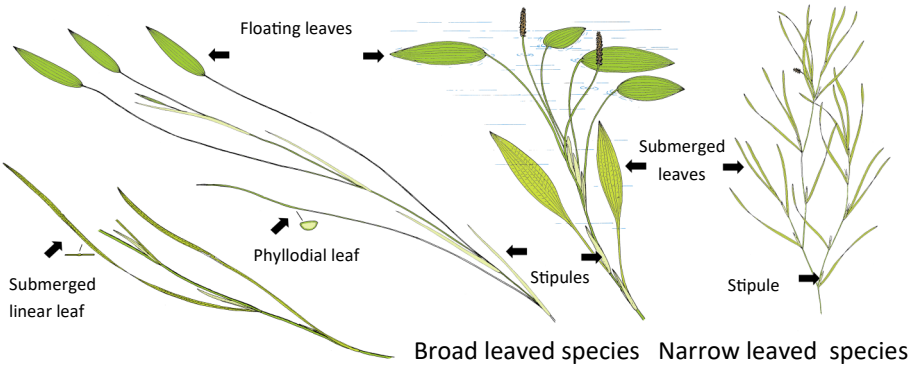
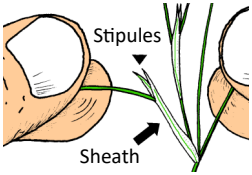
Groenlandia, Potamogeton, Stuckenia and *Zannichellia*

Key to species and most common hybrids.



1 Leaf base enclosing stem – gently pull the leaf away from the stem (***1***)
Stuckenia – see p. 49

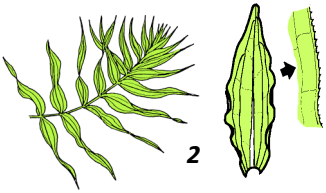
1 Leaf base not enclosing stem 2



1

2 Leaves opposite or 3–4 at each node 3

2 Leaves alternate
Potamogeton 4


2

3 Leaves ovate-oblong, margins finely denticulate (***2***)
65 *Groenlandia densa*

3 Leaves linear, margins entire
Zannichellia – see p. 51

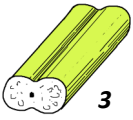
Potamogeton

4 All leaves linear to oblong with parallel margins sometimes undulate 5

4 At least some leaves lanceolate to elliptic with convex margins 20

5 Stem with a shallow groove on one or both of the broader sides (***3***). Leaves often undulate 6

5 Stem without grooves. Leaves not undulate 9


3

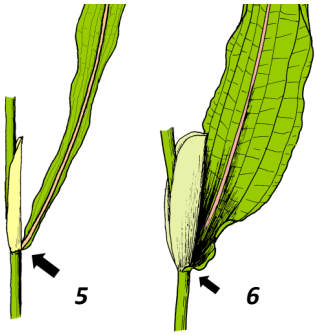
6 Leaf margin distinctly serrate (***4***) (visible to the naked eye)
75 *P. crispus*

6 Leaf margin obscurely serrate (use a hand lens) or entire 7
In addition to the hybrids keyed out in couplet 7 and 8 juvenile plants of 75 *P. crispus* may also have entire leaf margins, especially during autumn and winter


4

7 Leaves half-clasping the stem at base (***6***), 0.8–2.3 cm wide
93 *P. ×undulatus* *(P. crispus × praelongus)*

7 Leaves not clasping the stem at most slightly auriculate (***5***) 8

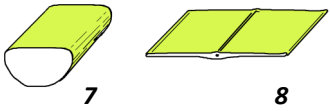

5 ***6***

8 Leaves 0.2–0.5 cm wide
94 *P. ×lintonii* *(P. crispus × friesii)*

8 Leaves 0.6–1.5 cm wide
91 *P. ×olivaceus* *(P. alpinus × crispus)*

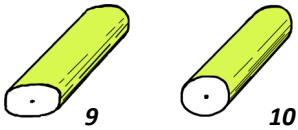
9 Leaves phyllodial, semi-terete, flat or shallowly concave on the adaxial side and convex on the abaxial side (***7***); veins 1–3, indistinct
66 *P. natans*

9 Leaves flat with a distinct midrib and lateral veins (***8***) 10


7 ***8***

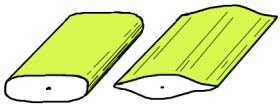
10 Rhizome present 11

10 Rhizome absent 12


9 ***10***

11 Stem somewhat flat (***9***) or almost terete towards the apex
76 *P. epihydrus*

11 Stem terete (***10***)
88 *P. ×sparganiifolius* *(P. gramineus × natans)*
or ***P. ×vepsicus*** *(P. natans × praelongus)*
P. ×sparganiifolius and *P. ×vepsicus* cannot be separated without use of DNA-sequencing, see though p. 226 in the book.

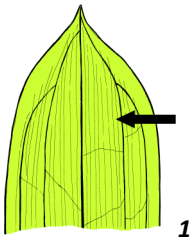

11 ***12***

12 Stem compressed to winged (***11,12***) 13

12 Stem terete (roll between your fingers) (***10***) 17

13 Leaves with several inconspicuous sclerenchymatous strands between the veins (use a hand lens against the light) (***13***). Stem flat or winged 14

13 Leaves without sclerenchymatous strands between the veins (use a hand lens against the light). Stem flat 15

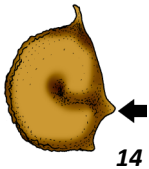


13

14 Leaves 3.5–8(–12) cm long, 1.5–4.0 mm wide; with 1 lateral vein on each side of the midrib. Stem flat, but not winged (***11***). Peduncle 0.5–2.0(–2.5) long, compressed, approximately 1–2 times the length of the inflorescence. Fruits with a tooth on the ventral side (***14***)

77 *P. acutifolius*

The hybrid **97 *P. ×bambergensis*** may key out here – for separation see the book.



14

14 Leaves 8.5–24 cm long, 3–6 mm wide; with 2 lateral veins on each side of the midrib. Stem winged (***12***). Peduncle 2.8–7.0 cm long, about 2–5 times the length of the inflorescence. Fruits without tooth (***15***)

78 *P. compressus*

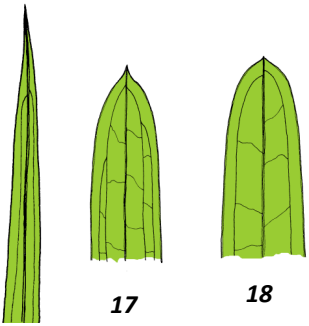
The hybrid **97 *P. ×bambergensis*** may key out here – for separation see the book.

15

15 Leaves gradually tapering to a very sharp, pointed apex, 0.5–1.1 mm wide (***16***). Stipules with several distinct veins (prominent when dry) between the 2 primary veins

85 *P. rutilus*

15 Leaves obtuse to obtusely mucronate, 1.5–3.5 mm wide (***17, 18***). Stipules with obscure to indistinct veins between the 2 primary veins 16



17 ***18***

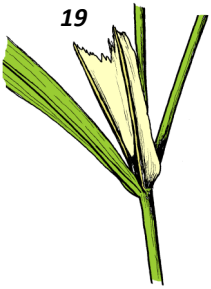
16

16 Shoots particularly rich and densely branched in the upper part. Stipules open and convolute, rounded or more or less obtuse not splitting into a "V"-shape when decaying

79 *P. obtusifolius*

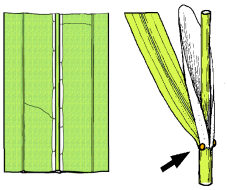
16 Shoots with branches more evenly distributed. Stipules connate at the base when young, with two very prominent veins, soon splitting into a "V"-shape (***19***)

80 *P. friesii*



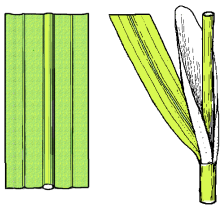
19

17 Leaves with a distinct band of pale tissue (lacunae) on each side of the midrib (***20***) and 2 well developed glands at the nodes (***21***)
81 *P. berchtoldii*
17 Leaves without a distinct band of pale tissue (lacunae) on each side of the midrib (***22***) and without glands at the nodes (***23***) 18



20 ***21***

18 Stipules with several distinct veins between the 2 primary veins, tubular in the basal 2–4 mm, but soon splitting (***24***)
85 *P. rutilus*
18 Stipules with inconspicuous veins between the 2 primary veins, tubular or not in the basal 2–3 mm 19



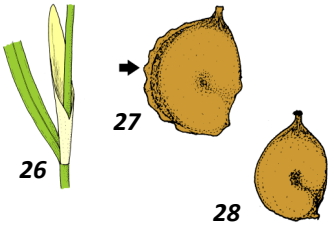
22 ***23***

19 Stipules blunt, not inrolled, tubular in the basal 2–3 mm (***26***). Fruits not muricate on the dorsal side (***28***)
83 *P. pusillus*
19 Stipules tightly inrolled and open at the base (***25***). Fruit muricate on the dorsal side (***27***)
84 *P. trichoides*

24 ***25***

20 Plants with only floating leaves 21
20 Plants with at least some submerged leaves 27

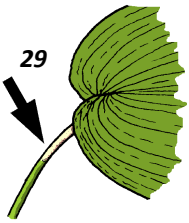
21 Leaves rather thin, translucent with distinct primary and secondary veins
68 *P. coloratus*
21 Leaves firm, coriaceous, not translucent 22



26 ***27*** ***28***

22 Petiole with a 1–2 cm long, slightly swollen, flexible, discoloured joint between the petiole and the lamina (***29***)
66 *P. natans*
22 Petiole without a discoloured joint between the petiole and the lamina 23

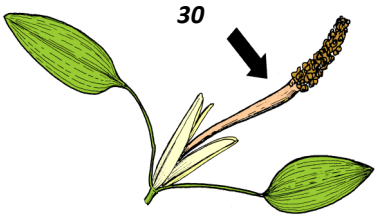
23 Stipule 6–14 cm long. Fruits never develop
86 *P. ×schreberi* *(P. natans × nodosus)*
23 Stipule 1–6 cm long. Fruits develop 24



29

24 Peduncle becoming broader and spongy towards the inflorescence spike (***30***). Fruit 2.4–3.1 mm long
70 *P. gramineus*

24 Peduncle of more or less uniform diameter and texture throughout. 25

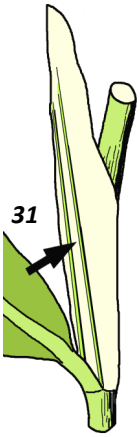


25 Fruits 1.9–2.6 mm long
67 *P. polygonifolius*

25 Fruits 2.6–4.1 mm long 26

26 Stipules 1.5–3.5(–4.5) cm long, the 2 most prominent veins not forming distinct ridges. Leaves with reddish tinge which intensifies when dried
71 *P. alpinus*

26 Stipules 3–8(–12) cm long, the 2 most prominent veins forming ridges (***31***). Leaves without a reddish tinge which intensifies when dried
69 *P. nodosus*



27 Leaves of two kinds present: petiolate floating leaves with oblong elliptic to ovate lamina and lanceolate to linear submerged leaves 28

27 Only lanceolate to linear submerged leaves present 39

28 Petiole with a 1–2 cm long, slightly swollen, flexible, discoloured joint between the petiole and the lamina (***29***). Submerged leaves phyllodial, linear, semi-terete without distinct midrib and lateral veins (***7***)
66 *P. natans*

28 Petiole of floating leaves without a discoloured joint between the petiole and the lamina. Submerged leaves lanceolate to linear, flat (***8***), with distinct veins 29

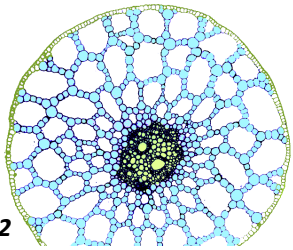
29 Floating leaves translucent with prominent primary and secondary veins, not very different from the submerged leaves
68 *P. coloratus*

29 Floating leaves coriaceous, not translucent and very different in shape and structure to the submerged leaves 30

30 Submerged leaves linear with parallel margins – sometimes slightly wider towards the apex 31
30 At least the upper submerged leaves lanceolate 32

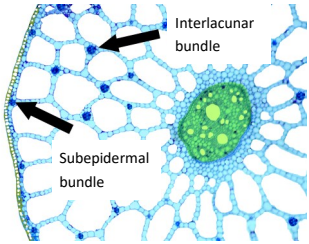
31 Submerged leaves sessile. Stem somewhat compressed or almost terete towards the apex of flowering stems
76 *P. epihydrus*
31 Submerged leaves petiolate. Stem terete
88 *P. ×sparganiifolius* *(P. gramineus × natans)*
or ***P. ×vepsicus*** *(P. natans × praelongus)*
P. ×sparganiifolius and *P. ×vepsicus* can not be separated without use of DNA-sequencing

32 Margins of submerged leaves entire 33
32 Margins of submerged leaves denticulate (use a hand lens and look carefully especially towards the apex) 37


32

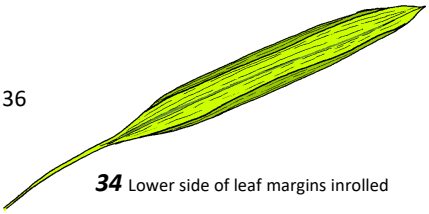
33 Submerged leaves all petiolate 34
33 Submerged leaves all sessile or the upper very rarely shortly petiolate
71 *P. alpinus*

34 Stem cross section with subepidermal and/or interlacunar bundles (***33***) (use a microscope) 35
34 Stem cross section without subepidermal and interlacunar bundles (***32***) (use a microscope)
69 *P. nodosus*



33

35 Margins of floating leaves somewhat inrolled (***34***). Upper submerged leaves with a mucro or an extended midrib
87 *P. ×fluitans* *(P. lucens × natans)*
35 Margins of floating leaves more or less flat. Apices of upper submerged leaves acute or obtuse, never with a mucro or extended midrib 36


34 Lower side of leaf margins inrolled

36 Submerged leaves all linear-elliptical or narrowly elliptical
67 *P. polygonifolius*

36 Basal submerged leaves phyllodial, linear, semi-terete, without distinct midrib and lateral veins (***35***), whereas the rest are linear-elliptical with a lamina
86 *P. ×schreberi* *(P. natans × nodosus)*

37 Submerged leaves gradually tapering to the base 38

37 Submerged leaves rounded or more or less amplexicaule at base
90 *P. ×nitens* *(P. gramineus × perfoliatus)*

38 Submerged leaves usually less than 12 mm wide, the upper sessile
70 *P. gramineus*

38 Submerged leaves usually more than 12 mm wide, the upper petiolate
89 *P. ×angustifolius* *(P. gramineus × lucens)*

39 Submerged leaves distinctly petiolate 40

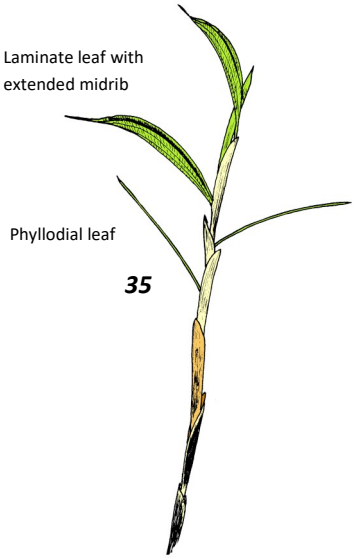
39 Submerged leaves sessile or some of them with a 1–5 mm long petiole 46

40 Submerged leaves with a mucro or an extended midrib. The 2 most prominent veins on the stipule appearing winged on the lower half of the abaxial side (***31***) 41

40 Submerged leaves acute or obtuse at apex, never with a mucro or an extended midrib. The 2 most prominent veins on the stipule not appearing winged on the lower half of the abaxial side 43

41 Petiole 2.5–10 cm long.
87 *P. ×fluitans* *(P. lucens × natans)*

41 Petiole less than 2.5 cm long 42



42 Leaves on main stem and branches of more or less equal size. All leaves with 0.2–0.7 cm long petioles. Stipules on main stem 3–8 cm long.
73 *P. lucens*

42 Leaves on main stem larger than those on branches (***36***). Most leaves sessile, but in the upper part of the plant there are usually leaves with long petioles. Stipules on main stem 2–5 cm long.
89 *P. ×angustifolius* *(P. gramineus × lucens)*


36

43 Stem cross section with 2–3 rows of interlacunar bundles (***33***) (use a microscope)
86 *P. ×schreberi* (*P. natans × nodosus*)

43 Stem cross section without interlacunar bundles (***32***) (use a microscope) 44

44 Stem cross section without subepidermal bundles (***32***) (use a microscope). Young leaves with minutely denticulate margin (use a hand lens)
69 *P. nodosus*

44 Stem cross section with subepidermal bundles (***33***) (use a microscope). Young leaves without minute teeth (use a hand lens) 45

45 Submerged leaves 2–5 cm wide, petiole 1.5–6.5 cm long. Fruits 1.3–1.9 mm long. Predominantly in alkaline water
68 *P. coloratus*

45 Submerged leaves 0.3–2.4 cm wide, petiole 1.5–8(–15) cm long. Fruits 1.9–2.6 mm long. Predominantly in non alkaline water
67 *P. polygonifolius*

46 Lamina of submerged leaves gradually tapering to the base 47

46 Lamina of submerged leaves rounded or more or less amplexicaule at base 50

47 Submerged leaves with entire margin
71 *P. alpinus*

47 Submerged leaves with denticulate margin (use a hand lens and look carefully especially towards the apex) 48

48 Most or all leaves on main stem less than 12 mm wide
70 *P. gramineus*

48 Most or all leaves on main stem greater than 12 mm wide 49

49 Submerged leaves with petioles 0.2–0.7 cm long, not recurved. Leaves on main stem not much larger than those on branches. Floating and transitional leaves absent
73 *P. lucens*

49 Submerged leaves sessile, often recurved, the upper often shortly petiolate. Leaves on main stem distinctly larger than those on branches. Floating and transitional leaves often present
89 *P. ×angustifolius* *(P. gramineus × lucens)*

50 Stem terete or nearly so (***10***) 51

50 Stem slightly compressed with a shallow groove running down on one or both of the broader sides (***3***) 56

51 Submerged leaves with denticulate margin (use a hand lens and look carefully especially towards the apex) 52

51 Submerged leaves with entire margin 55

52 Stipules fugacious, present only on young leaves 53

52 Stipules persistent. Leaves flat at apex 54

53 Leaf margin densely denticulate. Stipules present only on the youngest leaves
74 *P. perfoliatus*

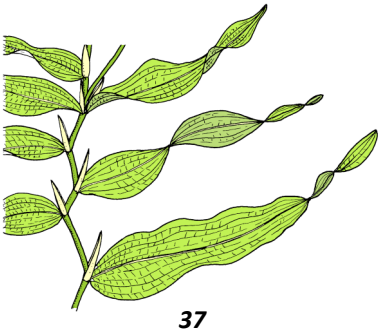
53 Leaf margin sparsely denticulate. Stipules present on most of the younger leaves
96 *P. ×cognatus* *(P. perfoliatus × praelongus)*

54 Submerged leaves widest at base. The 2 most prominent veins on the stipule not appearing winged on the lower half of the abaxial side
90 *P. ×nitens* *(P. gramineus × perfoliatus)*

54 Submerged leaves widest at the middle. The 2 most prominent veins on the stipule appearing winged on the lower half of the abaxial side
95 *P. ×salicifolius* *(P. lucens × perfoliatus)*

55 Stem with a characteristic zigzag shape (***37***). Stipules long-persistent
72 *P. praelongus*

55 Stem more or less straight. Stipules degrading early and only present on the younger leaves
96 *P. ×cognatus* *(P. perfoliatus × praelongus)*



37

56 Leaves with 1–2 veins on each side of the midrib. Leaf margin denticulate to coarsely serrate (***4***) - visible without a hand lens and often undulate
75 *P. crispus*

56 Leaves with 2–6 veins on each side of the midrib. Leaf margin entire or sparsely denticulate, undulate or not 57

57 Leaf margin entire or very obscurely denticulate (use a hand lens). Leaves 5–15 cm long
93 *P. ×undulatus* *(P. crispus × praelongus)*

57 Leaf margin denticulate (use a hand lens and look carefully especially towards the apex). Leaves 2.5–6 cm long
92 *P. ×cooperi* *(P. crispus × perfoliatus)*

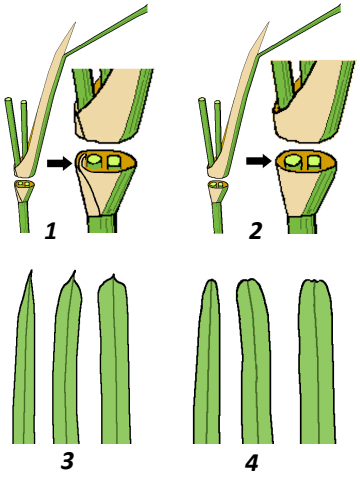
Stuckenia

1 All leaf sheaths open with overlapping edges (convolute) (***1***) 2

1 Leaf sheaths tubular at base (connate) at least when young for 2–3 mm or more (***2***) 4

2 Leaf apex acute to acuminate (***3***). Lower sheaths on main stem less than 1.5 times as wide as the stem. Ligules 1–9(–14) mm long. Fruits 3.2–4.5 mm long. Stigma with a distinct style 0.2 mm long
99 *S. pectinata* (L.) Börner

2 Leaf apex truncate to obtuse, rarely acute (***4***). Lower sheaths on main stem usually more than 1.5 times as wide as the stem. Fruits 2.6–3.4 mm long or not developed. Stigma sessile, without distinct style 3



1 ***2*** ***3*** ***4***

3 Leaves on main stem 1–6 cm long, often shorter than sheath. Ligules (or free part of sheaths) 1–1.5(–2.9) mm long on main stems, often caducous. Fruits 2.6–3.4 mm long
100 *S. vaginata* (Turcz.) Holub

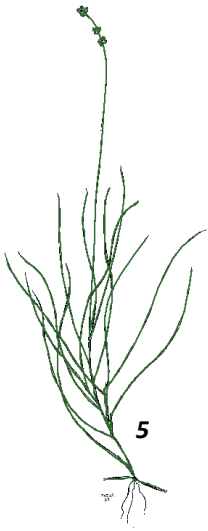
3 Leaves on main stem longer than 6 cm, longer than sheath. Ligules (or free part of sheaths) 6–17 mm long on main stems. Fruits not developed
101 *S. ×bottnica* (Hagstr.) Holub
(S. pectinata × vaginata)

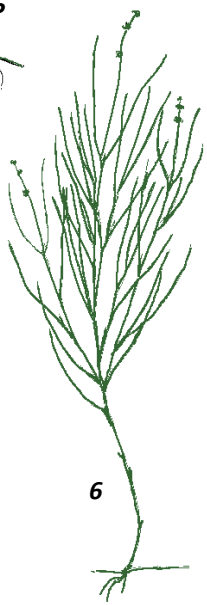
4 Stem richly branched at base, mostly unbranched above (***5***). Leaf apex rounded. No leaves with short lamina on the lower part of the stem. Fruits 2.2–2.8(–3.2) mm long
98 *S. filiformis* (Pers.) Börner

4 Stem branched above the base (***6***). Leaf apex shape variable. Some leaves on the lower part of the stem with short lamina. Fruits not developed 5

5 Fully developed leaves up to 16 cm long. Leaf apex obtuse to acuminate. Lower sheaths on main stem less than twice as wide as the stem
103 *S. ×suecica* (K.Richt.) Holub
(S. filiformis × pectinata)

5 Fully developed leaves more than 20 cm long. Leaf apex truncate, rounded or subretuse. Lower sheaths on main stem more than twice as wide as the stem
102 *S. ×fennica* (Hagstr.) Holub
(S. filiformis × vaginata)

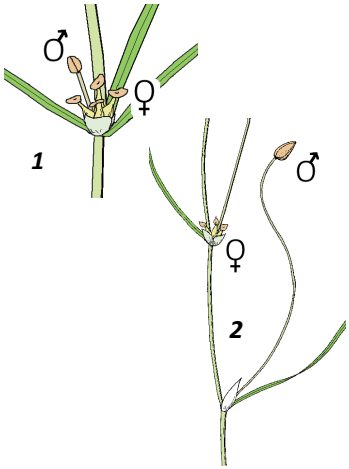




Zannichellia

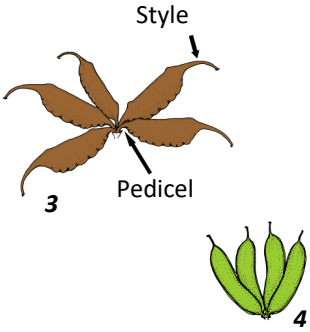
1 Male and female flowers at the same node (with rare exceptions) (***1***). Filaments short (< 12 mm), not elongating as they mature, anthers with 2 (rarely 3–4) pollen sacs. Leaves biconvex with air channels.
(= *Z. palustris* L. (agg.)) 2

1 Male and female flowers at different nodes (***2***). Filaments long (up to 70 mm), elongating as they mature, anthers with 4 pollen sacs. Leaves biconvex or flat, with or without air channels 4



2 Achenes (2.5–)3.0–4.5 mm long, (3–)4–6(–8), pedicels <0.8 mm long (***3***). Leaves (0.8–)1.0–2.0 mm wide. Plant perennial, salt-tolerant 5‰ to 20‰, in coastal brackish waters
107 *Z. palustris* L.
subsp. ***major*** (Hartm.) Oostr. & Reichg.

2 Achenes 1.5–2.5(–3.0) mm long, (1–)2–6, pedicels up to 2.6 mm long. Leaves < 1 mm wide. Plant mostly annual, in brackish or inland waters 3

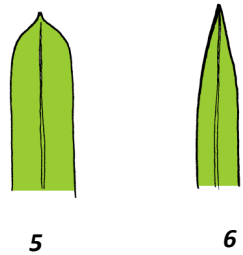


3 Pedicels < 0.5 mm long, fruits (2–)4–6, style length 25–50% of the length of the achene (***4***). Salt tolerant to 7–8 ‰,, mostly in inland waters
106 *Z. palustris* L. var. ***palustris***

3 Pedicels 1.5–2.5 mm long, fruits 1–4, style length 60–80% of the length of the achene. Salt tolerant to 20 ‰, in inland and coastal habitats
106 *Z. palustris* L.
var. ***pedicellata*** Wahlenberg & Rosén

4 Leaves obtuse (***5***), translucent, flat, without conspicuous air channels. Anthers conspicuous, 1.5–2.5 mm
104 *Z. obtusifolia*
Talavera, Garcia-Murillo et Smit

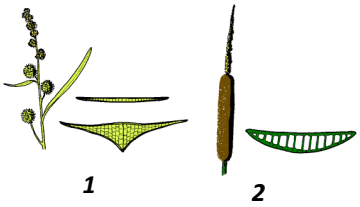
4 Leaves acute (***6***), opaque, biconvex in cross section, with several air channels. Anthers small, 1.4–1.9 mm
105 *Z. peltata* Bertol.



Sparganium and ***Typha***

1 Flowers and fruits in globose unisexual heads in spikes or panicles. Leaves flat or keeled (***1***)
Sparganium 2

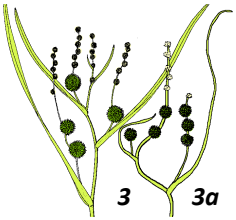
1 Flowers in dense racemes forming a cylindrical spadix. Leaves in cross section flat convex-concave (***2***)
Typha 15



Sparganium

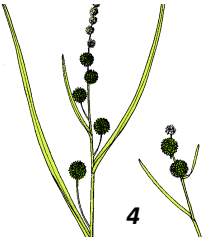
2 Inflorescence branched with several heads on main stem and branches (***3,3a***) 3

2 Inflorescence not branched (***4***) 9



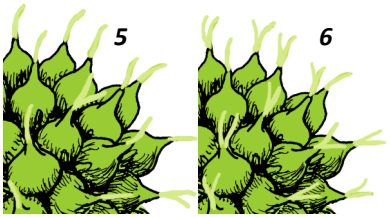
3 Leaves 7–20 mm wide, erect or ascending, sometimes floating. Main axis of inflorescence almost straight (***3***)
120-122 *S. erectum aggregate*
Determination of these species is only possible with more or less ripe fruits. 4

3 Leaves 2–3 mm wide, floating. Main axis of inflorescence S-shaped (***3a***)
117 *S. gramineum*



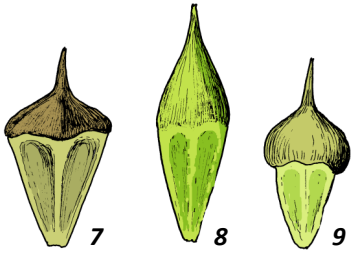
4 Fewer than half of stigmas bifid, unbranched (***5***). Fruit medium-sized to large *(S. erectum* group*)* 5

4 More than half of stigmas bifid (***6***). Fruits large (regularly up to 10 mm long) (**124 *S. eurycarpum*** group – not yet recognised within the region). 8



5 Fruit obpyramidal, upper part flat pyramid-shaped contracting into a short beak, with distinct lateral ridges, angled (***7***). Perianth segments dark at thetop, not visible in mature fruit heads
120 *S. erectum*

5 Fruit with domed or rounded upper part, lateral ridges fairly inconspicuous, indistinctly angled (***8,9***). Perianth segments not conspicuously dark at the top, visible or not in mature fruit heads 6



6 Fruit fusiform with inconspicuous shoulder and inconspicuous lateral ridges, upper and lower part alike in form and texture (***8***)
122 *S. neglectum*

6 Fruit fusiform to ellipsoidal, slightly constricted below conspicuous shoulder, with domed upper part tapering into the beak

7 Upper part of mature fruit dark brown or black, beak up to 2 mm long (***9***). Pedicels up to 1.5 mm long
121 *S. microcarpum*

7 Upper part of mature fruit light colored or brown, beak up to 4 mm long (***10***). Pedicels missing
123 *S. stoloniferum*
(not yet recognised within the region)

8 Fruit obpyramidal, upper part flattened when mature (***11***)
124 *S. eurycarpum*
(not yet recognised within the region)

8 Fruit rhomboidal to obovoid, upper part conical or pyramidal when mature (***12***)
125 *S. coreanum*
(not yet recognised within the region)

9 Stem leaves keeled (***13***)

9 Stem leaves not keeled, sometimes inflated (***14***)

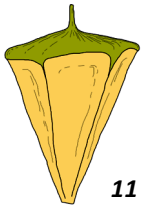
10 Male spikes 3–10. Female spikes not contiguous (***15***)
118 *S. emersum*

10 Male spikes 1(–2). Upper female spikes contiguous (***16***)
119 *S. glomeratum*

11 Fruit with beak (***18,19***)

11 Fruit without beak (***17***)
114 *S. hyperboreum*


7 ***10***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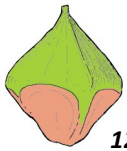
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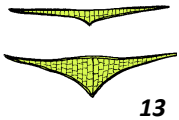
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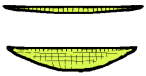
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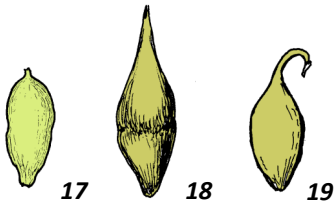
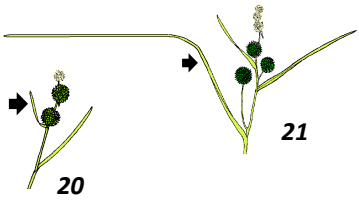

17 ***18*** ***19***

12 Lowest leaf-like bract shorter than 10 cm and at most slightly longer than the inflorescence (***20***). Usually with 1 male spike
115 *S. natans*
12 Lowest leaf-like bract more than 10 cm long and at least twice as long as the inflorescence (***21***). 2–8 male spikes (sometimes very close together) 13



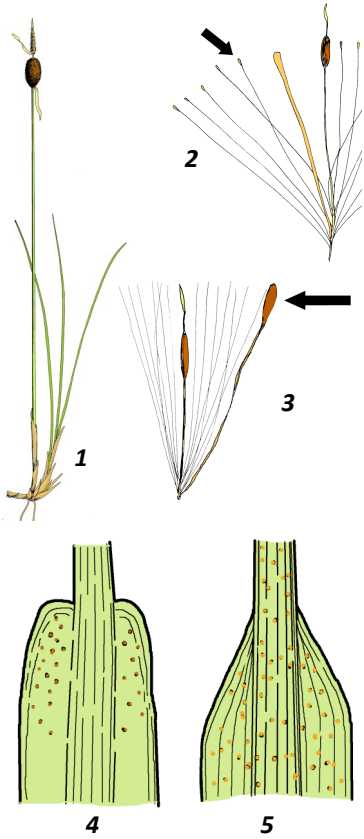
13 Ripe fruits with a straight beak (***18***). Inflorescence straight or a little curved (***21***)
116 *S. angustifolium*
13 Ripe fruits with a curved beak (***19***). Inflorescence S-shaped (***3a***)
117 *S. gramineum*

Typha

1 Flowering stem without leaves, but with several usually bladeless sheaths at base (***1***). Leaves 1–2(–3) mm wide. Hairs of female flowers with swollen tips (***2***)
126 *T. minima*
1 Flowering stem with leaves and some bladeless sheaths at base. Leaves (2–)3–20 mm wide. Hairs of female flowers without swollen tips 2

2 Female flowers with bracteoles (***3***). Male and female part of spike remote, rarely contiguous 3
2 Female flowers without bracteoles. Male and female part of spike contiguous or remote 5

3 Basal 1–2 cm of older leaf blades without orange-brown glands on the adaxial side, but with brown glands higher up (***4***). Female flowers with brown bracteoles 4
3 Basal 1–2 cm of older leaf blades with orange-brown glands on the adaxial side (***5***). Female flowers with straw-coloured to light brown bracteoles
130 *T. domingensis* (only planted)

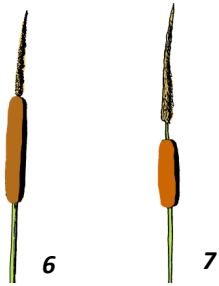


4 Leaves yellowish-green to green. Pedicels 0.5(–0.8) mm long. Pollen solitary
127 *T. angustifolia*
4 Leaves bluish green. Pedicels 0.9–1.5(–1.7) mm long. Pollen in groups of 1, 2, 3 or 4
128 *T. ×glauca*

5 Male and female part of spike more or less contiguous, < 10 mm apart (***6***)
5 Male and female part of spike remote, > 10 mm apart (***7***)

6 Female part of spike dark brown when mature, about as long as the male part
129 *T. latifolia*
6 Female part of spike silvery-grey when mature, distinctly longer than the male part (***8***)
131 *T. shuttleworthii*

7 Leaves 6–13(–19) mm wide, bluish green
128 *T. ×glauca*
7 Leaves 2–4(–7) mm wide, yellow-green to green
132 *T. laxmannii*


6 ***7***

6

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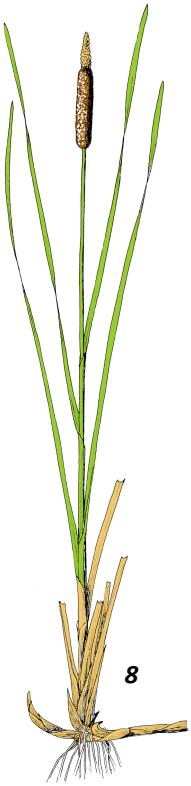
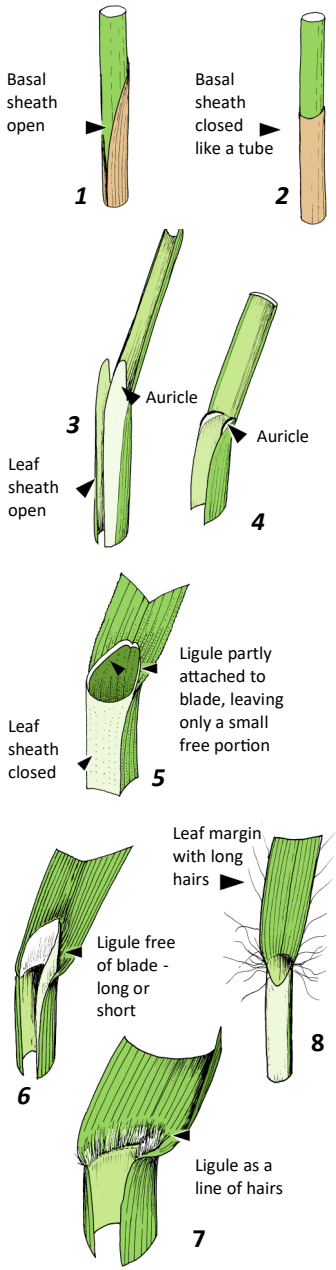

8

Grass-like plants

1	Leaves similar to stem or absent, sometimes with scales or bladeless sheaths at base	2
1	Leaves not similar to stem	4
2	Stem < 5 mm in diameter	3
2	Stem > 5 mm in diameter ***Schoenoplectus*** p. 66	
3	Basal sheaths open (***1***) ***Juncus*** p. 57	
3	Basal sheaths closed (***2***) ***Eleocharis*** p. 59	
4	Ligules or auricles present (***3-7***)	5
4	Ligules or auricles absent	8
5	Ligule present – eventually as a line of hairs (***5,6,7***)	6
5	Ligule absent, auricles present (***3,4***) ***Juncus*** p. 57	
6	Ligule partly attached to blade (***5***) ***Cyperaceae*** p. 58	
6	Ligule free of blade – eventually in form of a line of hairs (***6,7***)	7
7	Ligule rather thick, not hyaline ***Triglochin*** **or** ***Scheuchzeria*** (not treated in the book)	
7	Ligule thin, hyaline or as a line of hairs (***6,7***) ***Poaceae*** p. 65	
8	Leaf margins with long, light hairs (***8***) ***Luzula*** (not treated in the book)	
8	Leaf margins without long, light hairs	9
9	Margins of leaf blade rough ***Cyperaceae*** p. 58	
9	Margins of leaf blade smooth	10

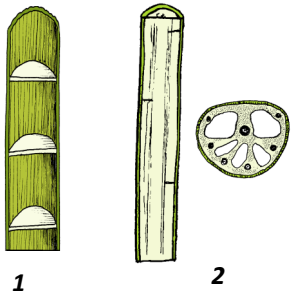


10 Basal leaves present 11
10 Only stem leaves present
Cyperaceae p. 58

11 Leaf sheaths open (***3***)
Juncus p. 57
11 Leaf sheaths closed (***5***)
Cyperaceae p. 58

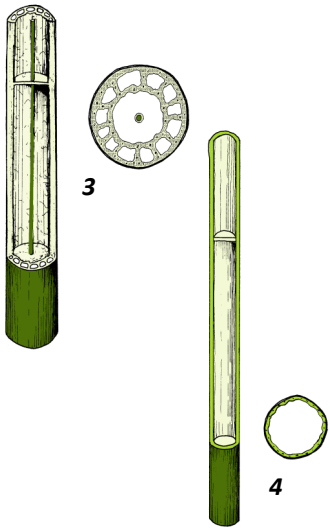
Vegetative *Juncus* growing in water

1 Leaves with distinct septae (***1***) – feels like small bumps when squeezing the leaf between two fingers and pulling them towards the tip. Stem without swollen base 2
1 Leaves with indistinct septae (***2***) – no bumps when squeezing the leaf between two fingers and pulling them towards the tip. Stem with or without swollen base
137 *Juncus bulbosus*



2 Leaves with a ring of about 15 air tubes, surrounding a large central air tube and a central vascular bundle in cross section (***3***)
134 *Juncus subnodulosus*
2 Leaves with one large airtube in cross section (***4***) 3

3 Leaves with 5–10 septae per 5 cm (***1***). Rhizome 2–3 mm thick. Internodes normally 0.1–0.5 cm long
135 *Juncus articulatus*
3 Leaves with 1(–2) septae per 5 cm (***4***). Rhizome 5–8 mm thick. Internodes normally 0.5–2 cm cm long
136 *Juncus acutiflorus*



Vegetative *Cyperaceae* growing in water

1. Leaves reduced, sheath-like, tubular, sometimes with a very short and narrow blade (***1***)
   Subkey A p. 59
1. Some or all leaves with normally developed blades and sheaths (***2***) 2

2. Annual plants forming small tufts without remnants of old, withering leaves and sheaths. Rhizome absent. Roots thin
   Subkey B p. 60
2. Perennial plants with remnants of old, withering leaves and sheaths. Rhizome short, erect or creeping 3

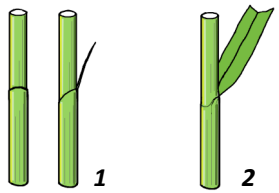
3. Leaf-sheaths without ligule (***3***), but sometimes thickened around the opening
   Subkey C p. 60
3. Leaf-sheaths with ligule (***4***) 4

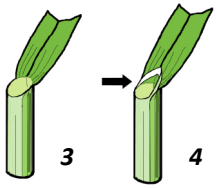
4. Leaves < 1.5 mm wide
   Subkey D p. 61
4. Leaves > 1.5 mm wide 5

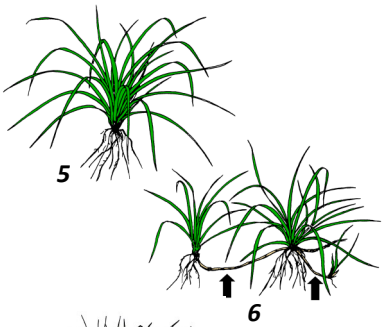
5. Stolons absent. Shoots more or less densely tufted (***5***) 6
5. Stolons present. Shoots solitary or few together from the rhizome (***6***) 7

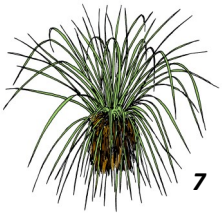
6. Plants forming dense tussocks with a peaty base (***7***)
   Subkey E p. 62
6. Plants forming more or less dense tufts.
   Subkey F p. 62

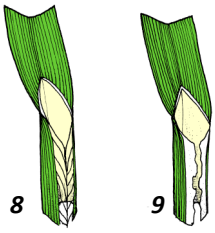
7. Leaf sheaths splitting in to fibres (***8***)
   Subkey G p. 63
7. Leaf sheaths not splitting in to fibres (***9***)
   Subkey H p. 64











Cyperaceae subkey A

1 Annual plants forming small tufts, without rhizome or remnants of old stems
152 *Eleocharis ovata*, **153 *E. obtusa*** and **154 *E. engelmannii***
1 Perennial plants with long or short underground rhizome 2

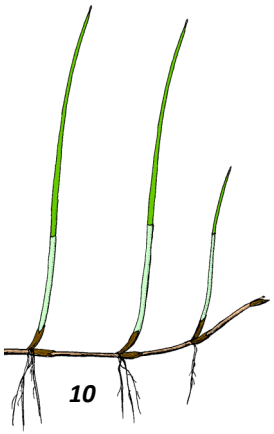
2 Stems sharply trigonous 3
2 Stems terete or bluntly trigonous above 4

3 Plant caespitose
151 *Schoenoplectiella mucronata*
3 Plant with scattered shoots from a creeping rhizome
149 *Schoenoplectus triqueter*

4 Stems > 5 mm in diameter 5
4 Stems < 5 mm in diameter 6

5 Stems dull, grey-green, up to 1.5 m long
146 *Schoenoplectus tabernaemontani*
5 Stems dull to somewhat shiny, green to dark green, up to 3.5 m long
145 *Schoenoplectus lacustris*

6 Underground stolons absent 7
6 Underground stolons present (***10***) 8

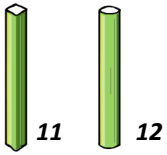

10

7 Stems 1–1.5 mm in diameter, numerous together in dense tufts. Roots whitish to yellowish, 0.5–1 mm in diameter
158 *Eleocharis multicaulis*
7 Stems 0.4–1 mm in diameter, at most 10 together in small tufts. Roots brownish, 0.1–0.5 mm in diameter
162 *Eleocharis quinqueflora*

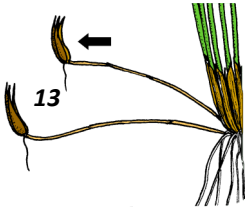
8 Stems > 0,5 mm in diameter 9
8 Stems < 0,5 mm in diameter 11

9 Stems weak, easily broken
156 *Eleocharis mamillata*
9 Stems firm, not easily broken 10

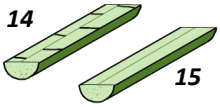
10 Stolons > 1 mm in diameter.
2 species which can not be separated reliably by vegetative characters
155 *Eleocharis palustris*
157 *Eleocharis uniglumis*
10 Stolons < 1 mm in diameter
162 *Eleocharis quinqueflora*



11 Stems 4-angular (***11***). Stolons without terminal tubers
160 *Eleocharis acicularis*
11 Stems terete (***12***)**.** Stolons with terminal tubers (***13***)



12 Stems septate (***14***). Tubers 2–4 mm long
161 *Eleocharis parvula*
12 Stems without septa (***15***). Tubers c. 1 cm long.
162 *Eleocharis quinqueflora*



Cyperaceae subkey B

1 Ligule absent or at most 1 mm long. Leaves arising from the basal part of the stem
1 Ligule 2–4 mm long. Leaves arising from the upper 2/3 of the stem
170 *Carex bohemica*

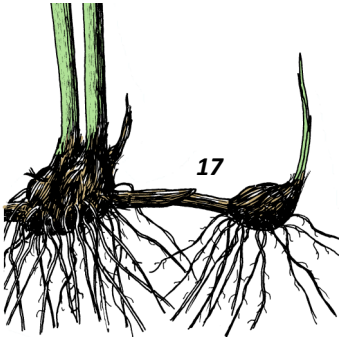
2 Leaves 0.2–0.7 mm wide, almost to terete
Isolepis setacea (L.) R.Br.
(not treated in the book)
2 Leaves 1–4–5) mm wide, flat to channeled
164 *Cyperus fuscus*

Cyperaceae subkey C

1 Leaf-margins with sharp teeth visible with the naked eye (***16***). Leaves grey-green, very long
167 *Cladium mariscus*
1 Leaf-margins without teeth visible with the naked eye but sometimes somewhat rough. Leaves yellowish-green to green or dark green.

2 Base of aerial shoots swollen (***17***)
5 species which can not be separated reliably using vegetative characters.
Bolboschoenus sp.
If fruits are present use the key p. 63

2 Base of aerial shoots not swollen 3


17

3 Leaves > 4 mm wide. Large plants 4

3 Leaves < 3 mm wide. Plants creeping on mud or floating in water (***18***)
163 *Isolepis fluitans*

4 Underground stolons present 5

4 Underground stolons absent. Leaves dark green. Vegetative growth from arching and rooting stem- or inflorescence-nodes
139 *Scirpus radicans*


18

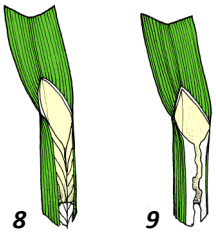
5 Leaves light green to green, at least some more than 10 mm wide
138 *Scirpus sylvaticus*

5 Leaves green to grey-green, not more than 10 mm wide
165 *Cyperus longus*

Cyperaceae subkey D

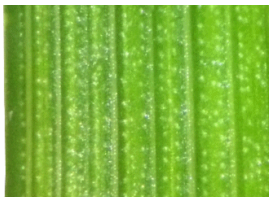
1 Leaf-sheaths splitting into fibres (***8***)
Scales red-brown to purplish brown
171 *Carex lasiocarpa*

1 Leaf-sheaths not splitting into fibres (***9***). Scales without red-brown to purplish brown tones 2


8 ***9***

2 Rhizome short, with short, ascending stolons usually 1–2 cm long. Plants loosely tufted. Leaves 1–2 mm wide, with stomata on the lower side
Carex diandra Schrank
(not treated in the book)

2 Rhizome creeping. Stolons rather long. Plants with scattered shoots or tufted with long stolons. Leaves 1.5–3 mm wide, with stomata on the upper side (***19***)
Carex nigra (L.) Reichard.
(not treated in this book)


19

Stomata are only visible using a 10-20x hand lens. They will then appear as small pale or greyish dots between the leaf-ribs.

Cyperaceae subkey E

1 Lower leaf-sheaths splitting into fibres (***8***). At base with straw-coloured, ± shiny, keeled scales (***20***)
179 *Carex elata*

1 Lower leaf-sheaths not splitting into fibres (***9***) 2

2 Leaves with stomata on the upper side (***19***)
Carex nigra (L.) Reichard.
var. ***recta*** (Fleisch.) Hyl.
(not treated in the book)

2 Leaves with stomata on the lower side (***19***) 3

3 Basal leaf-sheaths and scales with light brown ribs. Leaves flaccid
169 *Carex remota*

3 Basal leaf-sheaths and scales with dark brown to blackish brown ribs. Leaves rather rigid 4

4 Leaves 3–6 mm wide, with 9–12 ribs on both side of the midrib. Basal scales not splitting into horsehair-like fibres (***21***)
168 *Carex paniculata*

4 Leaves 1.5–3 mm wide, with c. 6 ribs on both side of the midrib. Basal scales splitting into horsehair-like fibres (***22***)
Carex appropinquata Schumach.
(not treated in the book)

20

21

22

Cyperaceae subkey F

1 Leaves with stomata on the upper side (***19***)
Carex canescens L.
(not treated in the book)

1 Leaves without stomata on the upper side 2

2 Leaves ≤ 4 mm wide. 3

2 Leaves > 4 mm wide. 6

3 Leaves with distinct hollows in cross section (use a hand lens) (***23***). 4

3 Leaves without hollows in cross section
169 *Carex remota*

23

4 Basal scales splitting into horsehair-like fibres (***22***)
Carex appropinquata Schumach.
(not treated in the book)

4 Basal scales not splitting into horsehair-like fibres (***21***) 5

5 Leaves < 3 mm wide, keeled
Carex diandra Schrank
(not treated in the book)

5 Leaves ≥ 3 mm wide, channeled
168 *Carex paniculata*

6 Lower side of leaves glaucous
179 *Carex elata*

6 Lower side of leaves not glaucous. 7

24

25

7 Leaves channelled to flat (***23,25***)
168 *Carex paniculata*

7 Leaves keeled to plicate (***24***)
174 *Carex pseudocyperus*

Cyperaceae subkey G

1 Leaves with stomata on the upper side 2

1 Leaves without stomata on the upper side 3

2 Leaves with a trigonous point 2–6 cm long. Sterile shoots often forming false stems (a stem-like structure formed by leaf sheaths)
175 *Carex rostrata*

2 Leaves with a flat point. Sterile shoots not forming false stems.
178 *Carex aquatilis*

3 Leaves more or less of the same colour on both sides 4

3 Leaves dark green on the upper side and glaucous on the lower side 6

4 Leaves plicate (***24***) 5

4 Leaves channeled to inrolled (***23,25***), 1–2 mm wide
171 *Carex lasiocarpa*

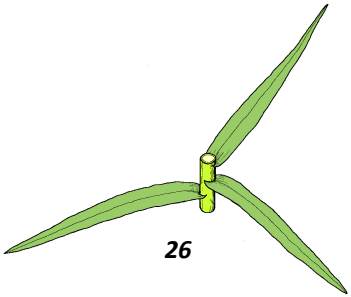
5 Leaves light green to green. Stolons short
176 *Carex vesicaria*
5 Leaves bluish green. Stolons long
173 *Carex riparia*

6 Leaves 3–10–(–12) mm wide. With 10–16 ribs on each side of the midrib
172 *Carex acutiformis*
6 Leaves 8–15(–20) mm wide. With 18–22 ribs on each side of the midrib
173 *Carex riparia*

Cyperaceae subkey H

1 Leaves usually less than 30 cm long 2
1 Leaves usually more than 30 cm long 6

2 Shoots with laminate leaves in the upper one-half of stem only. Shoots bamboo-like. Seen from above the leaves appear in three vertical rows along the stem (***26***)
166 *Dulichium arundinaceum*
2 Shoots with laminar leaves in the lower one-half of stem. Shoots not bamboo-like 3


26

3 Stems less than 2 mm wide, firm 4
3 Stems more than 2 mm wide, spongy 5

4 Leaves flat to channeled, with stomata on the upper side.
Carex nigra (L.) Reichard.
(not treated in the book)
4 Leaves trigonous almost throughout their length, with stomata on the lower side
Eriophorum gracile W.D.J.Koch ex Roth.
(not treated in the book)

5 Uppermost leaf-sheath without or with a short lamina. Stem 3–8 mm in diameter
149 *Schoenoplectus triqueter*
5 Uppermost leaf-sheath with a long lamina, up to 30 cm long. Stem 2–5 mm in diameter
150 *Schoenoplectus pungens*

6 Leaves trigonous in the distal one-third, channeled in the basal part
Eriophorum angustifolium Honck.
(not treated in the book)

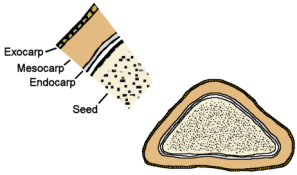
6 Leaves at most trigonous at apex 7

7 Leaves 8–15(–20) mm wide
173 *Carex riparia*

7 Leaves 2.5–10(–12) mm wide
177 *Carex acuta*

Bolboschoenus

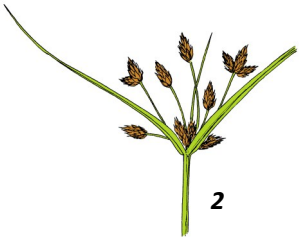
For proper identification of *Bolboschoenus* species cross sections of fully developed fruits are needed to observe the thickness and structure of the 3 layers of the pericarp.



1 Inflorescence more or less capitate, formed by a group of sessile spikelets and sometimes 1 or 2 rays each bearing 1–2(–4) spikelets. Rays less than twice as long as spikelets. Nuts light brown to reddish-brown, plano-convex to lenticular or faintly triangular in cross section. Exocarp as thick as or thicker than mesocarp 2

1 Inflorescence branched with a central group of sessile spikelets and 2–7 rays each bearing 1–4 spikelets. Rays more than twice as long as spikelets. Nuts dark brown to almost black, trigonous in cross section. Exocarp much thinner than mesocarp 3


1

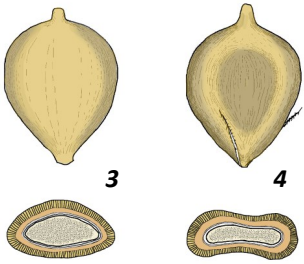

2

2 Nuts convex on the abaxial side, lenticular to faintly trigonous in cross section (***3***). Exocarp about twice as thick as mesocarp. Most styles trifid
140 *B. maritimus*

2 Nots concave on the abaxial side, plano-convex in cross section (***4***). Exocarp about as thick as mesocarp. Most styles bifid
141 *B. planiculmis*

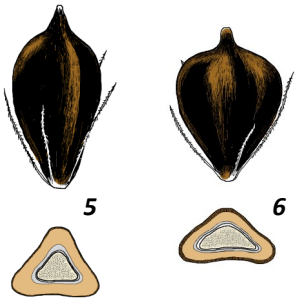
3 Nut 3.1–4.0 mm long 4

3 Nut 2.0–2.5 mm long
144 *B. glaucus*


3 ***4***

4 Nut 1.6–1.8 mm wide, equilateral triangular in cross section (***5***). Exocarp very thin less than 1/10 as thick as the mesocarp
143 *B. yagara*

4 Nut 2.0–2.4 mm wide, obtusely triangular in cross section, the abaxial side longer than the other sides (***6***). Exocarp about 1/3 as thick as the mesocarp
142 *B. laticarpus*



Schoenoplectus

1 Stem bluntly trigonous to sharply triquetrous at least in the upper part 2
1 Stem terete, including in the upper part 4

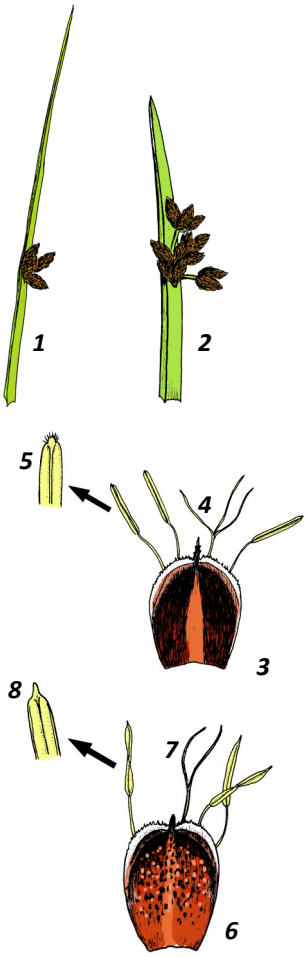
2 Plant with scattered shoots from a creeping rhizome. Styles bifid 3
2 Plant caespitose. Styles trifid
151 *S. mucronata*

3 Inflorescence with sessile spikelets only (***1***). Stem with 2 or 3 laminate leaves. Glumes with acute lateral lobes
150 *S. pungens*

3 Inflorescence with sessile spikelets and some pedunculated clusters of spikelets (***2***). Stem with lamina on uppermost sheath only. Glumes with obtuse lateral lobes
149 *S. triqueter*

4 Glumes smooth – without papillae (***3***). Styles trifid (***4***). Anthers with broad and rounded apex with a fringe of hair (***5***)
145 *S. lacustris*

4 Glumes with reddish papillae (***6***). Styles bifid (***7***). Anthers with narrow, tapering apex (***8***)
146 *S. tabernaemontani*



Aquatic *Poaceae* in vegetative state

1 All leaves with blades only 1–2 cm long. Upper leaf-sheaths strongly inflated (***1***)
186 *Coleanthus subtilis*

1 At least some leaves more than 2 cm long. Upper leaf-sheaths not or at most moderately inflated — 2

2 Ligule present as a fringe of hairs (***2***) — 18

2 Ligule membranous, thin — 3

3 Leaves folded when young (***3***) — 4

3 Leaves rolled when young (***4***) — 13

4 Leaves 1–2 mm wide, bristle-like. Lower leaf-sheaths open with overlapping margins
180 *Agrostis canina*

4 Leaves at least 3 mm wide Lower leaf-sheaths closed at least halfway up – if accidently split then margins not overlapping — 5

5 Leaves with cross-veins (***5***) — 6

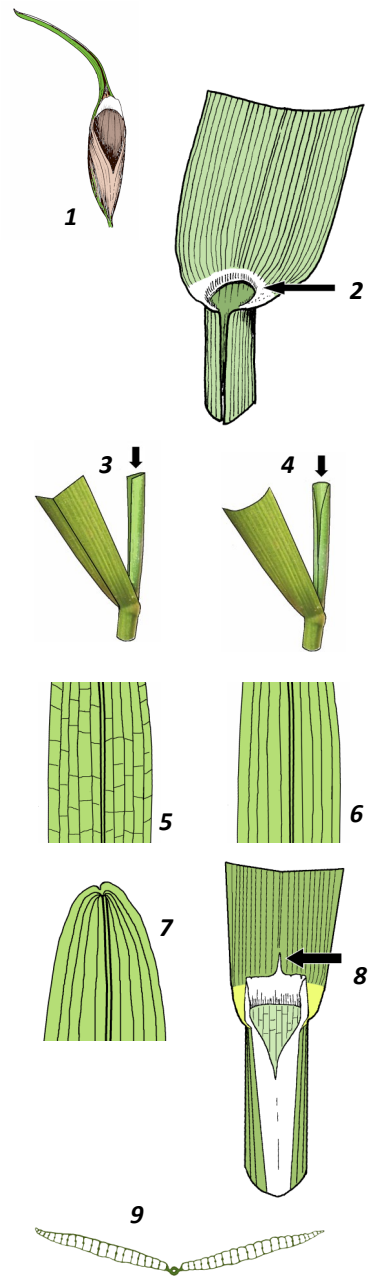
5 Leaves without cross-veins (***6***) — 10

6 Leaf tip blunt, often asymmetric, slightly hooded (***7***). Leaves with small, irregular air-cavities in cross section
185 *Catabrosa aquatica*

6 Leaf tip acute or rarely blunt, symmetric, hooded. Leaves with almost uniform, rectangular air-cavities in cross section (***9***) — 7

7 Ligule blunt with a fine, median tooth (***8***). Leaves7–20 mm wide, upper side not ribbed. Shoots stout to robust
187 *Glyceria maxima*

7 Ligule blunt or acute, but without a median tooth. Leaves 2–14 mm wide, upper side ribbed. Shoots rather slender — 8



8 Leaves glaucous to grey green or purplish tinged, 3–5(–9) mm wide. Cross-veins indistinct
189 *Glyceria declinata*

8 Leaves yellowish-green to dark green, 4–10(–15) mm wide. Cross-veins distinct 9

9 Youngest ligules much longer than the width of the associated leaf (investigate only very young, not yet unfolded leaves) (***10***). Leaves shallowly ribbed. Leaf-sheaths usually reddish
188 *Glyceria fluitans*

9 Youngest ligules only slightly longer than the width of the associated leaf (***11***). Leaves deeply ribbed. Leaf sheaths not reddish
190 *Glyceria notata*

10

11

10 Leaves with more or less uniform, rectangular air-cavities in cross section (***9***). Leaves 3–5(–9) mm wide
189 *Glyceria declinata*

10 Leaves without or with small, irregular air-cavities in cross section
Leaves 2–4 mm wide 11

11 Plant with underground stolons. Ligules less than 1 mm long. Leaves abruptly pointed, hooded
***Poa pratensis* L.** (not treated in the book)

11 Plant without underground stolons.
Ligules 2–10 mm long. 12

12 Leaf-sheaths rough.
Leaves abruptly pointed, hooded
195 *Poa trivialis*

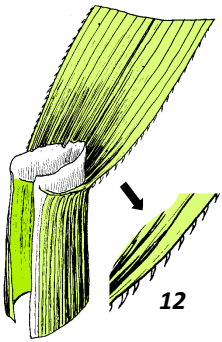
12 Leaf-sheaths smooth.
Leaves gradually tapering
194 *Poa palustris*

13 Plants large. Stems 60–250 m long.
Stolons 4–8 mm in diameter 14

13 Plants small or medium sized, slender.
Stems 15–120 m long. Stolons 1–2 mm in diameter. 15

14 Leaves stiff, greyish green
192 *Phalaris arundinacea*
14 Leaves rather flaccid, fresh green
196 *Scolochloa arundinacea*

15 Leaf-sheaths, leaf-margins and midribs rough with retrorse teeth on lower side of leaves (***12***)
191 *Leersia oryzoides*
15 Leaf-sheaths, leaf margins and midribs not particularly rough on lower side of leaves 16



16 Plants with long underground stolons clothed with more than 3 scales.
Leaves (2–)4–10 mm wide
181 *Agrostis gigantea*
16 Plants without or with very short underground stolons clothed with 1–3 scales.
Above-ground, creeping stolons present or not. Leaves 2–5(–6) mm wide 17

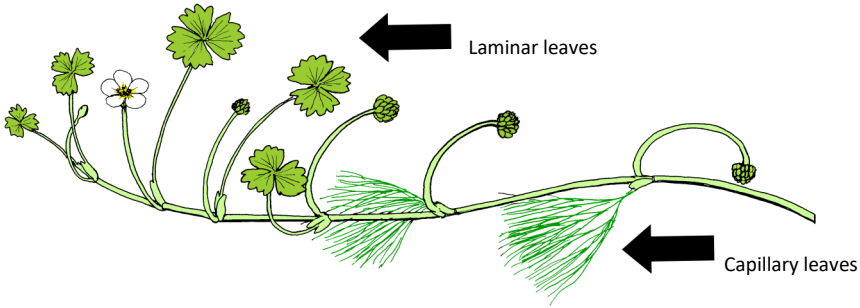
17 Uppermost leaf-sheath somewhat inflated.
Blades not keeled beneath.
2 species which can not be separated reliably using vegetative characters
184 *Alopecurus geniculatus*
183 *Alopecurus aequalis*
17 Uppermost leaf-sheath not inflated.
Blades slightly keeled beneath
182 *Agrostis stolonifera*

18 Leaf-margins papillate, somewhat rough especially towards the apex.
Plants of fresh-water habitats 19
18 Leaf-margins smooth, cartilaginous.
Plants of salt marshes
Spartina species
(not treated in the book)

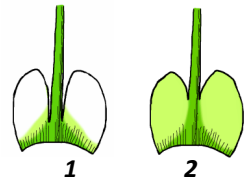
19 Leaves 20–60 long, more or less glaucous below
193 *Phragmites australis*
19 Leaves 60–100 cm long, shiny green below
Spartina pectinata Bosc ex Link
(not treated in the book)

Ranunculaceae.

Most of the characters used can only be observed in generative (fertile) shoots. The middle and upper parts of several flowering shoots from a population should be studied. Vegetative shoots of perennial species are not representative and usually have longer capillary leaves, while important floral characters will be missing. Measurements of capillary leaves apply to the middle part of a generative shoot. Measurements of floral parts (petal length, fruit length) given here refer to dried herbarium material. Fragmentary specimens, terrestrial forms and hybrids cannot be identified with this key.



1 Petals white with yellow claw at base
Ranunculus section ***Batrachium*** 2
1 Petals yellow 23



2 Stipules less than 1/2 adnate to the petiole (***1***), free part conspicuous, often whitish, membranous. Capillary leaves present or absent, if present filiform. Laminar leaves present, alternate or opposite. Sepals reflexed. Petals small to medium-sized. Nectar pits lunate (***3***), 1 per petal 3
2 Stipules more than 1/2 adnate to the petiole (***2***), free part mostly small, greenish. Capillary leaves present, mostly persistent, rigid or flaccid. Laminar leaves present or absent, alternate. Sepals spreading or reflexed. Petals medium-sized to large. Nectar pits lunate, horseshoe-like, circular, triangular, or pyriform (***3-7***), 1(–4) per petal 5