in shallow pond, 9500 ft, 7 Jun 1954, *J. D. A. Stainton, W. R. Sykes & L. H. J. Williams 5623* (BM); Jomosom, N. of Tukucha, Kali Gandaki, in pond, 9500 ft, 29 Jun 1954, *J. D. A. Stainton, W. R. Sykes & L. H. J. Williams 1494* (BM, E, G, P, UPS).

China: Xinjiang Uygur: district of Bohu Xian, near Wudadui, municipality of Guangming Gongshe, water 1.2 m deep, 13 Sept 1984, *Y. H. Guo & Fan 017* (Z); Tarim (Närman uppgift satuas), Nedre Tarim [= lower section of Tarim River, approx. 40°00′ N, 88°20′ E], ca. 830 m, 1900, *S. Hedin* (S, fragment in LD). – **Tibet:** Kongbo [= Gongbo'gyamda County], near Tsela Dzong, in deep still water, 9500 ft, 1 Aug 1947, *F. Ludlow, G. Sherriff & H. H. Elliot 14221* (BM, GH). – **Gansu:** Gobi australis [exact locality not given but perhaps from Gaotai], 1886, *G. N. Potanin* (BM, K). – **Inner Mongolia:** Gobi media, in lacu ad fl. Yedzin, 1886, *G. N. Potanin* (E, K, M, S); prope Edsen-gol, in laculo ca. 2 li (1 km) ad occid. versus a camp. LVIII, 27 V 1930, *B. Bohlin 1859* (S-Hedin); prov. Ning-hsia, Sogho-nor, Camp. VII, 13 Jul 1928, *K. G. Söderbom 7052* (S-Hedin); the same site, *K. G. Söderbom 7053* (S-Hedin); Lake Wuliangsuhai, Nan Tian Men Island, 4 km NW Fishery Farm shore, canal close to jetty, 40.89325° N, 108.81935° E, slightly brackish water, 14 Sept 2000, *A. Svenson 00151* (S); Bameng, lake Wuliangsu, 900 m, 31 Aug 1981, *G. H. Liu 2* (Z); Wumeng, lake Huangqi Hai, 30 Aug 1981, *J. G. Ying* (Z); Plaine du Toumet, T'ai hai [= lake Dalai Nur], 22 Aug 1919, *E. Licent 5844* (BM, K, P); pr. Jakschi [= Yakeshi], ozero, 19 Aug 1902, *D. Litwinow 476* (BM). – **Heilongjiang:** pr. Zizikar [= Qiqihar], ozero, 10 Aug 1902, *D. Litwinow 2417* (BM, GH, LE); the same site, *D. Litwinow 2479* (BM, LE); g. Kharbin [= Harbin], der. Kusyangyun', v vode, 1951, *Skvortzov 1199* (LE). – **Jilin:** Ad fl. Ssungari pr. Taladshao [= at river Songhua near Taolaizhao], ozero, 19 Jul 1903, *D. Litwinow 3353* (BM, LE). – **Liaoning:** Port'-Artur' [= Lüshun], v ozer'i, 6 Jul 1902, *D. Litwinow 1188* (K, LE). – **Beijing:** Pékin [= Beijing], plaine, bords du petit lac, près du palais impérial de Ouan cheou chan, Jun 1889, *E. Bodinier* (E). – **Tianjin:** Yangtsoun [= Wuqing] NO de Tientsin [= Tianjin], V 1915, *E. Licent 1015* (BM, P); Tientsin [= Tianjin], 1 Jul 1912, *M. S. Clemens 1564* (BM, E); the same area, 15 Aug 1912, *M. S. Clemens 1564a* (E); 22 V 1913, *M. S. Clemens 6059* (BM, E); 13 V 1913, *M. S. Clemens 6059a* (E, P); 1 Jul 1913, *M. S. Clemens 6059b* (E). – **Hebei:** fossés à Tcheng Ting Fou [= Zhengding], Aug 1912, *L. Chanet 610* (K); Tchang kia Ichoang, 10 May 1914, *E. Licent 106* (BM, P). – **Shaanxi:** district of Yulin, municipality of Mahe Gongshe, water reservoir Nanda Haizi, 23 Aug 1982, *Y. H. Guo 070* (Z). – **Shanxi:** Tai-yuan-fu, Hai-hsi-men, in aqua subdulci, ca. 800 m, 19 Oct 1924, *H. Smith 8034* (BM, LD, S, UPS); reg. centr., ad templum Chin-ssü, rice fields, ca. 800 m, 10 Aug 1924, *H. Smith 6814* (BM, S, UPS); vers le Miao tao, Tch'eng chan tao, 29 Aug 1921, *E. Licent 6424* (P); Yün-ch'eng, Salt Lake, in brackish water pools, 1 Jul 1924, *H. Smith 5991* (LD, S, UPS); Yün-ch'eng, Salt Lake, in fresh water pools, 4 Jul 1924, *H. Smith 6096* (S, UPS). – **Hubei:** district of Danjiang, Fujiagou, water course, 100 m, 25 Aug 1980, *W. X. Wang 224* (Z); lake Hong Hu, pond Chati, ship transport channel, 6 Sept 1979, *W. X. Wang 143* (Z). – **Yunnan:** Diqing Prefecture, Napa Hai, N of Zhongdian, pools and on mud in bed of seasonal lake, 3290 m, 15 Jun 1993, *B. Aldén, J. C. M. Alexander, D. G. Long, R. J. D. McBeath, H. J. Noltie & M. F. Watson 1355* (E); Dêgên Zang Aut. Pref., Zhongdian Co., Napa Hai Lake, 3300 m, 27° N, 99° E, 21 Sept 1995, *Forestry Commission, Roy. Bot. Gard. Edinburgh Exped. to Dêgên Pref. no. 345* (E); Along the base of the eastern flank of the Lichiang Rge., in shady pools, 27°10′ N, 9000 ft, Aug 1914, *G. Forrest 13149* (E); Lac de Tchao tong [above Heqing], 23 May 1882, *J. M. Delavay* (L); Lac de Lan Kong [near Yuhu], 2800 m, 19 Nov 1887, *J. M.*

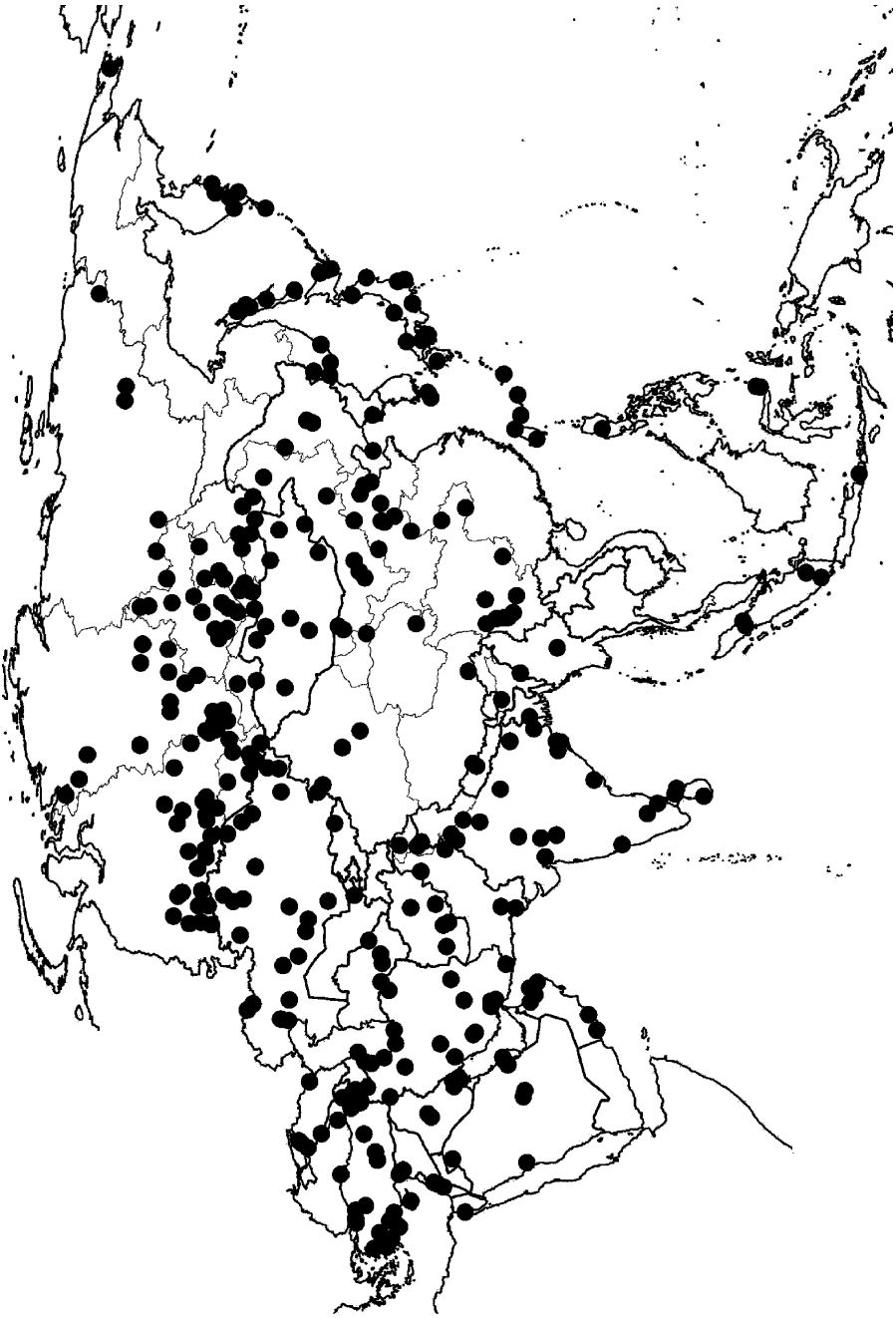

Fig. 9 Distribution of *S. pectinata* in Asia

Delavay 4610 (P); Margins of the Tali Lake [= lake Er Hai, near Dali], 25°40′ N., 6200 ft, May 1914, *G. Forrest 12387* (E); vicinity of Yun-nan-sen [= Xiangyun], *E. E. Maire 628* (E); In regione calide temperata prope urbem Yünnanfu [= Kunming], in parte stagnante lacus inter phragmiteta, ca. 1890 m, 1 Mar 1914, *H. F. v. Handel-Mazzetti 296* (WU); Yünnanfu [= Kunming], in canale Oryzetorum, ca. 1900 m, 12 Apr 1922, *H. Smith 1535* (BM, LD, S, UPS). – **Sichuan:** prope Ningyuanfu [= Xichang], in lacu, ca. 1700 m, 24 Apr 1914, *C. Schneider 1098* (B, E, G, GH, K); Nin-yüan-fu [= Xichang], in aqua dulce, ca. 1650 m, 15 May 1922, *H. Smith 1842* (BM, S, UPS); Prope urbem Ningyüen [= Xichang], in regione subtropica, in lacu locis haud profundis ubique, ca. 1610 m, 2 May 1914, *H. F. v. Handel-Mazzetti 1834* (K, S, WU). – **Guizhou:** rivière Pin-fan, 7 Oct [19]04, *J. Cavalerie 1962* (E).

Mongolia: Khujirtu-gol, Camp. VIII, in rivulo, 28 Aug 1927, *D. Hummel 1176* (S-Hedin); Khonin-chaghan-chŏlo-gol, Camp. XI, 1 Aug 1927, *D. Hummel* (S-Hedin); Kolobolchi Nor [= lake Holboljin Nuur], in lake, 4100 ft, 1925, *R. W. Chaney 289* (K); prov. Ning-hsia, Bayan-bogdo Camp, Wen-tsun-hai-tze, 22 Jun 1929, *K. G. Söderbom* (S-Hedin); Pr. pag. Dariganga, in lacu, cca. 1000 m, 20 Aug 1967, *R. Moldvai* (BP).

North Korea: in aquis Chinnampo [= Namp'o], Jun 1901, *U. Faurie 687*^{bis} (BM).

South Korea: in stagnis littoris maris Quelpaert [= island Jeju-do], Jun 1907, *U. Faurie 2076* (E); the same site, Jul 1907, *U. Faurie 2079* (BM, E); Quelpaert [= island Jeju-do], in aquis littoris Taitjyeng, Jul 1909, *E. Taquet 3114* (C, E, G, S); Quelpaert [= island Jeju-do], in lacunis salsuginosis insulae Saiseum, 6 Jul 1910, *E. Taquet 4028* (C, E, G).

Japan: Hokkaido: lac d'Abashiri, 20 Aug 1892, *U. Faurie 8586* (G, P); lac d'Akan, 9 Aug 1893, *U. Faurie 16711* (WU); lac de Kushiro, 25 Aug 1892, *U. Faurie 8617* (G). – **Honshu:** Pref. Chiba, Prov. Kadzusa, Sanbu-gun, Naritoo-choo, Kido, sea-side, 24 Jul 1968, *M. Furuse 46677* (K, L); Tottori Pref., Yonago, Hikonashinden, in Tsubasa pond, 21 Aug [20]05, *S. Iida 05001* (PRA-Kaplan). – **Shikoku:** Ehime Pref., Saijo, artificial ditch, 1 Aug [20]03, *S. Iida & S. Kobayashi 03021* (PRA-Kaplan); Pref. Kochi, Kochi City, 17 Jun 1929, *S. Saito 828* (BM).

Ryukyu Islands: Okinawa Island, pond along the seashore at Itoman, 10 Jun 1955, *S. Hatusima 18137* (L); Ikema Shima [= island Ikema-jima], east of central inlet, open channels of large brackish marsh, 0–1 m, 27 Aug 1956, *F. R. Fosberg 38501* (L); Yaeyama Gunto, Yonaguni Island, cool stream, 28 Aug 1951, *E. H. Walker & S. Tawada 6830* (K, L).

Taiwan: in canalibus Biyoritsu, 27 May 1903, *U. Faurie 530* (BM, G); Anpinq [= Anping], in salt water ditch, *A. Henry 1767* (K).

Myanmar: Shan State, Taunggyi division, Inle Lake (Inlay Lake), Inbawkon (silk weaving centre), lower part of the northern lake, ± 20° N, 97° E, ± 875 m, 7 Dec 2001, *C. D. Cook & I. H. Mueller 5513A* (Z).

Sumatra: Toba [= Lake Toba], Parsea, Becken, Sudufer, 8 Apr [19]29, *F. Ruttner 215* (W); Tobalake nr Tuktuk, [island] Samosir, 900 m, 1 Aug 1975, *J. F. Veldkamp 7178* (L); Perapat [= Parapat], East Lake Toba, 906 m, in the lake, 20 Dec 1928, *J. A. Lörzing 14840* (L); Danau Ranau [= Lake Ranau], am Nordufer angetrieben, 6 Feb 1929, *F. Ruttner 216* (W); Danau Ranau, on shallow water, 19 Feb 1983, *J. J. Sfriastini 826* (K); Palembang, Banding Agoeng, Ranaumeer, ± 55 m, 25 Oct 1929, *C. G. G. J. van Steenis 3170* (L).

Bali: Mount Batur [almost certainly from Lake Batur], ± 1200 m, 2 Jul 1958, *Kostermans, Kuswata, Soegeng & Soepadmo 254* (L); Lake Batur, 30 Dec 1930, *A. Ernst* (L); Lake Batur, 08°15′ S, 115°25′ E, 16 Jun 1976, *W. Meijer 10316* (L).

Sulawesi: Menado, Tondano [almost certainly from Lake Tondano] *[J. E. Teijsmann] 5317* (U); "Hab. Insulam Celebes" [exact locality not given], 1859–1860, *G. H. de Vriese & J. E. Teijsmann* (L); Minahassa (Menado), 700 m, 7 Feb 1895, *S. H. Koorders 19624β* (L).

Philippines: [island] Samar, Mount Purog, Oct 1951, *G. E. Edaño* (L).

Stuckenia pectinata is the most widespread species of the genus, occurring on all continents of the world except Antarctica. It is also the most frequent of the species of *Stuckenia* encountered in Asia (Fig. **9**), growing particularly between the 20th and 60th parallels, although it is absent in large areas of deserts and on high mountains due to the absence of suitable habitats. It grows in a wide range of habitats, mainly in mesotrophic to eutrophic, standing to fast running waters, most often in ponds, lakes and rivers. In contrast to most other *Potamogetonaceae*, it tolerates brackish water.

Stuckenia pectinata is known to be one of the most variable species of *Potamogetonaceae*. However, much of the observed variation is due to phenotypic plasticity or ontogenetic variation (Kautsky 1987, 1991; Spencer 1987; van Wijk 1988, 1989; Idestam-Almquist and Kautsky 1995; Kaplan 2002). Many attempts to evaluate this extensive morphological variation taxonomically have appeared in the literature. The proposed classifications are often dependent on highly plastic characters such as length and width of leaves, shape of leaf apex and length of internodes. The recent literature adopting these concepts and their inaccurateness are reviewed in detail by Kaplan (2002).

Robust river or deep-water forms of *S. pectinata* with wintergreen stems and large inflated sheaths on basal parts of the stem are sometimes incorrectly identified as *S. vaginata*. Specimens with the most divergent features are the overwintering shortened robust shoots or the young pioneer shoots sprouting at the beginning of spring (see the discussion on ontogenetic variation above). The best-known example is *P. helveticus*, described from deep water of a perialpine lake in the European Alps. The type specimen was collected at the beginning of March. Specimens sampled from the type population later in the season (e.g. 13 Sept 1904, *E. Baumann*, ZT; 23 Sept 1904, *E. Baumann*, PRA-Kaplan, ZT; 12 Sept 1913, *G. Kohler*, G) are of more usual phenotype and some of them fit so well within the normal variation range of *S. pectinata* that they would be unrecognizable without knowledge of their origin. *Potamogeton balatonicus*, first described as a variety of *P. helveticus* from a central European lowland lake, as well as later collected specimens designated with this name, do not deviate from the usual variation of *S. pectinata*. *Potamogeton helveticus* and other similar forms seem to be local ecotypic adaptations to environmental conditions that enable the overwintering of green shoots. Such plants occur in various parts of the species range and thus seem to have evolved repeatedly and independently of each other. No taxonomic status is therefore assigned to these robust forms.

One of the morphologically most distinct forms of *S. pectinata* is the morphotype with broad and obtuse to rounded leaves that was described as *P. zosteraceus*.

Typical forms occur along the coasts of the Gulf of Bothnia and Gulf of Finland in northern Europe, but similar plants are encountered elsewhere. Although the ultimate forms of this morphotype are markedly different from the most common phenotypes of *S. pectinata*, all are connected by all sorts of intermediates so that no clear-cut demarcation between them can be drawn. The spectrum of intermediates includes plants with all leaves of intermediate size as well as plants with broad leaf-blades on the main stem and narrow leaf-blades on the branches. This pattern of variation shows a rich mosaic of all possible combinations.

Because the "*zosteraceus*" phenotype is geographically confined to a relatively small geographic area the capacity to produce these broad and obtuse leaves may be genetically fixed. However, the development of the broad-leaved phenotype seems to be under environmental control, and partly also associated with ontogenetic variation. For example, Tiselius re-collected broad-leaved *P. zosteraceus* at the type locality on 28 Jun 1896 (distributed in his *Potamogetones suecici exsiccati* under no. 123) and these plants have leaves up to 2.5 mm wide. However, plants collected at the same site seven weeks later, on 16 Aug 1896 (*Potamogetones suecici exsiccati* no. 124), have leaves only 0.2–0.5 mm wide. In other words, the plants called "*zosteraceus*" are recognizable only in their extreme phenotypes, whereas the narrow-leaved phenotypes sometimes produced by the same genotypes cannot be consistently distinguished from the ordinary *S. pectinata*. This clearly shows that if this and other forms were recognized as formal taxa, only a small proportion of the available material, with standard methods of identification, could be reliably assigned to one or another of the recognized taxa. No formal status is therefore given to these forms here.

2. *Stuckenia macrocarpa*

Stuckenia macrocarpa (Dobrochot.) Tzvelev, Bot. Zhurn. 84(7): 111. 1999.

> ≡ *Potamogeton macrocarpus* Dobrochot., Bot. Mat. Gerb. Bot. Inst. Akad. Nauk SSSR [= Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS] 14: 70. 1951.
> Type: [Kazakhstan:] "Kas. SSSR, Aktyubinskaya oblast', oz. Chelkar, 10 Aug 1947, Leg. K. V. Dobrokhotova" (holotype: AA, not seen; isotype: LE).

Stem mostly densely branched above, particularly on terminal parts, with one branch emerging from each node. Leaves on main stem narrowly linear to linear, 18–65 mm long, 0.8–2.5 mm wide, 9–55 times as long as wide, decaying early, ± straight, usually dark green to brownish green or to light brown, the apex acute to obtuse; mature leaves on branches 9–46 mm long, 0.3–2.5 mm wide, 10–90 times as long as wide, the apex acute to subacute, occasionally obtuse, rarely rounded. Leaf sheaths open, usually dark green to brownish green, with narrow hyaline edges and ligules not conspicuously contrasting in colour with sheaths; sheaths on main stem slender, 9–27 mm long, 0.6–2.1 mm in diameter, projecting above into an indistinct ligule 0–1.2 mm long, the ligule often disappearing with time, the hyaline edges often indistinct, yellowish to brownish; sheaths on branches 6–20 mm long, 0.6–2.2 mm in diameter, with ligules 0–1.1 mm long. Peduncles 30–132 mm long. Spikes 12–26 mm long at anthesis, 19–36 mm long at fruit, the whorls contiguous to shortly remote at anthesis, almost contiguous to distinctly remote later, with pairs of flowers/fruits on axis of spike mostly unevenly spaced, when

fruiting the basal two pairs often more apart than the others. Flowers 6–8(–10), in 3–4(–5) whorls. Fruits (4.1–)4.3–5.8 mm long. Figures **10**, **11**, **12** and **13**.

Russia: Kurgan: Kurganskii raion, ozero Krutali, 27 May 1959, *V. M. Katanskaya* (LE); Kurganskii raion, ozero Glubokoe u der. Shelepovo, 9 Aug 1959, *V. M. Katanskaya* (LE); Lebyazh'evskii raion, ozero Nizhne-Glubokoe, 5 Aug 1959, *V. M. Katanskaya* (LE); Lebyazh'evskii raion, ozero Lebyazh'e Pervoe, 5 Aug 1959, *V. M. Katanskaya* (LE); Makushinskii raion, ozero Dolgoe u der. Suslovo, 15 Aug 1959, *V. M. Katanskaya* (LE). – **Novosibirsk:** Kupinskii raion, oz. Malyi Chan, u gr. Vertkovom, 14 Aug 1947, *T. G. Popova & N. I. Yakubova* (LE); d. Zhuravliki, oz. Malyi Chan, 29 Aug 1935, *N. Turtsina* (LE).

Kazakhstan: Prov. Turgai [= Torghay], Syr-Darya, Transcaspia, Bukhara, Chelkar' [= Shalqar], v r. Kaul'dzhur', 3 Jul 1910, *N. Androssow* (LE); Aktyubinskaya oblast', oz. Chelkar, 10 Aug 1947, *K. V. Dobrokhotova* (LE); Akmolinskii raion, v 50–60 km k yugo-zap. ot Akmolinska, pravoberezhie r. Nuri, v ozere Dzharli kul', 26 Jul 1930, *P. P. Polyakov* (LE); Akmolinskii raion, v 60–70 km k yugu ot Akmolinska, pravoberezhie rechki Nuri, v oz. Saumal-Kul', 24 Aug 1932, *P. P. Polyakov* (LE); Kustanaiskaya obl., Fedorovskii raion, ozero Saman-Kul', 20 Sept 1959, *V. M. Katanskaya* (LE); Kustanaiskaya obl., Uritskii raion, ozero Taly, 10 Sept 1959, *V. M. Katanskaya* (LE); Semipalatinsk. u. i okrug., Leninskaya, oz. Bolyk-Tykul' s slabo solonovatoi vodoi, 26 Aug 1928, *F. L. Zapryagaev 2313* (LE).

Stuckenia macrocarpa occurs in the lowlands of west-central and northern Kazakhstan and in the adjacent parts of western Siberia (Fig. **14**). Most collections come from lakes, rarely was it collected in rivers.

Although the species is only rarely found in herbaria, it is obviously common in suitable habitats within its range, but undercollected. This is documented by the fact that about one-third of all available herbarium specimens of this species were collected by Katanskaya during intensive fieldwork conducted in just one season in 1959.

No duplicates seem to have been distributed abroad and that is why almost no collections are preserved in herbaria outside the former Soviet Union. This, together with the limited distribution range of the species, may have been why this species has not been generally accepted but considered to be one of many forms of the variable *S. pectinata* (see e.g. Wiegleb and Kaplan 1998). However, the herbarium LE (the 'Middle Asia' and 'Siberia' sections) preserves a nice set of specimens of *S. macrocarpa* that show its typical variation pattern. Although *S. macrocarpa* is primarily defined by its fruits, which are bigger than in any other *Stuckenia* species, this feature is associated also with less reliable but still useful vegetative features. With a little practice, some phenotypes of *S. macrocarpa* can be distinguished even if only vegetative material is available. This is particularly true of plants with dense foliage on short internodes seen on the terminal parts of branches that have a characteristic markedly compact appearance. This appearance is not the same and should not be confused with the widespread richly branched phenotype "*scoparius*" of *S. pectinata*, which was distinguished in the past in European literature and which is only an extreme form of *S. pectinata* (Kaplan 2002).

Stuckenia macrocarpa is clearly related to *S. pectinata*. In contrast to the many variants of the latter, *S. macrocarpa* has its distribution range conspicuously well defined (see above). I have never seen specimens with the characters typical of *S. macrocarpa*

Fig. 10 General appearance of *S. macrocarpa*, with foliage concentrated mainly on terminal parts of branches (5 Aug 1959, *V. M. Katanskaya*, LE); scale bar=5 cm

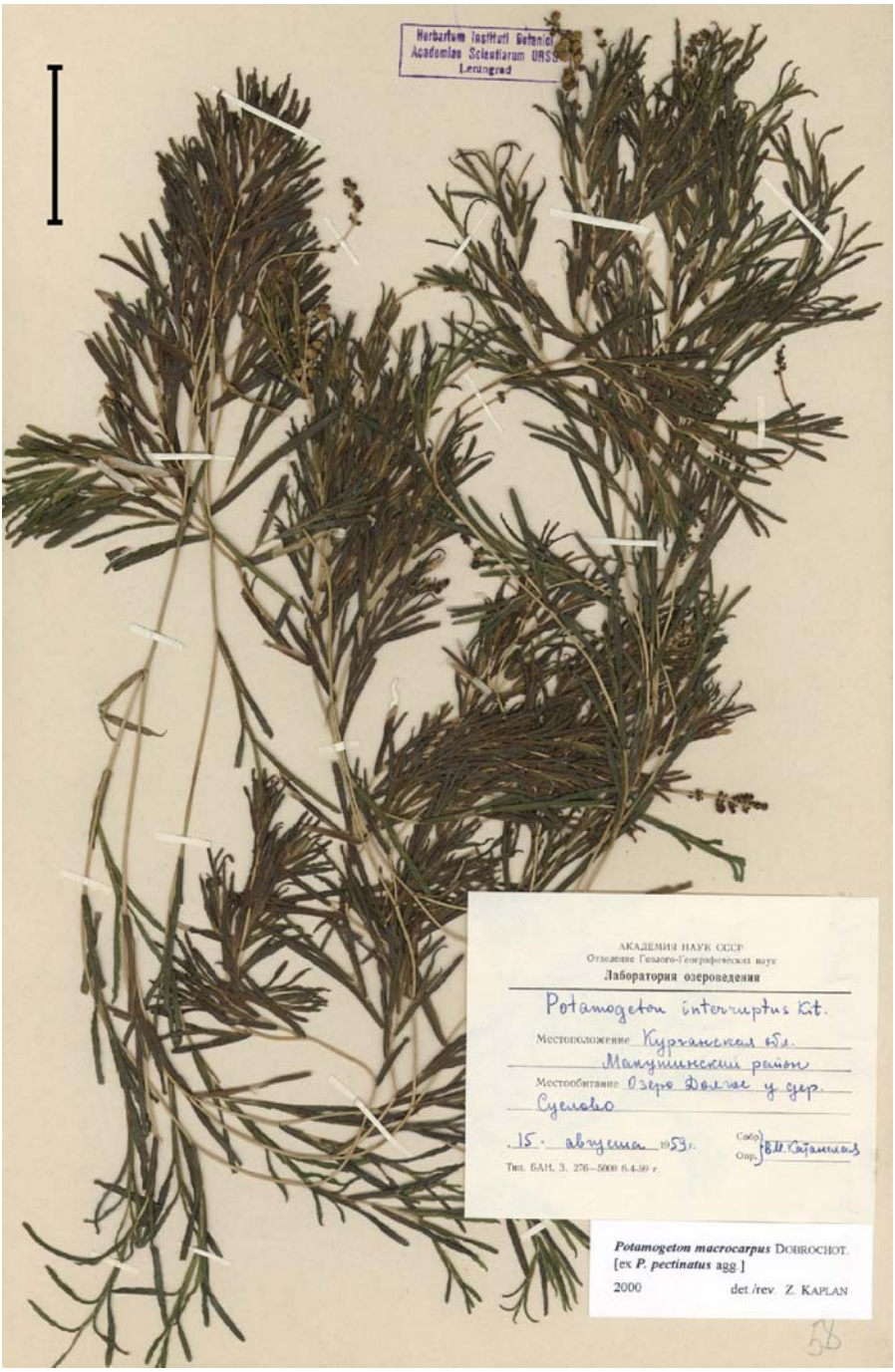

Fig. 11 Broad-leaved form of *S. macrocarpa* (15 Aug 1959, *V. M. Katanskaya*, LE); scale bar=5 cm

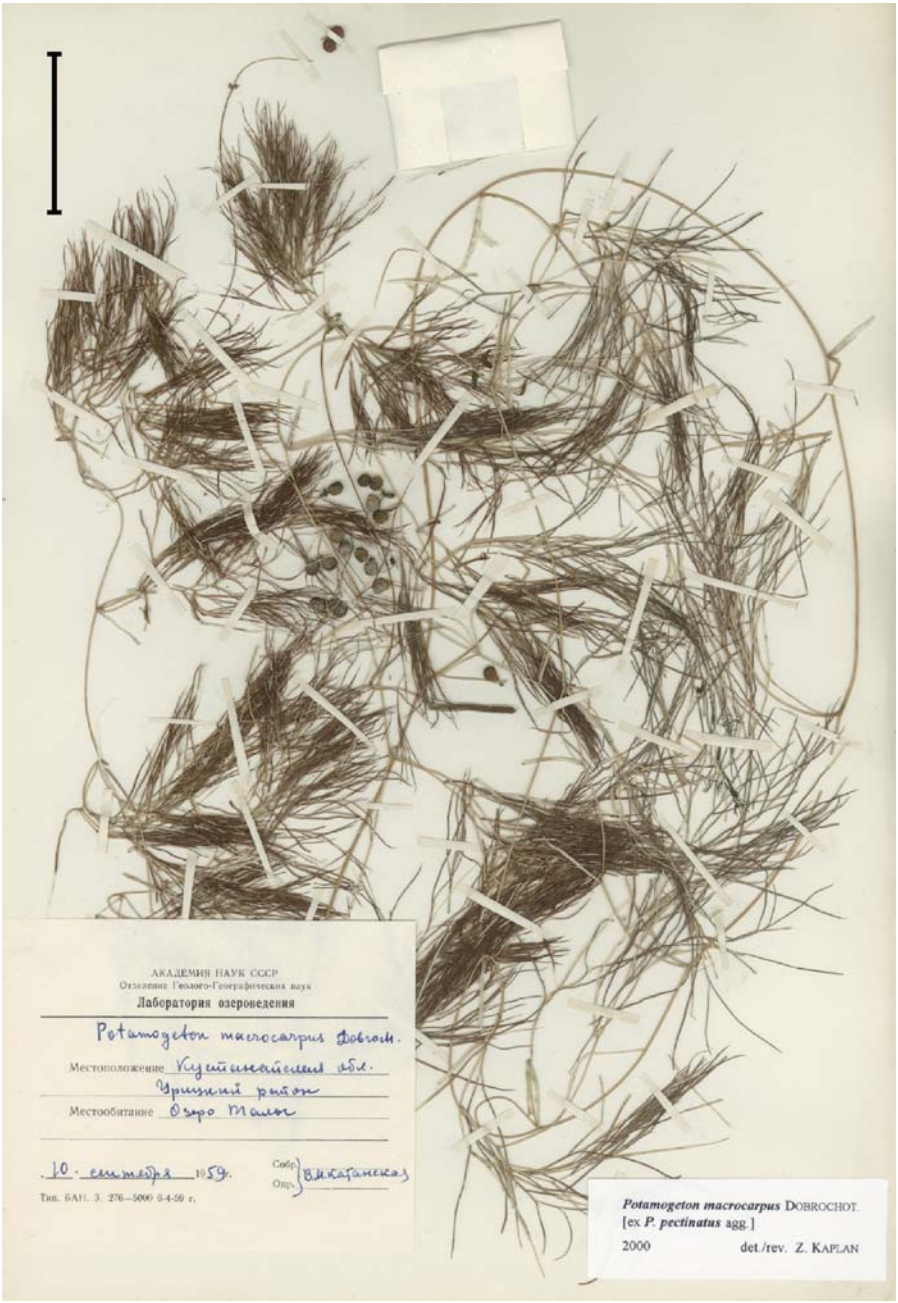

Fig. 12 Narrow-leaved form of *S. macrocarpa* (10 Sept 1959, *V. M. Katanskaya*, LE); scale bar=5 cm

Fig. 13 Fruits of *S. macrocarpa* (10 Sept 1959, *V. M. Katanskaya*, LE); scale bar=5 mm

from other parts of the world. Because of its unique character combination and the restricted geographic range, this taxon should be distinguished as a separate species.

3. *Stuckenia pamirica*

Stuckenia pamirica (Baagöe) Z. Kaplan, **comb. nova**

≡ *Potamogeton pamiricus* Baagöe, Vidensk. Meddel. Dansk Naturhist. Foren. Kjöbenhavn 1903: 182. 1903.
Type: [Tajikistan:] "Museum botanicum Hauniense, 644. Potamogeton pamiricus mihi, determ: Baagöe, legit: Ove Paulsen, 1/7 [18]98 in stagno prope lacu Kara Kul (alt. 4000 m), Submersus, infloresc. fluitante. Pamir, Olufsens anden danske Expedition i Centralasien 1898–99." (**lectotype designated here**: C; illustration: BM, C-Baagöe).

= *Potamogeton recurvatus* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 37. 1916.

Type: [Tajikistan:] "Potamogeton pamiricus mihi, In stagnis prope lacu Kara-Kul, alt. 4000 m. Pamir. Centralasia, 1/7 [18]98, Ove Paulsen legit, determ. I. Baagøe" (**lectotype designated here**: LD).

Stem unbranched or moderately to richly branched near base and sparingly above, with one branch emerging from each node. Leaves on main stem narrowly linear, 80–260 mm long, 0.5–1.7 mm wide, 60–290 times as long as wide, occasionally recurved towards apex, sometimes even twisted spirally when dried, dark green or mostly conspicuously dark brown to blackish when dried, older ones discoloured,

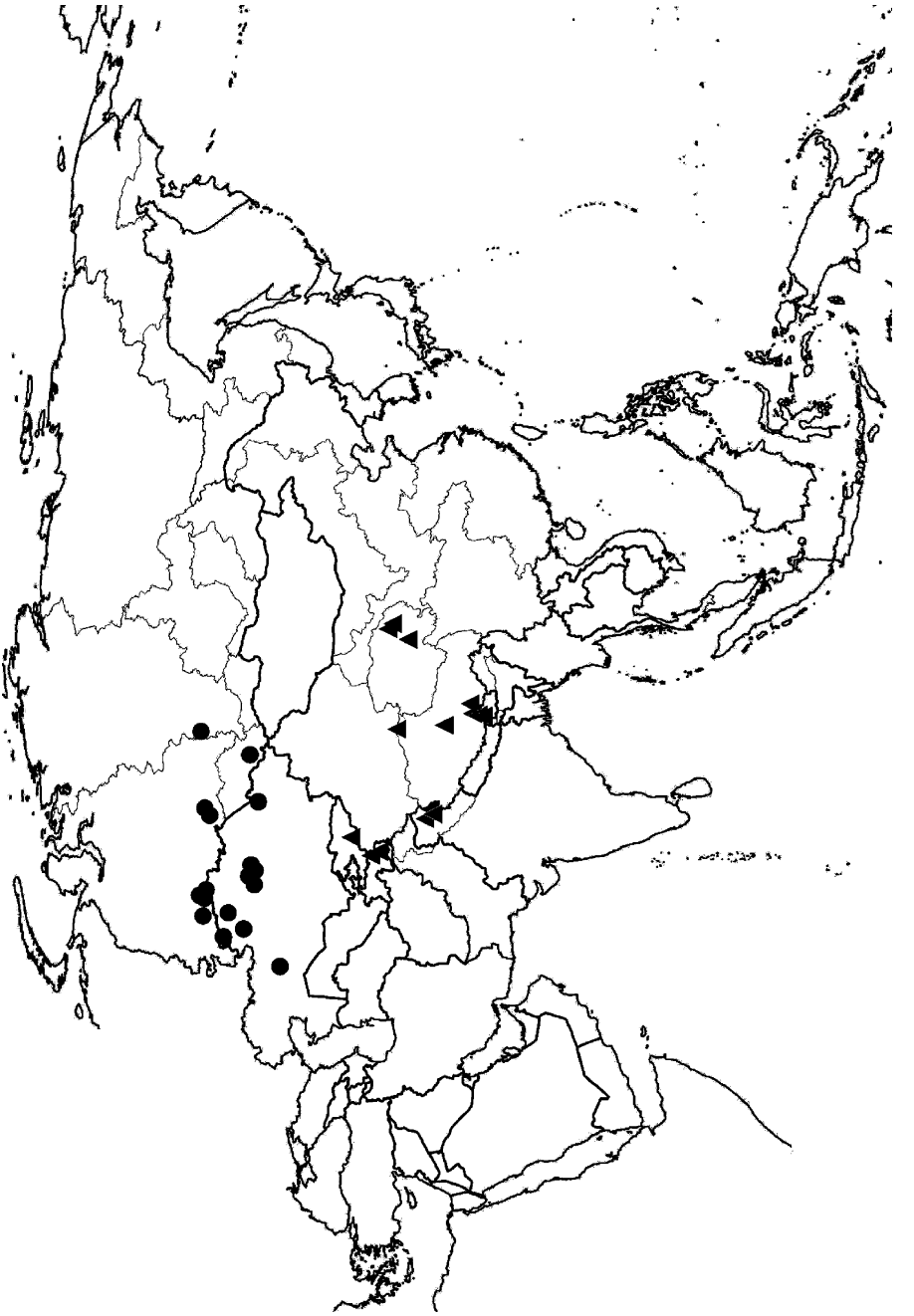

Fig. 14 Total ranges of *S. macrocarpa* (circles) and *S. pamirica* (triangles)

creamy whitish or greyish to bright white, the apex obtuse to rounded; mature leaves on branches 70–110 mm long, 0.3–0.8 mm wide, of similar proportional size as those on main stem, the apex obtuse. Leaf sheaths open, dark green or mostly conspicuously dark brown to blackish when dried, with hyaline edges and ligules markedly contrasting in colour with sheaths; sheaths on main stem slender 18–47 mm long, 1.2–2.5 mm in diameter, gradually projecting above into a distinct ligule 5–19 mm long, the hyaline edges distinct, creamy yellowish to light brownish; sheaths on branches 11–16 mm long, 0.7–1.4 mm in diameter, with ligules 3–6 mm long. Peduncles 12–38 mm long. Spikes 10–17 mm long at anthesis, 16–30 mm long at fruit, the whorls shortly remote to distinctly remote, with pairs of flowers/fruits on axis of spike unevenly spaced, when fruiting the basal two pairs at least slightly more apart than the others. Flowers 8–11, in 4–6 whorls. Fruits 3.8–4.2 mm long. Figures **15**, **16**, **17** and **18**.

Tajikistan: Pamir, in stagno prope lacu Kara Kul, 4000 m, 1 Jul 1898, *O. Paulsen 644* (C, LD); Turkestania, v' oz. Karakul', u berega, 10 Jul [18]95, *S. Korshinsky 5068* (LE); Pamir, fluv. Chatyn-art, 19 Jul 1878, *A. Kuschakewicz* (C).

Kyrgyzstan: Przheval'skiy uezd', Tian Shan, ozero Chatyr'-kul' [= lake Chatyr-Kul], 11000–12000 ft, 26 Jul 1903, *V. Lipskiy [= W. Lipsky] 3187* (LE, fragments in BM, C).

India: Jammu and Kashmir: Ladakh, region Rupshu, Samad Rokchen, Startsa Puk Tso (SE), 33°14.79′ N, 78°3.47′ E, 4550 m, 10 Sept 2005, *L. Klimeš 6276* (PRA-Klimeš); Ladakh, region Rupshu, Tso Moriri, Karzok (E), 32°57.9′ N, 78° 15.1′ E, 4550 m, 14 Sept 2005, *L. Klimeš 6327* (PRA-Klimeš); Ladakh, region Rupshu, Kyung Tso, Kyun Tso – N lake, NW banks, 32°59,4′ N, 78°35,3′ E, 5022 m, 11 Aug 2002, *L. Klimeš 2080* (PRA-Klimeš).

China: Tibet: Liten svagt salthaltig sjö i N. Ö. Tibet, Lâger XIV [= in a small slightly saline lake near camp XIV, NE Tibet, i.e. approx. 35°55′ N, 88°05′ E], 4968 m, 28 Aug 1896, *S. Hedin* (C, LD, S); Lâger LXXVIII, Jure Tibet, vid Naktsong-tso [= camp LXXVIII, Inner Tibet, lake Naktsong-tso, i.e. approx. 31°40′ N, 88°22′ E], 4636 m, 11 Sept 1901, *S. Hedin* (C, LD, S); Yamdrok Tso (Gyantse – Lhasa), in the lake, 28°59′ N, 90°25′ E, 14500 ft, 5 Apr [19]43, *F. Ludlow & G. Sherriff 9467* (BM); Lhasa – Nagarze, Yamdruk Yumco [= lake Yamzho Yumco], W shore N of Nagarze, subalp. saline lake, 29°0′ N, 90°23′ E, 4450 m, 31 Oct 1989, *B. Dickoré 6732* (GOET-Dickoré, PRA-Kaplan); Sakang (Phari – Gyantse), running water, 28°43′ N, 89°40′ E, 13500 ft, 25 Mar 1943, *F. Ludlow & G. Sherriff 9463* (BM, TI); Dochen (Phari – Gyantse), along the edge of Hram Tso, 28°09′ N, 89°18′ E, 14500 ft, 21 Mar [19]43, *F. Ludlow & G. Sherriff 9458* (BM); Tuna, 27°58′ N, 89°13′ E, 14900 ft, 15 Apr 1938, *F. Ludlow, G. Sherriff & G. Taylor 4072* (BM); Tuna (Phari – Gyantse), running water, 27°58′ N, 89°13′ E, 14700 ft, 21 Mar [19]43, *F. Ludlow & G. Sherriff 9455* (BM); Gyantse – Phari Road, Hot Springs, in still or slightly moving warm (tepid) water from a spring, 14500 ft, 27 Nov 1947, *F. Ludlow, G. Sherriff & H. H. Elliot 13354* (BM, E); the same site, *F. Ludlow, G. Sherriff & H. H. Elliot 13355* (BM, E). – **Qinghai:** Kuen-Lun [= Kunlun Mountains], vost[ochnoe] prodolzhenie gor' Dzurgin'-ula, ozero Nogon'-nor' [= lake Ngoring Hu],

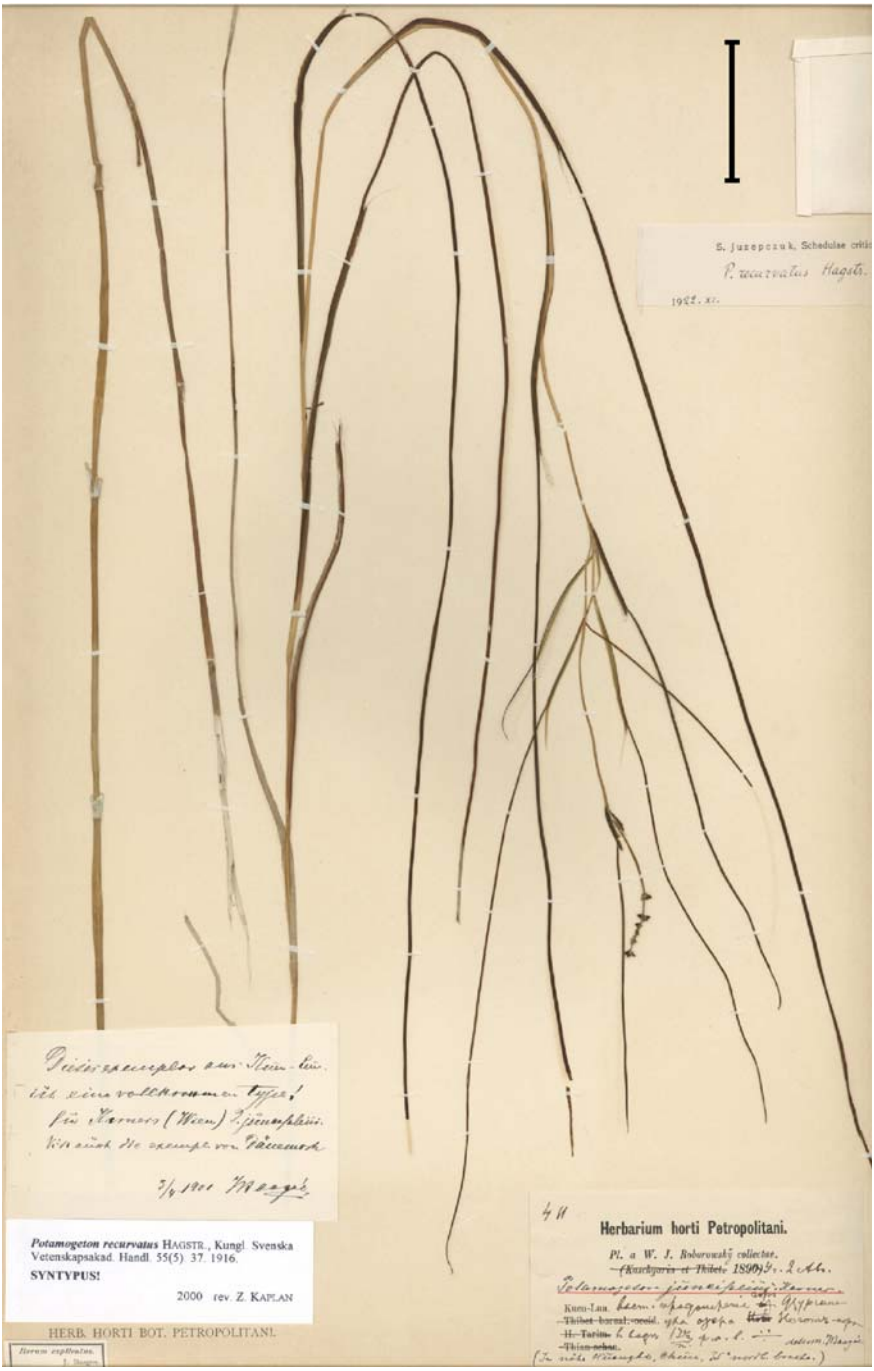

Fig. 15 General appearance of *S. pamirica*, with characteristic long leaves (*W. J. Roborowsky 411*, LE); scale bar=5 cm

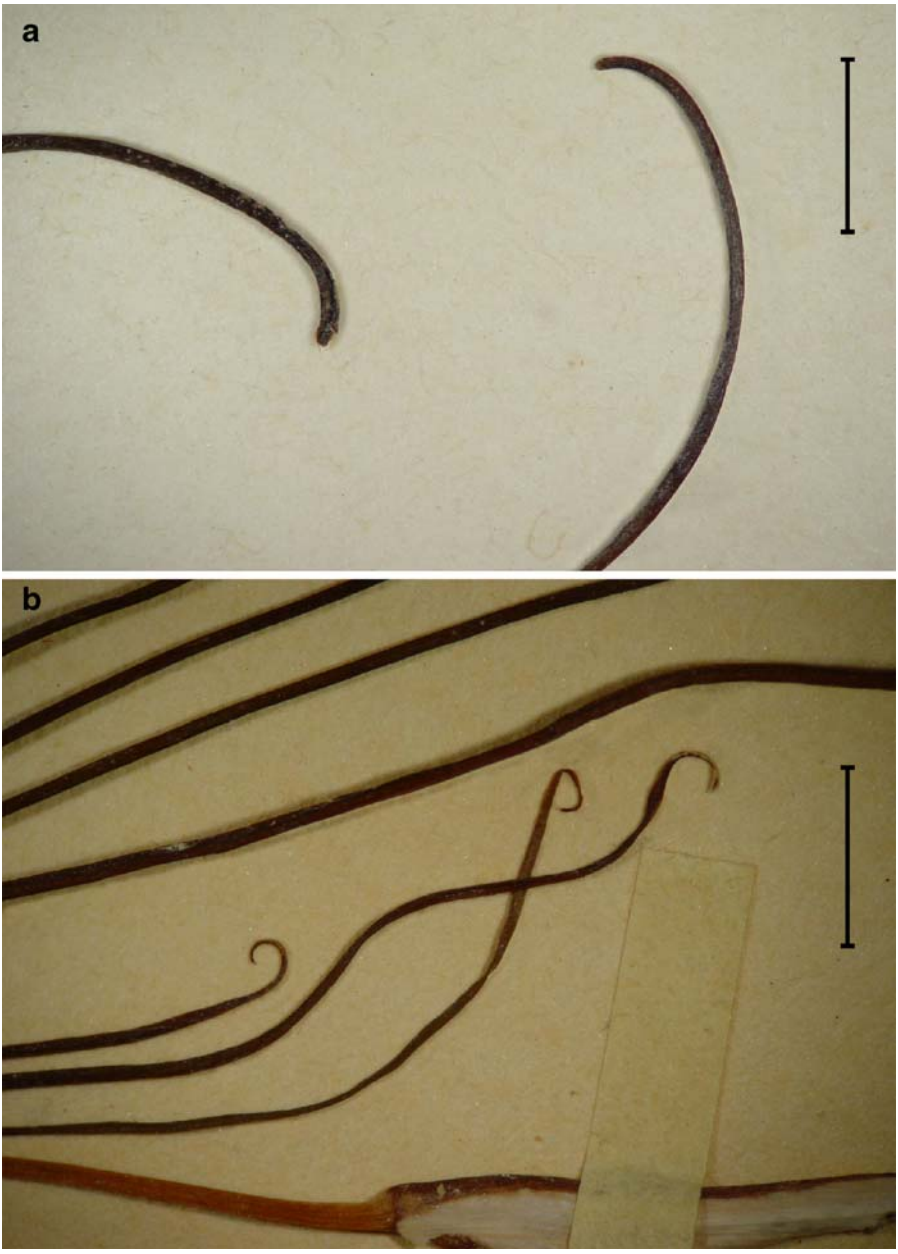

Fig. 16 Terminal parts of blackish leaves of *S. pamirica* characteristically recurved towards the apex (**a** *O. Paulsen 644*, C, lectotype; **b** *Hopkingson 966*, P); scale bars=5 mm

Fig. 17 Spirally twisted terminal parts of brownish to blackish leaves of *S. pamirica* (**a** *L. Klimeš 6327*, PRA-Klimeš; **b** *L. Klimeš 6276*, PRA-Klimeš); scale bars=2 mm

Fig. 18 Leaf sheath of *S. pamirica* gradually projecting into a distinct ligule (*O. Paulsen 644*, C, lectotype); scale bar=5 mm

v vode, 13500 ft, 2 Aug 1894, *W. J. Roborowsky 411* (LE); Kokonor [= lake Qinghai Hu], 3150 m, 22 Aug 1930, *Hopkingson 965* (P); the same site, *Hopkingson 966* (P).

Stuckenia pamirica is found at high elevations in the mountains of Central Asia (Fig. **14**). It occurs from the Pamir Mountains in the west, over the Kunlun Range eastwards to Qilian Shan Mountains, and southwards over the eastern Tibetan Plateau to Himalaya. It grows in cold mountain lakes, less often in running water, and is also recorded from tepid water around hot springs.

Because of its occurrence in poorly accessible areas, this species is rarely collected. However, botanists collecting plants in their areas of interest often record the species in suitable habitats. This indicates that the species is likely to be more frequent within its range than appears from herbarium records.

Although the species was first described by Baagöe (1903), the name is only rarely used by taxonomists studying Central Asian pondweeds and, besides the original author, only exceptionally in the same delimitation. The reason is that Hagström (1916), in his authoritative world-wide treatment, misapplied the name to a taxonomically different plant.

Baagöe (1903) cited two collections in the protologue, Paulsen's specimen from Pamir (preserved in C) and Roborowsky's collection from the Chinese mountain range Kunlun (preserved in LE). However, owing to Baagöe's note "*Potamogeton pamiricus* mihi", Hagström (1916) erroneously interpreted this name from another collection (coll. Thomson, now preserved in LD) from "Tibet occidentalis", which was actually Ladakh and not Tibet. Unfortunately, this specimen was not conspecific

with the original *P. pamiricus* but it was the species here called *S. filiformis*. So Hagström (1916) correctly commented that the collection was "very nearly allied to *P. filiformis* and scarcely specifically separated from it" but incorrectly assigned this observation to *P. pamiricus*, which is actually a different species. As it can be seen from the descriptions provided here and from Table **1**, these two species differ in many characters.

Hagström apparently did not see any of the syntype collections of *P. pamiricus* because none of them are annotated by him and none cited as seen in his monograph under that name (Hagström 1916: 25). When he saw the first collection taxonomically identical to *P. pamiricus* (now preserved in LD), although named "*Potamogeton pamiricus* mihi" by Baagöe and possibly a duplicate of one of the original elements of *P. pamiricus*, Hagström annotated the sheet (translated from Swedish) "This is not *P. pamiricus* Baagøe but another undescribed species which I propose to call *P. recurvatus*". To summarize, Hagström correctly distinguished the two species in question but used incorrect names: misapplied the name *P. pamiricus* to *S. filiformis* and re-described true *S. pamirica* as *P. recurvatus*. Following the authority of Hagström's monograph, later researchers often called the long-leaved species with open sheaths *P. recurvatus* and reserved the name *P. pamiricus* for broad-leaved plants of *S. filiformis*. Some (e.g., Yuzepczuk 1934; Ikonnikov 1963; Vvedensky 1968; Matzenko 1971) even cited the original specimens of *S. pamirica*, which they did not examine, under a description referring to broad-leaved *S. filiformis*. Comparison of the rDNA sequences cited by Wang et al. (2007) for *P. pamiricus* with our sequences for *Stuckenia* species also reveals another misapplication of this name to plants of *S. filiformis* (Fehrer and Kaplan, unpubl.). Nikitina and Protopopov (1952) provide a description that is very close to true *P. pamiricus* and gave Tschatyr-Kul as the only site/collection listed by which they referred to the correct species. Sidorenko (1957) gives a similar description but his list of collections seems to include more species than just *S. pamirica*. Because of the frequent misapplication of the name and confusion with other *Stuckenia* species, no literature records of *S. pamirica* can be adopted.

Although *S. pamirica* is little known and often confused in the literature, it is well defined by a combination of unique characters associated with its occurrence in a relatively limited area with specific ecological properties. Dry herbarium plants of *S. pamirica* are relatively easily recognizable by a combination of its colour pattern (Figs. **15** and **18**), long leaves (Fig. **15**), the frequent curvature of terminal portions of leaf blades (Figs. **16** and **17**), and the prominent ligules (Fig. **18**).

4. *Stuckenia vaginata*

Stuckenia vaginata (Turcz.) Holub, Folia Geobot. Phytotax. 19: 215. 1984.

≡ *Potamogeton vaginatus* Turcz., Bull. Soc. Imp. Naturalistes Moscou 27(2/3) [Fl. Baical.-Dahur.]: 66. 1854.
Type: [Russia:] "Potamogeton vaginatus mihi, In paludibus prope salinas Selenginenses, 1829, Turcz[aninow]." (**lectotype designated here**: LE; isolectotypes: BM, C-Baagöe, G, LE).
≡ *P. pectinatus* subsp. *vaginatus* (Turcz.) Magnin, Bull. Soc. Bot. France 43: 447. 1897. ("1896")

≡ *P. pectinatus* var. *vaginatus* (Turcz.) Aschers. & Graebn., Synops. Mitteleur. Fl. 1: 351. 1897.
≡ *P. pectinatus* subvar. *vaginatus* (Turcz.) Hegi, Ill. Fl. Mitt.-Eur. 1: 137. 1906.
≡ *P. filiformis* proles *vaginatus* (Turcz.) Aschers. & Graebn., Synops. Mitteleur. Fl. ed. 2. 1: 544. 1913.
≡ *Coleogeton vaginatus* (Turcz.) D. H. Les & R. R. Haynes, Novon 6: 390. 1996.

= *Potamogeton subretusus* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 30. 1916.

Type: [Russia:] [label 1:] "Malo Briochovskij-ön [island], 11/8 1876, Sahlberg, Plantae Jeniseienses." [label 2:] "Potamog. subretusus m., 70° 50′ n. lat., J. O. Hagström [19]13." (**lectotype designated here**: S; photo: BM).
≡ *Stuckenia subretusa* (Hagstr.) Holub, Preslia 69: 364. 1997.

Stem mostly richly branched, mainly above, with 1–5 branches emerging from each node. Leaves on main stem linear, 11–57 mm long, 0.7–2.7 mm wide, 8–60 times as long as wide, olive green to dark green, often with a greyish tinge, the apex obtuse, rounded to truncate or retuse; mature leaves on branches 37–125 mm long, 0.2–0.8 mm wide, 55–490 times as long as wide, the apex obtuse to subacute. Leaf sheaths open, olive green to dark green, often with a greyish tinge, with hyaline edges and ligules; sheaths on main stem 20–73 mm long, 1.4–7.1 mm in diameter, truncate at apex, the hyaline upper edge united with and rather abruptly contracted to an indistinct ligule 0–1.5(–2.9) mm long, yellow-brown; sheaths on branches 13–28 mm long, 0.5–3.1 mm in diameter, with ligules 0–1.8 mm long. Peduncles 19–190 mm long. Spikes 17–73 mm long at anthesis, 33–62 mm long at fruit, the whorls contiguous at anthesis, shortly remote later, with pairs of flowers/fruits on axis of spike ± evenly spaced, only the basal two pairs sometimes a slightly more apart and the terminal two pairs nearer together than the others. Flowers (9–)14–18(–20), in (5–)7–9(–11) whorls. Fruits 2.6–3.4(–3.8) mm long. Figs. **19** and **20**.

Russia: Taymyr: Pravyi bereg r. Pyasiny (v srednem techenii) okr. pos. Tareya, ozero v mezhdurech'i rek Tarei i Neury, 18 Aug 1968, *A. A. Vinokurov* (LE); Jenisei [= river Yenisey], Nikandrovski ön [= Nikandrovskii island], 1876, *M. Brenner* (S, UPS); Nikandroffskij ostroff [= Nikandrovskii island], 70°20′ N, 14 Aug 1876, *H. W. Arnell* (S); Jenisei [= river Yenisey], Tolstoi nos [= Tolstyi Nos], 70°10′ N, 31 Aug 1876, *H. W. Arnell* (S). – **Irkutsk:** distr. Balagansk, in aqua fluente ad p. Bashejewsky, 5 Jul 1904, *N. Malzew* (Herb. Fl. Ross. no. 1935) (BP, C, G, H, LE, PRC, S, WU); Ust'-Ordynskii buryatskii avtonomnyi okrug, Alarskii raion, okrest. pos. Alyaty, oz. Alyaty, yugo-zapadnyi bereg, pribrezhnaya polosa, 15 Jul 2003, *V. Chepinoga & M. Ineshina 12150* (PRA-Kaplan); Ust'-Ordynskii buryatskii avtonomnyi okrug, Alarskii raion, 1 km k zapadu ot sel. Ivanicheskoe, prud, 17 Jul 2003, *M. Ineshina & N. Jakovchits 12443* (PRA-Kaplan). – **Buryatiya:** In paludibus prope salinas Selenginenses [= Selenginsk], 1829, *Turczaninow* (BM, C-Baagöe, G, LE); ad pagum Verchne Ubukunskaya [= Verkhnii Ubukun], 1–12 Jul 1900, *K. E. H. Odenvall* (H). – **Chukot**: Poberezh'e Vostochno-Sibirskogo morya, Rauchua, v vode protoki, 29 Jul 1975, *T. M. Koroleva & V. V. Petrovskii* (BM).

Fig. 19 General appearance of *S. vaginata* (14 Jul 1930, *A. Lindfors*, PRA-Kaplan); scale bar=5 cm

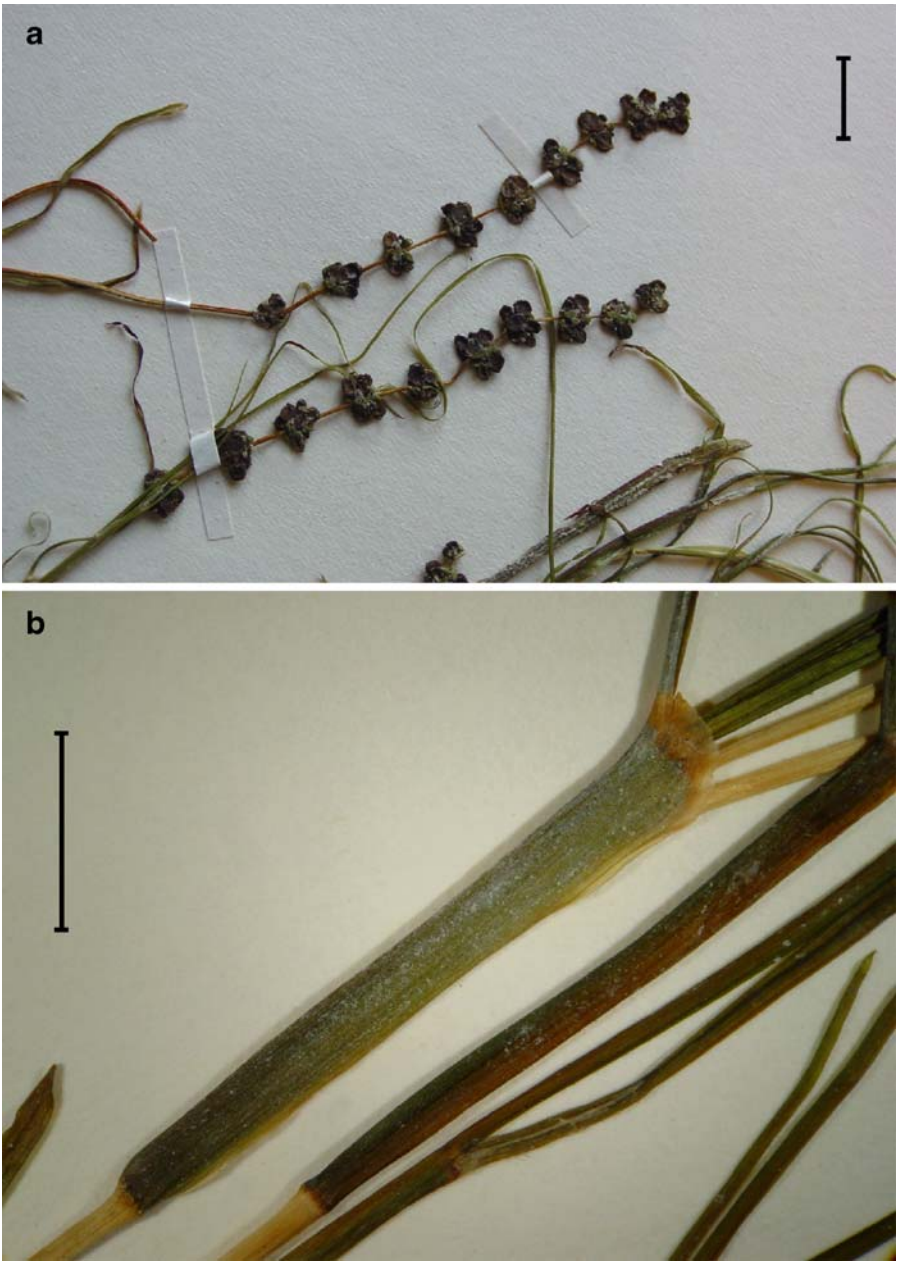

Fig. 20 Diagnostic characters of *S. vaginata*; **a** spike with a high number of ± evenly spaced whorls of young fruits (*C. L. Porter 6767*, W); **b** leaf sheath from the middle part of the stem with a hyaline upper edge and two branches emerging from the node in addition to the main stem (*H. M. Raup 1550*, K); scale bars=1 cm

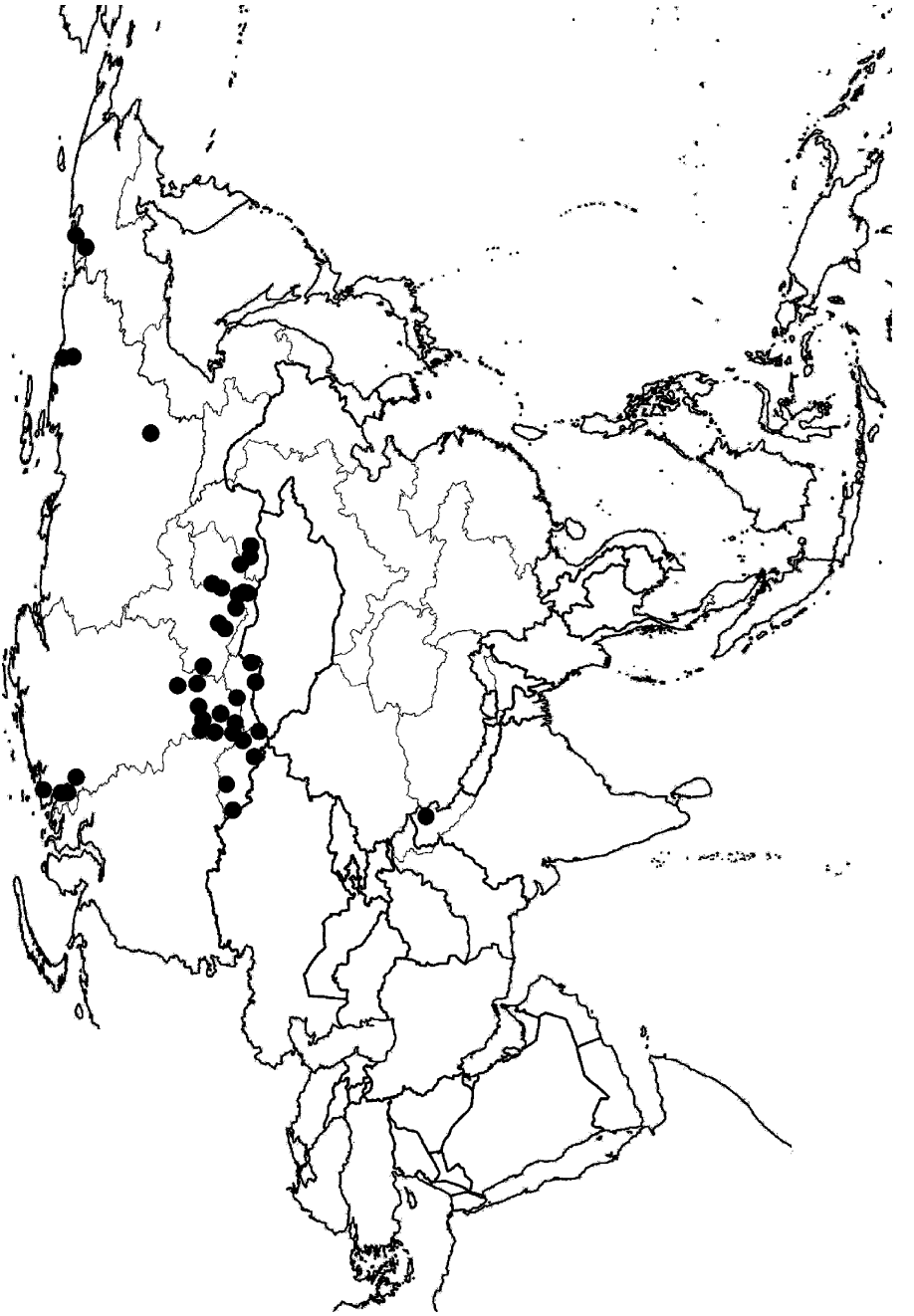

Fig. 21 Distribution of *S. vaginata* in Asia

India: Jammu and Kashmir: Rupshu, Tso Kar, in pool 1 ft. deep, 15000 ft, 1 Jul 1931, *W. Koelz 2144* (E, K); Rupshu, Tso Kar, in lake 2 ft. deep, alt. 15000 ft, 1 Jul 1931, *W. Koelz 2145* (L, S) [see this page below for discussion on this collection].

Stuckenia vaginata is a species with a markedly disjunct distribution range, which is divided into three main geographical regions: Scandinavia, southern Siberia and North America. Additionally it occurs in several other isolated localities or areas of occurrence, such as the lower Yenisey River basin, northernmost Russian Far East and Ladakh (Fig. **21**). It grows in lakes, pools and rivers, mainly in cold water.

The species is reported also from a few other countries. Dobrokhotova (1956) recorded it for Kazahkstan. However, at least the records from lowlands are based on robust forms of *S. pectinata* with huge sheaths on the basal parts of the stem. Matzenko (1971, 2002), Grubov (1982) and Belavskaya (1994) recorded *S. vaginata* for Mongolia. I have seen no specimens of this species from Mongolia but it may occur in the northern and western mountains. I have seen collections from the bordering Russian regions. However, the distribution of *S. vaginata* in Mongolia requires careful revision because the collection *Chaney 289* listed by Matzenko (1971, 2002) as *S. vaginata* is in fact *S. pectinata*.

In this paper *S. vaginata* is for the first time reported from the Central Asia Ranges, from the latitude south of the 45th northern parallel. This report, from Ladakh, Kashmir, is based on specimens collected under the name *P. pectinatus* by Koelz from an alpine lake named Tso Kar and an adjacent pool. The collection *Koelz 2144* is uniform in all herbaria studied and all duplicates seen contain only *S. vaginata*. The subsequent number *Koelz 2145* is a heterogeneous collection, as the duplicates preserved in L and S are of *S. vaginata* whereas those in DD, E and K contain *S. filiformis*. However, this case is not a herbarium mixture when a plant from a different place is mislabelled. In this case the two collections (*Koelz 2144* and *2145*) were collected together at the same time, hence the two different collection numbers. However, when the individual plants were sorted, because of their overall similarity, a few plants of *S. vaginata* (collection *Koelz 2144*) were included with *S. filiformis* (collection *Koelz 2145*). Anyway, all of these plants came from the same site and there is no doubt about their origin.

Stuckenia vaginata is usually easily distinguishable particularly by its spikes with a high number of ± evenly spaced flower/fruit whorls (Fig. **20**a), robust main-stem leaf sheaths with a hyaline upper edge and an indistinct or missing ligule (Fig. **20**b), the specific branching pattern with up to five branches emerging from most nodes, short and broad main-stem leaves, which are mostly shorter than the sheaths (Fig. **22**) and markedly contrasting to long and fine leaves on branches (Fig. **19**), and by its fruit size, which is similar only to that of the otherwise dissimilar *S. amblyphylla* (Table **1**).

Stuckenia subretusa is a morphotype often distinguished as a separate species in Russian floras dealing with Siberian or Arctic plants. It was described by Hagström (1916) who studied fragmentary *Stuckenia* specimens from Siberia and noticed its slightly retuse leaf apex. This feature, together with the unusual appearance of the specimen, led Hagström to describe a new species *P. subretusus*. This taxon was later recorded from a few other places in Siberia (Kashina 1986, 1988) and the Russian Far East (Tzvelev 1987), but was always reported as rare. More recently similar plants were recorded as *P. subretusus* also from Bol'shezemelskaya Tundra on the northern coast of European Russia (Myaemets 1979) and from Alaska in North America (Tzvelev 1996).

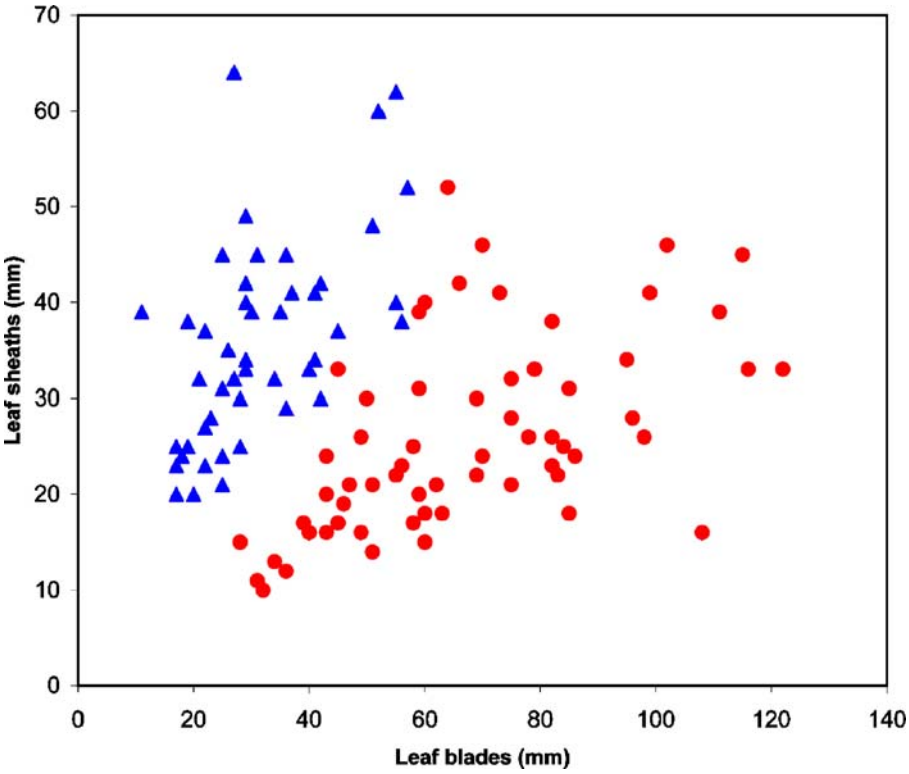

Fig. 22 Length of main-stem sheaths plotted against the length of the leaf blades for *S. vaginata* (blue triangles) and *S. pectinata* (red circles)

Only about 20 specimens of the morphotype called *S. subretusa* are known even though 90 years have elapsed since its description. This seems to be too low considering the reported distribution range is more than 7500 km wide. As Siberia is the centre of the recorded occurrence, most specimens of this morphotype should be in the herbarium at St. Petersburg (LE). However, in spite of a detailed search for *S. subretusa* at LE in 2000 I only found two specimens that fit the description of *S. subretusa*, after several obvious misidentifications were excluded.

The key character claimed for this taxon, the (sub)retuse apex, occurs sometimes in the very similar *S. vaginata*. Wiegleb and Kaplan (1998) noted that *S. subretusa* is closely related to *S. vaginata* and might be regarded as an extreme morphotype of that species. Careful and detailed examination was therefore conducted on a rich set of well-developed herbarium specimens of *S. vaginata* from northern Europe and North America not including Alaska, i.e., from areas where *S. subretusa* is not reported. This investigation revealed that approximately 18% of specimens had at least one leaf with a retuse apex (Fig. **23**). The proportion of retuse to obtuse leaf apices varied greatly between specimens. The illustration of a typical *S. vaginata* from Canada given by Ceska (2001) also shows one leaf with a slightly retuse apex.

Tolmachev (1995) considered *S. subretusa* to be an arctic race of *S. vaginata*. However, the present findings reveal that both morphotypes are largely sympatric.

Other morphological characters reported to distinguish *S. vaginata* and *S. subretusa* (peduncle length, size of leaf sheaths, number of circles of interlacunar bundles) show large overlaps, and those states ascribed to *S. subretusa* are mostly associated with undeveloped specimens or terminal fragments. Recently collected specimens identified as *S. subretusa* are generally dwarf phenotypes of *S. vaginata* or fragmentary material of this species (often the terminal parts of side branches with small leaf sheaths). Considering the above facts and until there is evidence supporting an independent position of *S. subretusa* (e.g., experimental or molecular), I prefer to consider it to be one of the phenotypes of *S. vaginata*.

The following is a list of selected herbarium specimens of *S. vaginata* from outside of Siberia (i.e., the main recorded range of "*S. subretusa*") that have at least one retuse leaf apex:

Sweden: in provincia Ångermanland, Själevad, Nötbolandet, in sinu maris Deckarsjöfjärden, non procul ab oppido Örnsköldsvik, 63°18′ N, 2 Jul 1896, *K. Aulin* (G. Tiselius, Potamog. Suec. Exs., fasc. 3: 109) (BM, BP, C, C-Baagöe, E, G, H, K, LE, PRC, S, UPS, WU, Z); in provincia Ångermanland, Själevad, Nötbolandet, in sinu maris Deckarsjöfjärden, non procul ab oppido Örnsköldsvik, 63°18′ N, 17 Aug 1896, *G. Blomqvist & C. Lundberg* (G. Tiselius, Potamog. Suec. Exs., fasc. 3: 110) (BM, BP, C, C-Baagöe, E, G, H, K, LE, PRC, S, UPS, WU, Z); Ångermanland, Örnsköldsvik, Däckarsjöfjärden, in mari, Aug 1893, *G. Blomqvist* (S); in prov. Ångermanland, in mari ad oppidum Mernosand, freto australi, 62°37′ N, 29 Jul 1899, *G. Tiselius* (S); Bottnia Centralis in mare extra Kallal prope Luleå, Jul 1914, *T. Rydén* (S); Norrbotten, Neder-Luleå sockar, Hålfjärden, 3 Aug 1911, *E. Marklund* (S); Vb, Nederkalix Båtskärsnäs, 20 Jul 1904, *A. Stjernspetz* (UPS).

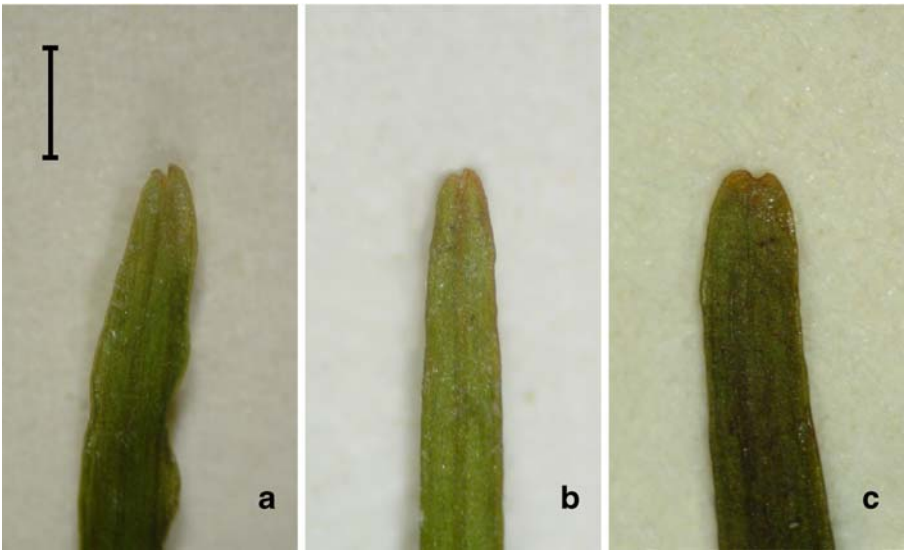

Fig. 23 Shape of leaves of a form of *S. vaginata* with retuse leaf apex (**a** *L. H. Jordal 2460*, S; **b** *G. H. Ward 1420*, S; **c** 29 Jul 1975, *T. M. Koroleva & V. V. Petrovskii*, BM); scale bar=0.5 mm

Finland: Ostrobotnia australis, Nerpes, Maristrandsfjärden, vid inloppet till Knåplådan, 10 Aug 1897, *R. Dahlberg* (B, G, PR, UPS); Jacobsstad [= Jakobstad], 64° N, 16 Jul 1902, *J. Baagöe* (BM, BR, G, H, L, P); North Pohjanmaa, Oulunsalo, Varjakanniemi, on shore of the Gulf of Bothnia, 2 Jul 1959, *Y. Mäkinen* (BM).

U. S. A.: Alaska: Arctic North Slope, Maybe Creek, large shallow lake, 600 ft, 154° 30′ W, 69°20′ N, 7 Aug 1949, *L. A. Spetzman 2557* (LE); Kotzebue Sound, Hotham Inlet, 20 Aug 1964, *C. Holmquist* (S); Vicinity of East Oumalik, "large" (landing) lake, about 69°50′ N, 155°30′ W, 13 Aug 1952, *G. H. Ward 1420* (K, S); Brooks Range, 50 miles north of Bettles, Wild Lake, 28 Jul 1949, *L. H. Jordal 2460* (S).

Canada: Labrador, Straits of Belle Isle, swift current of Blanc Sablon River, 3 Sept 1925, *M. L. Fernald, K. M. Wiegand & B. Long 27329* (BM).

5. *Stuckenia amblyphylla*

Stuckenia amblyphylla (C. A. Mey.) Holub, Preslia 69: 364. 1997.

≡ *Potamogeton amblyphyllus* C. A. Mey., Beitr. Pflanzenk. Russ. Reiches 6: 10. 1849. ("amblyophyllus")
Type: [Georgia:] "N^{o} 2127 Potamogeton amblyphyllum (n. sp.), Prope pagum Kasbek, alt. 900 hexap., Flora Caucasica, Legit Dr. Kolenati, 2/8 1844" (holotype: LE; isotypes: BM, C-Baagöe, fragment in LD).
≡ *P. pectinatus* proles *amblyphyllus* (C. A. Mey.) Graebn. in Engl., Pflanzenr. 31 (IV.11): 125. 1907.
≡ *P. filiformis* proles *amblyphyllus* (C. A. Mey.) Aschers. & Graebn., Synops. Mitteleur. Fl. ed. 2. 1: 545. 1913.

Stem moderately branched near base and sparingly above, with one branch emerging from each node. Leaves on main stem narrowly linear, 77–145 mm long, 0.7–2.4 mm wide, 35–145 times as long as wide, light green to dark green, sometimes with brownish tinge, the apex obtuse to rounded, occasionally subacute; mature leaves on branches similar in size and shape to main-stem leaves. Leaf sheaths closed and tubular towards base when young but often split later, 6–37 mm long, 0.8–3.5 mm in diameter, light green to dark green, sometimes with brownish tinge, on the side opposite from the leaf blades rather indistinctly hyaline, yellowish green to brownish green, and gradually projecting above into a ligule 2–16 mm long. Peduncles 10–225 mm long. Spikes 9–28 mm long at anthesis, 23–72 mm long at fruit, the whorls contiguous to shortly remote at anthesis, when fruiting shortly remote at least in the basal part. Flowers 8–12(−16), in 4–6(−8) whorls. Fruits (2.7–) 2.9–3.3 mm long. Figures **24**, **25**, **26**, **27**, **28** and **29**.

Kazakhstan: Dzhungarskii Alatau, Semirechenskaya oblast', Distr. Lepsinsk, Urochishche Chulak, 16 Jul 1909, *R. J. Roshevitz 728* (LE).

Tajikistan: Saravschan [= Zeravshanskii Khrebet], [lake] Iskander-kul, 7000 ft, V 1893, *V. L. Komarov* (C-Baagöe, LE); Gorno-Badakhshanskaya A. O., dolina r. Kukui-Bel'-Su v 30 km ot Sorezskogo ozera, 3800 m, 27 Jul 1958, *N. Tsvelev 893* (LE).

Tajikistan/Afghanistan: Pamir, Prov. Wakham [= Vakhan], in aqua fluente ad Nut [= Nyut] prope Ishkashim, 3 Oct 1898, *O. Paulsen 1456* (C, C-Baagöe).

Kyrgyzstan: Alayskiy khrebet, r. Aylama, 28 Jul 1930, *S. Juzepczuk 1058* (LE).

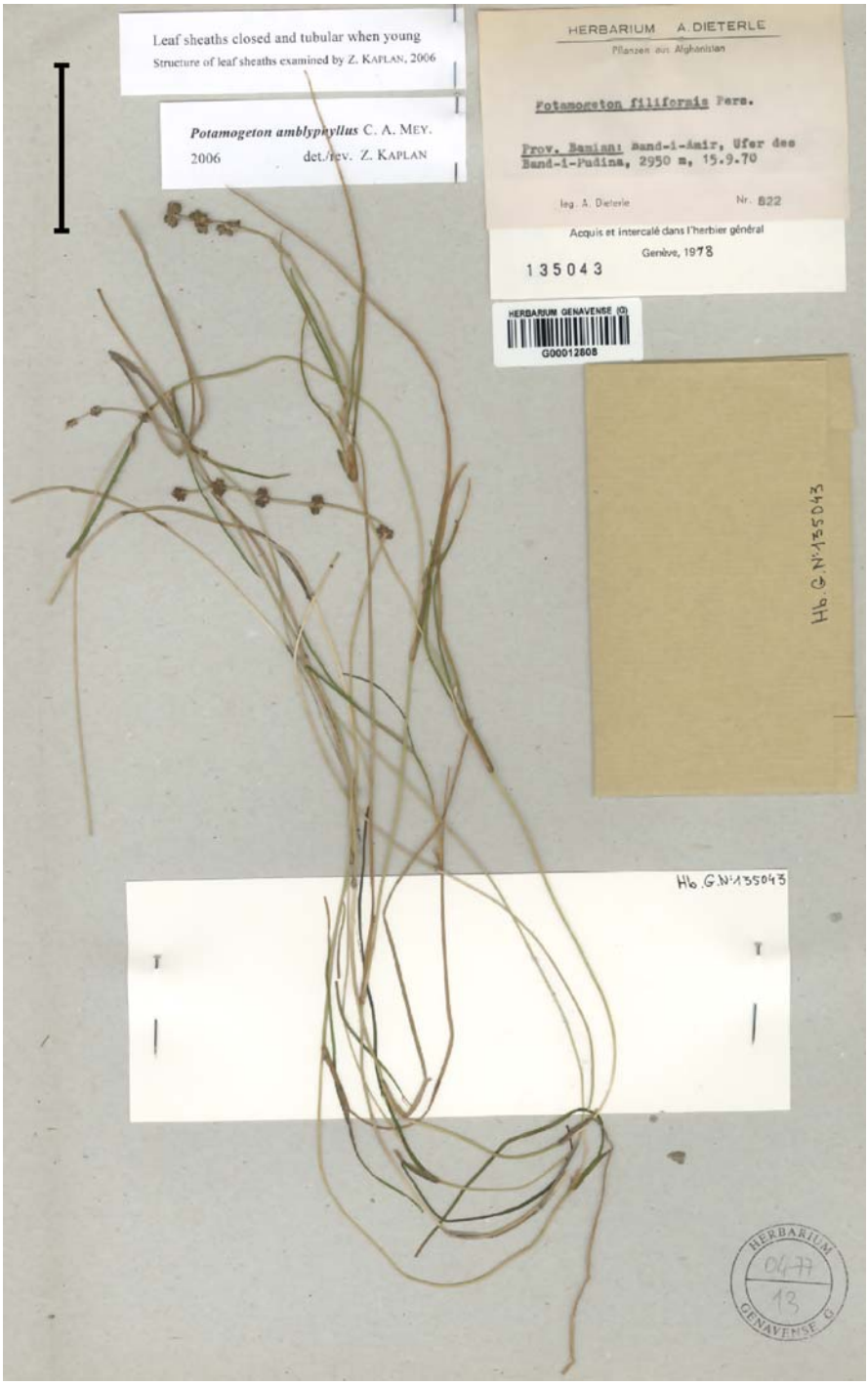

Fig. 24 General appearance of *S. amblyphylla* (*A. Dieterle 822*, G); scale bar=5 cm

Fig. 25 General appearance of *S. amblyphylla* (*I. Hedge & P. Wendelbo 4745*, E); scale bar=5 cm

Fig. 26 Upper parts of vegetative shoots of *S. amblyphylla* (*O. Paulsen 1456*, C); scale bar=2 cm

Caucasus: Georgia: Prope pagum Kasbek, 900 hexap., 2 Aug 1844, *Kolenati 2127* (BM, C-Baagöe, LE, fragment in LD); Georgia chevia, in aquosis flum. Aragwa Gudaschaurica (= Gudashaurskaya Aragva) non procul pag. Sno et Kazbek, 8 Aug 1937, *V. Kreczetowicz* (LE); Georgia chevia, in aquosis fontis Arscha

Fig. 27 Shape of leaf apex of *S. amblyphylla* (**a** *F. Kasy 33*, W; **b** *L. Klimeš 5963*, PRA-Klimeš); scale bar=0.5 mm

(= Arshan) non procul pag. Kazbek, 11 Aug 1937, *V. Kreczetowicz* (LE); Carthalinia, Gori, Jul 1881, *A. H. Brotherus & V. F. Brotherus 867* (BM, H, LD, P).

Turkey: Prov. Kars, Haçuvan, in stream, 1800 m, 20 Aug 1957, *P. H. Davis & I. G. Hedge 32568* (E, K); Prov. Kars, Haçuvan, in pool, 1800 m, 20 Aug 1957, *P. H. Davis & I. G. Hedge 32577* (BM, E, K); Van, 4 km E Çalderan, 2200 m, 17 Jul 1981, *F. Sorger 81–43–3* (M, W); Van, Çaldiran, Wasserstellen und Gräben in der Bergsteppe am Kaz Gölü nordöstlich des Ortes, 2200 m, 17 Jul 1981, *T. Raus 4148* (B); Eastern Turkey, Jannik to Gundennad? [sic!], streams, 28 Aug 1906, *B. V. D. Post 749* (G).

Iran: Prov. Markazi, Firuzkuh – Pol-e Sefid, 300 m NE des Bahniibergangs (Strasse nach Khumán) ca 4 km NE Firuzkuh [= Fīrūz Kūh], Bach (am Bahndamm), 1950 m, 26 Aug 1977, *K. P. Buttler & R. von Bothmer 22805* (H); m. Elbrus, in valle Lar (pr. Demavend), 2400–2500 m, 14 Jul 1902, *J. Bornmüller & A. Bornmüller 8261* (B, G, W); See von Daescht-aerdschin [= Dasht-e Arzhan], May [18]85, *O. Stapf* (WU).

Afghanistan: Doao [= Do Āb], in spring, 5000 ft, 23 Aug 1939, *W. Koelz 13537* (W); Wakhan [= Wakhrān], Ptukh, im Verlandungsgürtel des Sees, 3300 m, 21 Aug 1975, *H. Huss 140b* (MSB); the same site, *H. Huss 140c* (MSB); 20 km E of Bamyan [= Bamian], overgrown river-bed in shallow, ca. stagnant water, 2400 m, 29 Jul 1976, *J. F. Veldkamp 7385* (L); Bamlac [= ? Bamian], Siah Sang [= Sīāh Sang],

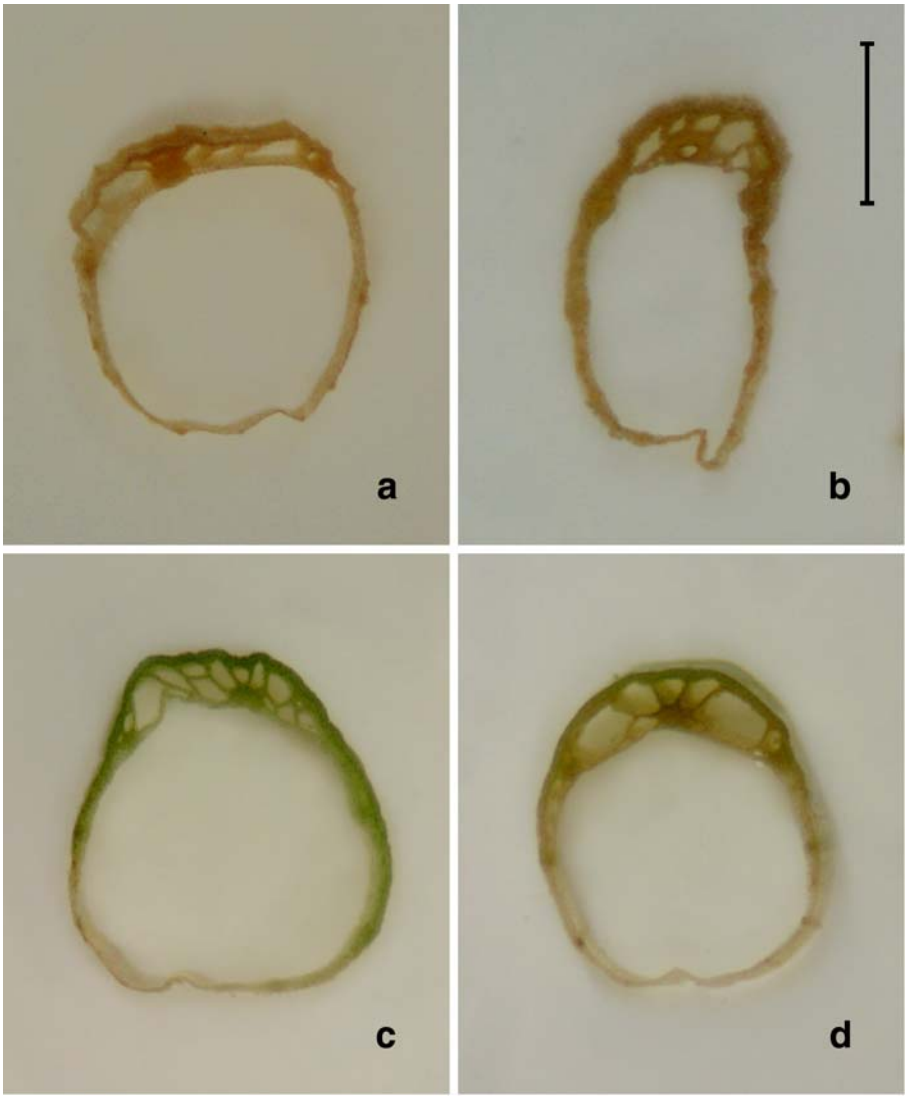

Fig. 28 Transversal sections of closed leaf sheaths of *S. amblyphylla* (**a** *A. Dieterle 785*, G; **b** *O. Paulsen 1456*, C; **c** *L. Klimeš 2798*, PRA-Klimeš; **d** *L. Klimeš 4767*, PRA-Klimeš); scale bar=0.5 mm

Griffith 5605/10 (K, P); Prov. Bamian, Montes Kuh-i Baba [= Selseleh-ye Kūh-e Bābā], in latere austro-orientali jugi Hadjigak, ca. 34°38′ N, 68°8′ E, ca. 3000 m, 17 Jul 1962, *K. H. Rechinger 18530* (W); Nord de Panjao [= Panjāb], marécages, 15 Oct 1958, *H. Pabot 1437* (G); Prov. Ghorat, Darrah-i-Tarbolagh bei Dahane Khargol, im Wassergräben, 2880 m, 31 Jul 1970, *D. Podlech 19064* (G, M, MSB); Prov. Ghazni, ad lacum Sabzab, inter Okak et Behzund (Diwal Kol), ca. 34°00′ N, 68°55′ E, ca. 2800 m, 6 Jul 1962, *K. H. Rechinger 17965* (W); Dasht-i-Nawar

Fig. 29 Fruiting spike of *S. amblyphylla* (*K. H. Rechinger 17977*, W); scale bar=3 mm.

[= Nāvor] NW v. Ghazni, in Bach, 3000 m, 8–10 Jun 1965, *F. Kasy 33* (W); Prov. Ghazni, Okak, NE altoplanitiei Dasht-e Nawar (Naour) [= Nāvor], ca. 33°50′ N, 67° 55′ E, ca. 3000 m, 4 Jul 1962, *K. H. Rechinger 17697* (W, ZT); Prov. Ghazni, Dasht-i-Nawar [= Nāvor], West-seite, im Bereich einer großen Süßwasserquelle, 3130 m, 16 Aug 1976, *S. W. Breckle 4584* (MSB); Prov. Ghazni, Dahan-e Barikak inter Okak et Behzud (Diwal Kol [= Dīvāl Qowl]), in rivulo, ca. 34°00′ N, 68° [sic!] 55′ E, ca. 2800 m, 6 Jul 1962, *K. H. Rechinger 17977* (B, G, W); Prov. Maidan, Darrah-i-Syahsang (Tal südlich des Hajigak-Passes) bei Syahsang, im Bach, 3050 m, 24 Aug 1970, *D. Podlech 19494* (M, MSB); Prov. Bamian, Band-i-Amir, Ufer des Band-i-Pudina, 2950 m, 15 Sept 1970, *A. Dieterle 822* (G, M, MSB); Prov. Bamian, Band-i-Amir, Band-i-Amir-Tal bei Kotak [= Kowtak], 2800 m, 17 Jun 1971, *A. Dieterle 1320* (M, MSB); Prov. Bamian, Band-e-Amir, in lake, ca. 2900 m, 29 Jun 1962, *I. Hedge & P. Wendelbo 4745* (E); Prov. Bamian, Band-i-Amir, Ufer des Band-i-Haybat, 2920 m, 8 Sept 1970, *A. Dieterle 785* (G, M, MSB); Prov. Bamian, inter jugum Kotal Deraz Kol et Panjao prope pagum Mandigak [= Mīndigak], ca. 34°20′ N, 67°10′ E, ca. 2800–3280 m, 23 Jul 1962, *K. H. Rechinger 18697* (E, G, K, W); Prov. Vardak, between Sokhta and Markas (Behsud), Dasht-i-Mazar, stream, ca. 2800 m, 13 Jun 1969, *I. Hedge & P. Wendelbo 8827* (E, H); Prov. Bamian, west side of Shibar pass, in running water, ca 2600 m, 20 May 1962, *I. Hedge & P. Wendelbo 3336* (E).

India: Jammu and Kashmir: Ladakh, region Indus Vy, Sham (W), Wanla, 34° 14.95′ N, 76°49.74′ E, 3160–3220 m, 19 Sept 2006, *L. Klimeš 7277* (PRA-Klimeš);

Ladakh, region Shyok (E), Takthak to Tangtse, 34°03.5′ N, 78°14′ E, 4050–4090 m, 11 Sept 2002, *L. Klimeš 2721* (PRA-Klimeš); Ladakh, region Indus Valley, Zhung (Leh), Spituk, 34°07.5′ N, 77°31.7′ E, 3220 m, 16 Sept 2002, *L. Klimeš 2798* (PRA-Klimeš); Ladakh, region Dras, Dras – NW, 34°26′ N, 75°44.2′ E, 3200–3220 m, 14 Sept 2004, *L. Klimeš 4767* (PRA-Klimeš); Ladakh, region Suru, Yumtum village to Gulmatungo, 34°2.63′ N, 76°14.24′ E, 3990 m, 22 Aug 2005, *L. Klimeš 5963* (PRA-Klimeš); Sind Valley, 6000–7000 ft, 24 Jun [18]92, *J. F. Duthie 11463* (BM, E, K); Kulu-Lahaul, Zanskar-zu, 1888, *J. R. Drummond 23156* (E, G, K); Prov. Núbra, Liágtšung to Panamik (left side of the Núbra valley), 24–31 Jul 1856, *Schlagintweit 2051* (G, LD).

China: Xinjiang Uygur: Wushi, behind Personnel Training Institute, 24 Sept 1984, *Y. H. Guo & Fan X 039* (Z); upper Yarkand valley (intramontane, Kunlun Shan side), ca. 3 km W of Mazar, 36°27′ N, 76°57′ E, 3770 m, source of a freshwater rivulet in the alluvium of the main river, 25 Aug 1986, *B. Dickoré 0358* (GOET-Dickoré). – **Tibet:** Kongbo [= Gongbo'gyamda County], Pangkar, 12500 ft, 6 Sept 1947, *F. Ludlow, G. Sherriff & H. H. Elliot 15687* (BM, E, GH). – **Qinghai:** Yushu Xian, south of the city of Yushu on the road to Nangqen at Shang-Baitang, gravel bar with *Myricaria* and adjacent limestone ledges, in both still and flowing water, 32°52′45" N, 97°04′03" E, 3780 m, 29 Jun 1995, *D. E. Boufford, X. F. Lu & T. S. Ying 26800* (A). – **Yunnan:** prope pagum Dschungdien („Chungtien") [= Zhongdian], in regionis temperatae rivis versus monasterium, ca. 3400 m, 22 Aug 1915, *H. F. v. Handel-Mazzetti* (Iter sinense 1914−1918 no. 7738) (E, K, S, WU).

The main centre of distribution of *S. amblyphylla* is in the Central Asia Ranges among the Pamirs, Central Afghanistan Ranges and Karakoram; with several disjunct localities it reaches westwards to the Caucasus Mountains, easternmost Turkey and Iran, northwards it extends to the Tarbagatay-Jungarskiy and the Central Tien Shan ranges, and eastwards with a few exclave localities to the Tanggula Shan range and mountains of northwesternmost Yunnan (Fig. 30). It grows in streams, lakes and pools.

The greatest concentration of localities recorded is in eastern Afghanistan. However, this may be associated with a high number of collections made in that area during intensive fieldwork in the 1960s and 1970s, in contrast to many other areas that are only poorly explored by botanists.

Although this species is primarily distinguished from the highly variable *S. filiformis* by the size of its fruits and shape of its spikes, most specimens lack mature fruits. Such herbarium specimens often can be identified only by less reliable characters such as the general plant appearance, its branching pattern, leaf width and shape, size of leaf sheaths, and size and shape of spikes. In the absence of fruit, *S. amblyphylla* may be indistinguishable from broad-leaved forms of *S. filiformis* that are found in running water. Thus, an identification based on features other than fruit characters can only be used with care within the range of *S. amblyphylla*, but not in other areas where confusion with robust forms of *S. filiformis* is likely.

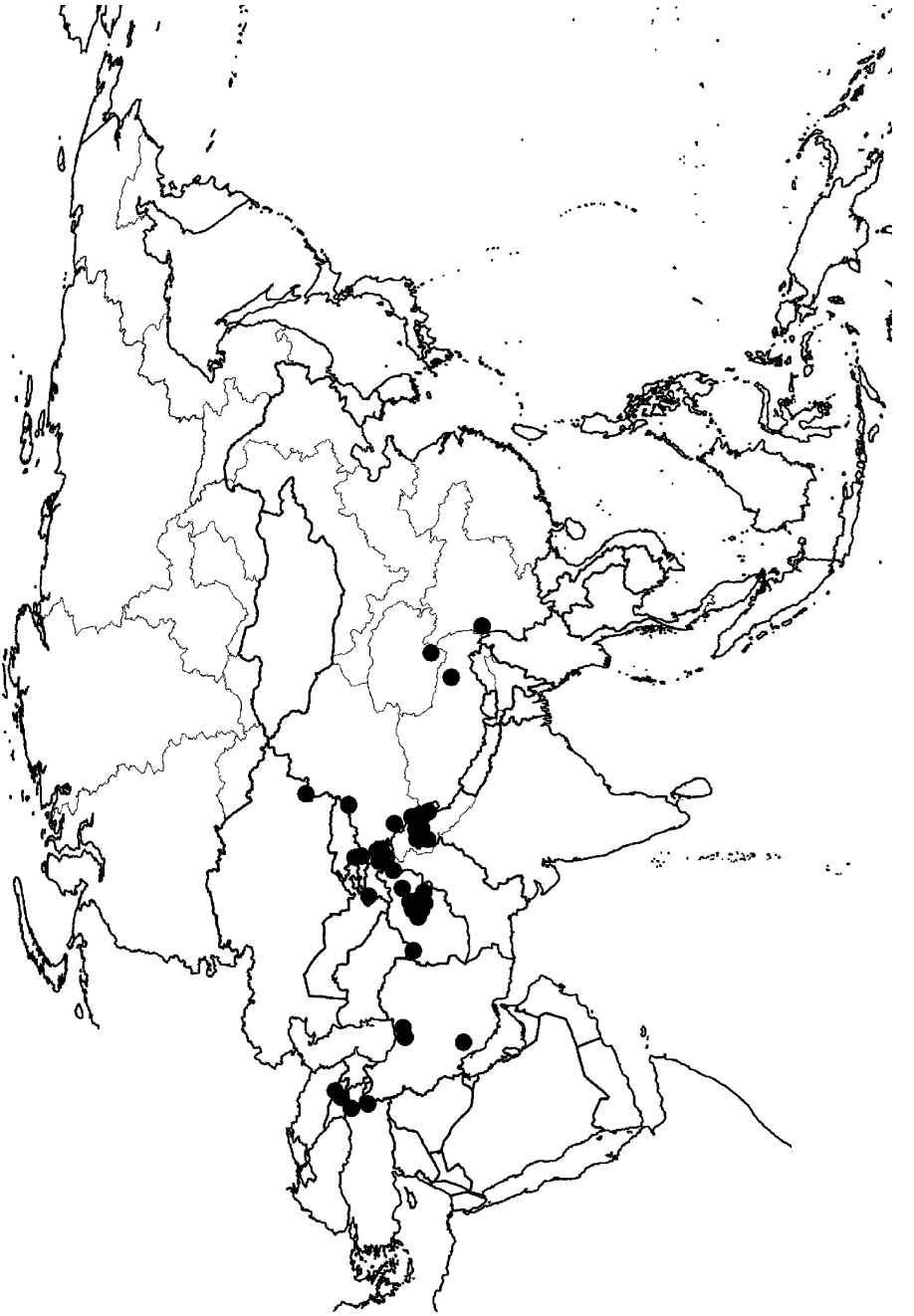

Fig. 30 Total range of *S. amblyphylla*

6. *Stuckenia filiformis*

Stuckenia filiformis (Pers.) Börner, Fl. Deutsche Volk 713. 1912.

≡ *Potamogeton setaceus* Schumach., Enum. Pl. 1: 51. 1801, nom. illeg. ("setaceum"), non L. 1753.
≡ *P. filiformis* Pers., Syn. Pl. 1: 152. 1805.
Type: [Denmark:] [text given on the reverse side of the original herbarium paper:] "Potamogeton setaceum, Lyngbye Söe" [text on the modern herbarium sheet:] "Plantae danicae, Herb. Schumacher, Lyngby Sø" (**lectotype designated here**: C; isolectotype: C).
≡ *P. marinus* var. *setaceus* (Schumach.) Roth, Enum. Pl. Phaen. Germ. 1/1: 542. 1827.
≡ *P. pectinatus* [var.] *setaceus* (Schumach.) C. Hartm., Handb. Skand. Fl. ed. 7. 250. 1858.
≡ *P. pectinatus* subsp. *filiformis* (Pers.) Hook. fil., Stud. Fl. Brit. Isl. 374. 1870. – *P. filiformis* f. *vulgaris* Tiselius, Potamog. Suec. Exs., fasc. 3: [sched.] no. 111 & 112. 1897, nom. inval.
≡ *Spirillus filiformis* (Pers.) Nieuwl., Amer. Midland Naturalist 3: 18. 1913.
≡ *Coleogeton filiformis* (Pers.) D. H. Les & R. R. Haynes, Novon 6: 390. 1996.

= *Potamogeton fasciculatus* Wolfg. in Schult. & Schult. fil., Mant. 3: 364. 1827.

Type: [Lithuania:] "Potamogeton fasciculatus Wolfg., In lacubus Lithuan., Herb. W. Besser" (lectotype: LE, designated by Kaplan & Zalewska-Gałosz 2004; isolectotypes: BM, G, K, KRA, L, LE, P).
≡ *P. filiformis* var. *fasciculatus* (Wolfg.) Baagöe, Bot. Tidsskr. 20: 324. 1896. ("fasciculata")
≡ *P. filiformis* f. *fasciculatus* (Wolfg.) Tiselius, Potamog. Suec. Exs., fasc. 3: [sched.] no. 116. 1897. ("fasciculata")

= *Potamogeton marinus* var. *alpinus* Blytt, Norges Fl. 1: 370. 1861.

Type: [material from several sites in Norway cited in the prologue, the following specimens were studied:] "Potamogeton filiformis Pers. Forma: alpinus Blytt, Lomsvand i Lom, Norvegia, 1200' inf. mare, leg. N. Moe, comm. I. Baagøe" (syntype: C-Baagöe); [label 1:] "E museo botanico Christianiensi, Norvegia: Lomsvand i Lom, 1200', N. Moe" [label 2:] "Potamogeton marinus β alpinus Blytt" (syntype: C-Baagöe).
≡ *P. filiformis* f. *alpinus* (Blytt) Hagstr. in Neuman, Sverig. Fl. 794. 1901.
≡ *P. filiformis* var. *alpinus* (Blytt) Almq. in Krok, Hartmans Handb. Skand. Fl. ed. 12. 1: 55. 1889. ("alpina")
≡ *Coleogeton filiformis* subsp. *alpinus* (Blytt) D. H. Les & R. R. Haynes, Novon 6: 390. 1996.
≡ *Stuckenia filiformis* subsp. *alpina* (Blytt) R. R. Haynes, D. H. Les & M. Král, Novon 8: 241. 1998.
≡ *Stuckenia filiformis* var. *alpina* (Blytt) Dorn, Vasc. Pl. Wyoming, ed. 3. 377. 2001.

= *Potamogeton aulacophyllus* K. Schum. in Mart., Fl. Bras. 3, 3: 696. 1894.

Type: "Ex Museo botanico Berolinensis, 226. Potamogeton aulacophyllum K. Sch., det. K. Schum., Argentina, Cordillera de la Rioja, 24. II. 1879 leg. Hieronymus & Niederlein" (**lectotype designated here**: BM); "Flora argentina, 226 Potamogeton, Al pié del Peñon, Cordillera de la Rioja, 24. II. 1879, leg. Hieronymus & Niederlein" (isolectotypes: B†, C-Baagöe, G).

= *Potamogeton juncifolius* A. Kerner ex C. Fritsch, Verh. K. K. Zool.-Bot. Ges. Wien, 45(1895): 364. 1896.

Type: [Austria:] "Potamogeton fluitans, Im Gräben bei Innsbruck, Somer [sic!] [1]866, Kerner" (**lectotype designated here**: WU).
– *P. juncifolius* A. Kerner ex Tiselius, Bot. Not. 1884: 91. 1884, nom. inval. [Vienna ICBN Art. 34.1(a); McNeill et al. 2006]
≡ *P. filiformis* var. *juncifolius* (A. Kerner ex C. Fritsch) Hegi, Ill. Fl. Mitt.-Eur. 1: 138. 1906. ("iuncifolius")
≡ *P. filiformis* subsp. *juncifolius* (A. Kerner ex C. Fritsch) Aschers. & Graebn., Synops. Mitteleur. Fl. ed. 2. 1: 544. 1913.

= *Potamogeton filiformis* f. *elongatus* Baagöe ex G. Fisch., Mitt. Bayer. Bot. Ges. 1/27: 306. 1903. ("elongata")

Type: [Germany:] [label 1:] "Potamogeton marinus L., Fructus ecarinati!, Algäueralpen: Seealpersee, 14. IX. 1848, Sendtner" [label 2:] "Ich halte diese Pflanze für Potamogeton filiformis Person, Dr. Fischer" [label 3:] "Potamogeton filiformis Pers., forma: elongatus mihi, determ. 10/3 [19]02 J. Baagøe" (**lectotype designated here**: M).
≡ *P. filiformis* var. *elongatus* (Baagöe ex G. Fisch.) G. Fisch. in Dalla Torre & Sarnth., Fl. Gef. Grafsch. Tirol. 6/1: 134. 1906.

= *Potamogeton juncifolius* var. *amphibius* Baagöe ex G. Fisch., Ber. Bayer. Bot. Ges. 11: 132. 1907.

Type: [Germany:] [text written by Fischer:] "P. filiformis var. fluviatilis Fischer, in der Ramsach ober Murnau" [coll. G. Fischer] [text written by Baagöe:] "Potamogeton juncifolius Kern. forma amphibius, Für filiformis sind die pedunculen zu kurzig, 12. 6. 1903, determ. I. Baagøe" (**lectotype designated here**: M).

= *Potamogeton juncifolius* var. *fluviatilis* G. Fisch., Ber. Bayer. Bot. Ges. 11: 132. 1907.

Type: [Germany:] "Potamogeton filiformis Pers. var. fluviatilis Fischer, In der Ramsach bei Murnau, 1. 8. 1905, Lg. Dr. Fischer" (**lectotype designated here**: M; isolectotypes: B, ZT).
≡ *P. filiformis* f. *fluviatilis* (G. Fisch.) G. Fisch., Mitt. Bayer. Bot. Ges. 4/10: 160. 1930.

= *Potamogeton filiformis* var. *kihlmanii* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 18. 1916. ("Kihlmanii")

Type: [Sweden:] [label 1:] "Potamogeton pectinatus L., setaceus, Jämtl[and]., Fahnbyn i Sundsjön, Aug. 1856, T. O. B. N. Krok" [label 2:] "Herbar. Th. M.

Fries" [label 3:] "Potam. pycnostegus m., A. O. Kihlman, 1887" [label 4:] "Potamogeton filiformis Pers. v. Kihlmanii m., 1905. Determ. O. Hagström" (**lectotype designated here**: UPS; isolectotype: UPS).

= *Potamogeton rostratus* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 27. 1916.

Type: [label 1:] "Mongolia borealis, desertum a Thian-schan boream versus, Asia, 1877, leg. G. N. Potanin, com. Arthur Bennett" [label 2:] "Potam. rostratus m., determ. O. Hagström 20. 11. [19]08." (holotype: S); "Pl[antae]. a G. N. Potanin collectae, Mongolia borealis, ad lacum salsum Turkul in fonte fundo copioso limoso, desertum a Thian-schan boream versus, 16 Juni 1877" (isotypes: BM, G, LE).

= *Potamogeton strictus* var. *magellanicus* Hagstr., Kungl. Svenska Vetenskapsakad. Handl. 55(5): 27. 1916.

Type: [Chile:] "hôjd 700 m, 9/1 1902, Lat. S 44°0′, Long. W 70°30′, bäck, territorio Chubut, C. Högberg" (**lectotype designated here**: S).

= *Potamogeton austrosibiricus* Kaschina in Krasnob. & Safonova, Novoe Fl. Sibiri 243. 1986. ("austro-sibiricus")

Type: [Russia:] [label 1:] "Potamogeton pectinatus L., N 975, Tuvinskaya ASSR, Kaa-Chemskiy r-n, okr. s. Bel'bey, v vode r. M. Eniseya, vbliz berega, 27. 7. 1975, I. M. Krasnoborov" [label 2:] "P. austrosibiricus, L. Kašina" (holotype: NS, not seen; isotype: LE).
≡ *Stuckenia austrosibirica* (Kaschina) Tzvelev, Bot. Zhurn. 84(7): 111. 1999. ("austro-sibirica")

= *Potamogeton punensis* Galán-Mera, Phytologia 64: 495. 1988. ("punense")

Type: "Peru, Dept. Puno, Prov. Lampa (on San Roman border), small cold clear stream, at road and railroad crossing of stream draining Lago Jaracocha, ca. 9 km SW of Santa Lucia, alt. ca. 4000 m, Jan. 12, 1963, H. H. & C. M. Iltis, D. & V. Ugent No.: 1441" (holotype: USM, not seen; isotype: S).
≡ *Stuckenia punensis* (Galán-Mera) Galán-Mera, Novon 10: 115. 2000.

= *Potamogeton rostratus* var. *humilis* Volob., Sibir. Biol. Zhurn. 1992/5: 54. 1992.

Type: [Russia:] [label 1:] "Predgor'ya vostochnogo makrosklona Kuznetskogo Alatau: Krasnoyarskiy kray, Sharypovskiy r-n, ozero Bol'shoe, zabolochennyy zaliv zapadnogo berega, v vode "okon" na splavine, 30. 06. 1990, Sobr. P. Volobaev, A. Marikova" [label 2:] "Potamogeton rostratus Hagstr. var. humilis Volob." (holotype: KEM, not seen; isotypes: LE, OLD).

Stem mostly richly branched near base and unbranched above (in standing-water plants) or sparingly branched to middle (mainly in running-water plants), with one branch emerging from each node. Leaves on main stem mostly filiform, rarely (mainly in robust running-water forms) narrowly linear, 33–180 mm long, 0.2–1.6 mm wide, (40–)95–450 times as long as wide, mostly olive green to dark green, later sometimes brownish, the apex obtuse to subacute, rarely rounded or mucronate; mature leaves on branches similar in size to main-stem leaves, obtuse to acute. Leaf

Fig. 31 General appearance of *S. filiformis* (*Y. H. Guo 119*, Z); scale bar=5 cm

Fig. 32 General appearance of *S. filiformis* (*L. Klimeš 2194*, PRA-Klimeš); scale bar=5 cm

sheaths closed and tubular towards base when young but often split later, 6–44 mm long, 0.3–1.8 mm in diameter, mostly olive green to dark green, sometimes with a greyish tinge, on the side opposite from the leaf blades rather indistinctly hyaline, yellowish green to brownish green, and gradually projecting above into a ligule 2–13 mm long. Peduncles 38–205 mm long. Spikes 12–36 mm long at anthesis, 17–65 mm long at fruit, the whorls almost contiguous to distinctly remote at anthesis, always remote when fruiting. Flowers 5–12(−14), in 4–6(−7) whorls. Fruits 2.1–2.6(−3.0) mm long. Figures **31**, **32** and **33**.

Russia: Altay: Kosh-Agachskii r-on, dolina r. Builyukem v srednem techenii, 50° 06′ N, 89°16′ E, 19 Aug 1997, *A. I. Shmakov, S. Smirnov, D. Tikhonov & S. Kostyukov* (IRKU). – **Irkutsk:** Ziminskii raion, 3 km k zapadu ot pos. Osipovskii, protochnaya staritsa v poime r. Oka, v protoke na glubine 30 cm, 9 Jul 2005, *V. Chepinoga & S. Rosbakh 14720* (PRA-Kaplan), the same site, *V. Chepinoga & S.*

Fig. 33 A transversal section of closed leaf sheaths of *S. filiformis* (*S. Rosbach & B. Voges 17459*, PRA-Kaplan); scale bar= 0.5 mm

Rosbakh 14721 (IRKU); Tulunskii raion, 7 km k yugo-zapadu ot pos. Ikey, protoka r. Ikey, 23 Jul 2006, *S. Rosbakh & B. Voges 17459* (PRA). – **Buryatiya:** Baikal area, Barguzinskaya Basin, arms of Ina river 6 km NW of Yubileinyi (Yubileinyy) village, 495 m, 2 Aug 1993, *Z. Kaplan 93/576* (PRA-Kaplan). – **Chukot**: Ostrov Itygran [= island Yttygran], SO chast ostrova, 6 Aug 1972, *V. Yu. Razzhivin, N. A. Sekretareva & V. A. Yurtsev* (BM, S); Lorino, poberezh'e ozerka, 10 Aug 1962, *V. Gavrilok* (BM); Lorino, v ozerke, bliz poselka, 13 Aug 1962, *V. Gavrilok* (L, S).

Tajikistan: Pamir', mezhdu Muskolom' i Karakulem' [= between Muzkol and Kara-Kul Lake], 1904, *B. A. Fedtschenko* (K); Pamür, Kara-Kuli järve idakalvalt [= Kara-Kul Lake], 21 Jul 1961, *L. Viljasoo* (TU); östra Pamir, Tjakker-agil, Sô kvallens [= freshwater lake Tjakker-agil], 3319 m, 22 Jul 1895, *S. Hedin* (S); Pamir, in stagno prope lacu Kara Kul, alt. 4000 m, 1 Jul 1898, *O. Paulsen 639* (C, C-Baagöe); Pamir, in palude fluminis Alitshur [= Alichur], 3700 m, 22 Jul 1898, *O. Paulsen 879* (C, C-Baagöe).

Kyrgyzstan: Terski Alatau [= Terskey-Alatau], Kokbulak, ad fontes fl. Naryn, in laculo reg. alp., 9 Aug 1896, *V. F. Brotherus 81* (H, LD); Zaalayskiy khrebet' [= mountain range Qatorkŭhi Pasi Oloy], mezhdu Bordaboy i Sarytashem' [= between Bordaba and Sary-Tash], 11 Aug 1901, *O. A. Fedtschenko & B. A. Fedtschenko* (BM).

Turkey: Niğde, Bolkar Dağlari, Karagöl-Gebiet, ca. 400 m östlich des Kara Göl, im aus der Moräne austretenden Bach, ca. 20 cm tiefer, langsam fließender Bach, in Marmor-Moräne, 37°25′ N, 34°37′ E, 2620 m, 9 Aug 1992, *P. Hein 90* (B); Vil. Antalya (Isauria), Eğri göl at N. foot of Geyik dag, in lake, 2000 m, 1 Sept 1947, *P. H. Davis 14672* (BM, E, K).

Afghanistan: Prov. Badakshan, Panjshir [= Panj Shīrī] valley, Auz Anjuman, creeks of river, ca. 3400 m, 24 Jul 1962, *I. Hedge & P. Wendelbo 5478* (E); Nord de Panjao [= Panjāb], marécage, 15 Oct 1958, *H. Pabot 1436* (G); Bala Murghab [= Bālāmorghāb], v řece Darya-I-Murghab asi 3 km jižně od vesnice [= in river Darya-I-Murghab ca. 3 km S of the village], 470 m, 6 Oct 1964, *O. Jakeš* (BRA).

Pakistan: Baroghil Pass, in lake, 18000 ft, 24 Jul 1958, *J. D. A. Stainton 2993* (BM, E, UPS); Baroghil Pass, at edge of pond, 12000 ft, 27 Jul 1958, *J. D. A. Stainton 3028* (BM, E, UPS); Baltistan, Skardu, 7700 ft, 16 Aug 1876, *C. B. Clarke 30502* (K); Baltistan, Skardu, in swift running water of canals, ca. 7500 ft, 24 Jun 1955, *G. L. Webster & E. Nasir 5738* (G); Prov. de la Frontière N.-O., alpage au-dessus de Gittidas, 4600 m, 20 Jul 1953, *F. Schmid 494* (BM, G).

India: Jammu and Kashmir: Ladakh, region Rupshu, Samad Rokchen, Thukje, 33°21.5′ N, 78°01.2′ E, 4591 m, 5 Aug 2001, *L. Klimeš 1268* (PRA-Klimeš); Ladakh, region Indus Valley, Stot (E), Yaye Tso, SW banks, 33°18.4′ N, 78°28.4′ E, 4703 m, 18 Aug 2002, *L. Klimeš 2194* (PRA-Klimeš); Ladakh, region Indus Valley, Zhung (Leh), Spituk, 34°07.1′ N, 77°32.6′ E, 3220 m, 16 Sept 2002, *L. Klimeš 2801* (PRA-Klimeš); Ladakh, region Indus Valley, Domkhar – Dha, Kanji valley, confluence of Chulung, Kong and Hamar rivers, 34°10.1′ N, 76°34.9′ E, 4020–4060 m, 19 Aug 2003, *L. Klimeš 3087* (PRA–Klimeš); Ladakh, Jongtse – Zukung, in marshy places and in stagnant water, 20 Aug 1982, *P. K. Hajra 74206* (BSD); Ladakh, Saspole, 3200–3300 m, in gently flowing stream, 28 Jul [19]76, *B. M. Wadhwa 59240* (BSD); Baltistán, Drás Valley, 11000–12000 ft, 30 Jun [18]92, *J. F. D. [= J. F. Duthie] 11688* (DD); Ladakh, Shushal, in shallow muddy lake, 14200 ft, 25 Jul 1931, *W. Koelz 2435* (DD, E, K, L, S); Seni, Zaskar, ca. 12,000 ft, 19–21 Jul 1933, *W. Koelz 5767* (H, G, S); Gurez [= Gurais], Kishenganga valley, spring water, 8000 ft, 25 Sept 1940, *F. Ludlow & G. Sherriff 8268* (BM, E, UPS); Ladak, Treaty Road, Spitok, running water from Indus and springs, 10500 ft, 10 Jun 1941, *F. Ludlow 8396* (BM, E); Ladak, Rupshu, Tso Kar lake, in ponds on a salt plain, 15000 ft, 17 Jul 1941, *F. Ludlow 8509* (BM, E). – **Himachal Pradesh:** Punjab, Darcha Lahul, in small backwater, 11000 ft, 26 Aug 1916, *R. E. Cooper 5499* (B, E, M, P); Lahul Punjab, Patseo, 12600 ft, in a marsh and also in running streams, 18 Jul [19]41, *N. L. Bor 15163* (DD, K); Lahul, Kyelang – Jespa, in a stream, 10400 ft, 16 Jul [19]41, *N. L. Bor 16419* (E, K); Likhim Yongma, in a slow flowing stream, 4300 m, 15 Aug [19]88, *R. McBeath 2143* (E); Chandratal Lake, stagnant pools, 4170 m, 19 Aug [19]88, *R. McBeath 2160* (E).

Nepal: Chhairogaon (N. of Tukucha), 9000 ft, 30 V 1954, in running stream, *J. D. A. Stainton, W. R. Sykes & L. H. J. Williams 811* (BM, E, UPS); Ringmigaon, Phoksumdo Tal, in shallow water near edge of lake, 14000 ft, 20 Sept 1952, *O. Polunin, W. R. Sykes & L. H. J. Williams 3520* (BM, E, G, UPS); Changyam Khola, still water, 13500 ft, 14 Jun 1953, *P. C. Gardner 743* (BM).

Bhutan: Marulhang, in flowing spring water, 27°35′ N, 90°16′ E, 11800 ft, 10 Aug [19]49, *F. Ludlow, G. Sherriff & J. H. Hicks 17096* (BM).

China: Xinjiang Uygur: Alg från Bassik-kul, 3727 m, 21 Jul 1894, *S. Hedin* (S, fragment in LD); östra Pamir, Sjön nedre Bassik-kul [= lake Lower Basik-kul], 3727 m, 23 Jul 1894, *S. Hedin* (C, S); Lilla Kara-Kul [= lake Little Kara-kul], 3720 m, 17 Jul 1894, *S. Hedin* (C, S). – **Tibet:** Yamdrok Tso, along the edge of the Lake, 28°59′ N, 90°25′ E, 14500 ft, 12 Sept [19]44, *F. Ludlow & G. Sherriff 11154* (BM); Takpo Prov., Langong, more or less still pools in grassy meadows, formed by seepage from river, 28°46′ N, 93°48′ E, 12500 ft, 1 Jun 1938, *F. Ludlow, G. Sherriff & G. Taylor 3934* (BM); Kongbo [= Gongbo'gyamda County], Dzala, Pasum Chu, in ditches with still or slightly running water, 12500 ft, 20 Jun 1947, *F. Ludlow, G. Sherriff & H. H. Elliot 13940* (BM, GH); Kongbo [= Gongbo'gyamda County],

Lhasa, 29°40′ N, 91°05′ E, 12000 ft, 11 Jun [19]43, *F. Ludlow & G. Sherriff 9569* (BM); Nagarze – Lhozak [= Garbo], SE of Pomo Co [= lake Puma Yumco], alp. flush, 28°29′ N, 90°33′ E, 5060 m, 23 Jul 1994, *B. Dickoré 9877* (GOET-Dickoré, PRA-Kaplan); Khamba Jong, 10 Jul [19]03, *F. E. Younghusband 40* (B, K). – **Qinghai:** Tangula Shan N, Upper Yangtse basin, Gar Qu, below Mt. Geladandong NE glacier, alp. pond in *Kobresia schoenoides* fen, 33°31′ N, 91°20′ E, 5080 m, 24 Sept 1989, *B. Dickoré 4372* (GOET-Dickoré, PRA-Kaplan); Maqin (Maqên) Xian: Wahema, Dawu Xiang, along the Gequ He, between Maqin (Maqên) and Gande (Gadê), in river, 4100 m, 34°15′58" N, 100°17′3" E, 3 Aug 1993, *T. N. Ho, B. Bartholomew & M. Gilbert 714* (BM, E); Golog Zang Aut. Pref., Maqên Co., bridge 2 km west of Dawu, in pool, 3760 m, 34°29′55" N, 100°13′17" E, 11 Jul 1997, *D. G. Long et al.* (Sino-British Qinghai Exped. 1997 no. 549) (E); Huangnan Zang Aut. Pref., Henan Mongol Aut. Co., north of Henan Xian, Zêkog River, in pool, 3560 m, 34°45′59" N, 101°39′41" E, 14 Jul 1997, *D. G. Longet et al.* (Sino-British Qinghai Expedition 1997 no. 632) (E); vers Tsa kang tch'eng, 25 Sept 1918, *E. Licent 4907* (BM, P). – **Shaanxi:** District of Jingbian, municipality of Haizetan, lake Haizetan, 1290 m, 7 Sept 1982, *Y. H. Guo 119* (Z). – **Inner Mongolia:** Ordos, 1884, *G. N. Potanin* (BM). – **Sichuan:** Prov. Sze-ch'uan, reg. bor.-occid., in rivulo circ. 20 km occ.-bor.-occ. a Merge, ca. 3500 m, 29 Aug 1922, *H. Smith 4237* (BM, S, UPS).

Mongolia: lac. Bain-Nor, in aqua dulce, 750 m, 7 Jul 1907, *J. G. Granö* (H); Khangai [= mountain range Hangayn Nuruu], in small lake in the valley of Khoit-Tamir river above Tsetsen-van, 21 Aug 1926, *N. Pavlov 16* (S); Artsa Bogdo [= mountain range Artsa Bogdo Ula], in small stream, 1925, *R. W. Chaney 297A* (K); Circa lacus Kirghiz-nor [= lake Hyargas Nuur], 1879, *G. N. Potanin* (BM, E, K, P).

Stuckenia filiformis is broadly distributed in the northern hemisphere and in South America. In Asia it occurs mainly in central Siberia, the Russian Far East, and in the mountains of Central Asia, additional isolated localities are in Anatolia and the Caucasus Mountains (Fig. **34**). It grows mainly in cold, shallow, mesotrophic to eutrophic waters, most often in lakes, streams and rivers.

Outside Siberia, *S. filiformis* occurs almost exclusively in mountains. Reports of the species from lowlands (e.g. Karyagin 1950; Dobrokhotova 1956), particularly those of saline habitats [cf. Dobrokhotova 1956: "i v sil'no solonovatoy (do 11‰) vode", i.e,. also from strongly saline water (up to 11‰)], are highly suspicious and almost certainly refer to slender and extremely narrow-leaved forms of *S. pectinatus*. All vouchers that were identified or later referred to as *S. filiformis* and originated from lowland habitats of Azerbaijan, Turkmenistan, Uzbekistan and Kazakhstan, many of them explicitely indicating that they originated from saline water (e.g., "in lacus amaro-salsi", collection *Granitov 408b*, or "in aquis lacus subsalsis", collection *Popov & Vvedensky 408a*), belong to *S. pectinata*.

I have not seen *S. filiformis* from Turkmenistan. The only record of this species given for Turkmenistan by Fedtschenko et al. (1932, as "bl. g. Kipchaka na levom beregu r. Amu-dar'i, Granitov") is based on a misidentified collection of *S. pectinata* (see the list of records under that species).

Like *S. pectinata*, *S. filiformis* is an extremely variable species. Its variation ranges from small plants with leaves concentrated near the base of the stem to robust elongated river forms with richly foliated stems, and from plants with extremely

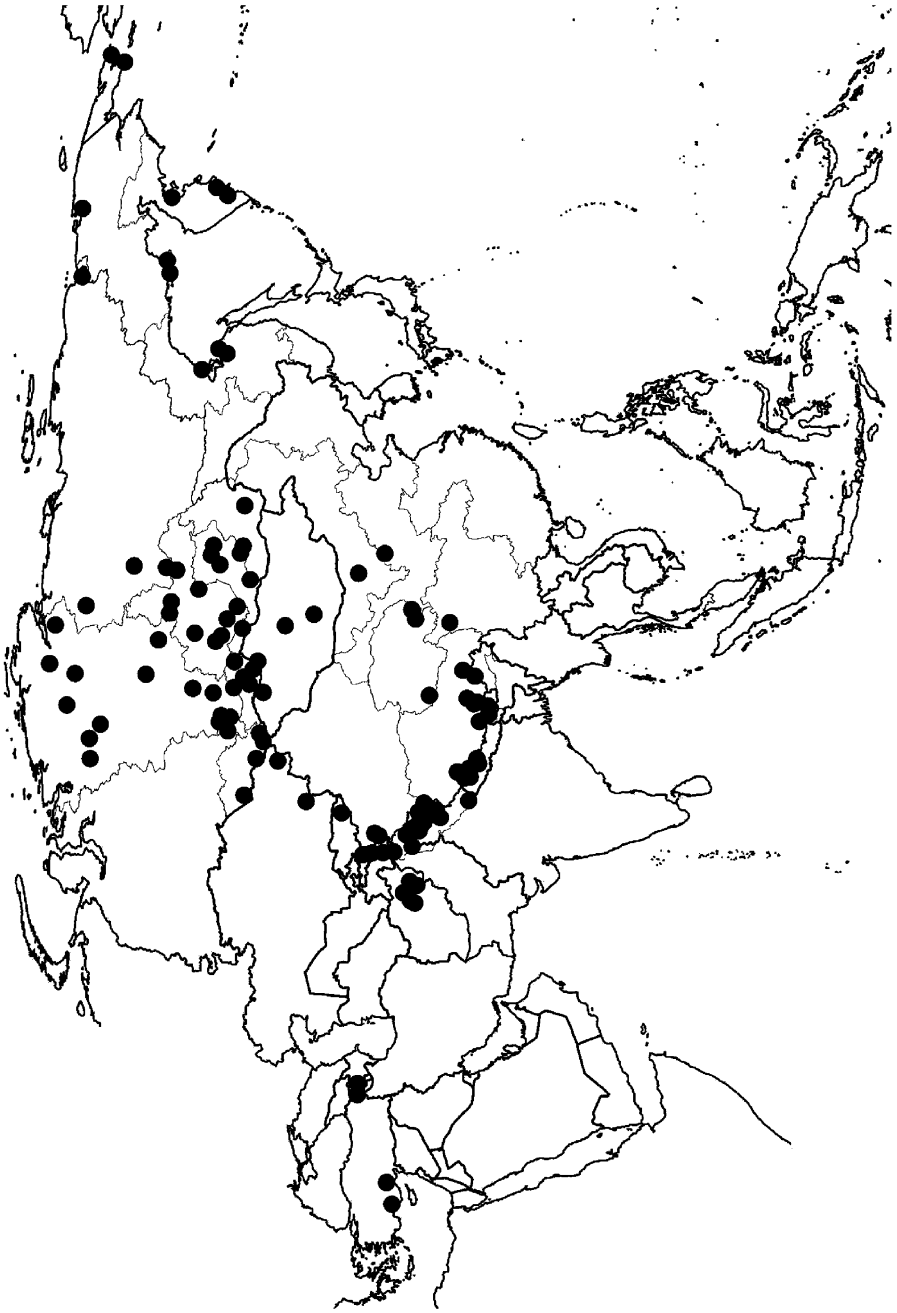

Fig. 34 Distribution of *S. filiformis* in Asia

narrow and almost acute leaves to broad-leaved forms with rounded leaf-tips. The best character for the delimitation of this species is fruit size because *S. filiformis* has smaller fruits than any other species of *Stuckenia*. The general vegetative morphology is often unreliable for accurate identification. However, the structure of the leaf sheaths provides a useful tool because, besides *S. filiformis*, only in *S. amblyphylla* are the young sheaths closed over most of their length.

Many botanists have recorded extensive variation within *S. filiformis*. Those who attempted to describe the variation in terms of a formal taxonomic structure proposed many new names at the rank of variety, subspecies or even species. In Europe, this approach culminated in the first decades of the 20th century (e.g., Fischer 1907; Ascherson and Graebner 1913; Hagström 1916). However, when the sources of the variation were better understood, any formal infraspecific classification within *S. filiformis* was abandoned.

The robust forms from running waters particularly have attracted the attention of taxonomists. These forms are recorded from almost the entire range of the species and often described as distinct taxa. Such forms from the European Alps were named *P. juncifolius*, from Siberian rivers *P. austrosibiricus*, in North America *P. filiformis* var. *occidentalis* and South America *P. strictus* var. *magellanicus*. Although often recognized taxonomically, the background of their morphological distinctiveness has not previously been studied experimentally. A simple transplant test was made when a robust river form with leaves up to 1.2 mm wide corresponding to "*P. juncifolius*" was collected in Switzerland in 1998 (Fig. **1**) and cultivated in standing water simulating the common habitat of the ordinary forms of *S. filiformis*. The following year these plants produced much finer phenotypes with leaves only 0.2–0.3 mm wide (Fig. **2**). This demonstrates that the remarkable features of these robust river forms are not fixed genetically and that these phenotypes easily convert to typical *S. filiformis*. Although both plants shown in the figures are genetically identical, these phenotypes are likely to be treated as distinct taxa if a narrow, solely morphology-based concept is applied. Besides this practical difficulty in defining these forms morphologically, it should also be pointed out that these robust river forms are known from many parts of the species range. This indicates that they can be produced rather easily and repeatedly, which also indicate the low importance of their formal taxonomic treatment.

The plants described as *S. austrosibirica* are similar to *S. pectinata* in general appearance, because they are rather elongated in comparison with typical *S. filiformis*, but their young leaf sheaths are closed and tubular (see Fig. **33**) and fruits, if present, are of a size typical of *S. filiformis*. In the absence of cultivation experiments or molecular studies it is impossible to ascertain their exact identity. Because these plants share common characteristics with other river forms from outside southern Siberia, which proved to be just phenotypes of *S. filiformis*, the plants called *S. austrosibirica* are tentatively included here in the concept of the former species.

In contrast to the European literature, which does not subdivide *S. filiformis* at all at present, several taxa are recognized in the American literature. St. John (1916) presented an infraspecific treatment at the rank of variety for North American plants. This concept was nomenclaturally updated by Reveal (1977) and more recently the formerly recognized varieties were elevated to the rank of subspecies (Les and Haynes 1996; Haynes and Hellquist 2000). These taxa are separated mainly by the size of the plants, width of the leaves and spike characteristics. However, most of the

characters used for delimiting these entities are under environmental control. As described above, forms of *S. filiformis* from running water with elongated stems and broad leaves develop into normal narrow-leaved forms with short stems when grown in standing water. Secondly, plants designated under this concept as *S. filiformis* subsp. *occidentalis* include individuals with leaf sheaths consistently open at their bases, which excludes them from even being *S. filiformis*. Some of them may be running-water forms of *S. pectinata* with broad leaves and obtuse leaf apices, but various hybrids with *S. pectinata* and *S. vaginata* are also likely. For example, Brayshaw (2000) equates *S. filiformis* subsp. *occidentalis* with *S.* × *fennica* recognized in Europe. A detailed investigation of the identity of intermediate *Stuckenia* forms in Europe (Hollingsworth et al. 1996; Preston et al. 1998, 1999; King et al. 2001; Bobrov and Chemeris 2006) showed that hybrids of *S. filiformis*, *S. pectinata* and *S. vaginata* are more widespread than previously assumed.

The concept of subdividing *S. filiformis* into subspecies was applied also by Haynes and Holm-Nielsen (2003) to neotropical plants. Although they distinguish only subsp. *alpina* in their treatment, the range of variation of *S. filiformis* in this region is broader than the concept of this taxon defined by Haynes and Hellquist (2000) for North American plants. Their neotropical material included more robust plants, with longer stems and broader leaves, but these seem to be connected with the low-growth plants by intermediate forms.

Besides the taxonomic difficulties, there also seem to be problems with the adopted nomenclature. The type material of *S. filiformis* (subsp. *filiformis*) falls into subsp. *alpina* when the key by Haynes and Hellquist (2000) is used. Although these authors report "subsp. *alpina*" only from North America and Asia, the basionym was established on European plants. Thus the American usage of these names does not conform with their original European delimitations.

Another form was recently described from running waters in Peru as *P. punensis* (Galán-Mera 1988). This was included in the synonymy of *P. filiformis* by Wiegleb and Kaplan (1998). Recently Galán de Mera et al. (2000) advocated recognition of *S. punensis* and gave a list of the diagnostic features allegedly separating it from *S. filiformis*. However, most of the features claimed to be exclusive to *S. punensis* are known also from *S. filiformis* in both South America and elsewhere. Often they are associated with the occurrence in running water. The only unique feature described by Galán de Mera et al. (2000) is "scabrous" leaves. However, even after a detailed examination of all the collections cited by them I was unable to find any structure on the leaves that corresponded to this characteristic or any other that deviated from the normal range of variation of *S. filiformis*. The leaves are smooth, but some may appear "scabrous" because of low longitudinal ribs that only become apparent when the leaves are dried. This character therefore may be just an artefact of the drying procedure.

This discussion indicates that even after exclusion of similar but taxonomically unrelated plants, such as the river forms of *S. pectinata* and various hybrids, *S. filiformis* consists of a rich mosaic of numerous phenotypes and local forms. Their practical taxonomic delimitation in terms of formal classification does not seem to be possible. For this reason no infraspecific taxa are distinguished in this revision.

Uncertain Taxa

Six new *Stuckenia* species (under *Potamogeton*) are described by Chen (1987) based on the specimens collected during a 3-day excursion to two Chinese lakes. Their diagnostic characters include minute or insignificant morphological differences such as shape of leaf apex, branching pattern, size of whole plants and length of peduncle. They are unlikely to represent new species within the taxonomic concept adopted in this revision (see also Kaplan 2002). Unfortunately, type specimens are not available for examination in spite of repeated requests to PE where they are indicated to be preserved. Thus the exact identity of these names is uncertain.

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Appendix

Index of scientific names.

Only final epithets are included in the index. Nomenclatural synonyms with the same final epithet are represented by their basionym only. Epithets of correct names of accepted species are printed in **bold**.

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