Plant Crib

CAREX

For the identification of *Carex*, the BSBI Handbook *Sedges of the British Isles* 2nd ed. (Jermy, Chater & David 1982) is essential. A third edition which will describe and illustrate the hybrids is in preparation. The notes below merely emphasize or supplement the information given in the Handbook. References to a series of papers by R. W. David detailing the distribution of most of the rarer species can be found in the Handbook, and recent maps of many species are given in the *Scarce Plants* and *Aquatic Plants*.

Most species show great variation in vegetative characters, and fruiting material is often essential for identification. Sterility of utricles, or total non-flowering, is often caused by environmental factors rather than by hybrid origin; non-emergence of the anthers is a more reliable indicator of the latter but some hybrids (e.g. *C. divulsa* × *C. muricata*; O'Mahony 1989) regularly have emergent anthers. Abnormalities in the inflorescence are not uncommon and can cause difficulties when using the keys.

The groups dealt with are as follows:

1 *C. paniculata* etc. (p. 342)
2 *C. vulpina* etc. (p. 343)
3 *C. muricata* etc. (p. 343)
4 *C. disticha* etc. (p. 344)
5 *C. acutiformis* etc. (p. 344)
6 *C. rostrata* etc. (p. 346)
7 *C. strigosa* etc. (p. 346)
8 *C. flacca* etc. (p. 347)
9 *C. binervis* etc. (p. 347)
10 *C. flava* etc. (p. 348)
11 *C. digitata* etc. (p. 348)
12 *C. caryophyllea* etc. (p. 349)
13 *C. limosa* etc. (p. 350)
14 *C. nigra* etc. (p. 350)
15 *C. bigelowii* etc. (p. 351).

Stomata

The distribution of stomata on the leaf surfaces can be a very useful identification character. The stomata are arranged in rows, and can usually be seen as minute white dots with the aid of a ×20 or even a ×10 lens. It is especially useful as a field character on fresh specimens, and the stomata become slightly less easy to see in dried material. In the field it is often a much easier character to use than some of the more traditional ones such as the number of stigmas. If a microscope is available, it is a good idea to confirm what you are looking at with a selection of species, either by stripping off bits of epidermis or, more easily, by making an impression of the surface with nail varnish. Generally speaking, the leaf surface with the most stomata becomes concave on drying, so that for example in *C. nigra*, in which the stomata are mostly confined to the upper surface, the leaf margins roll inwards on drying, while in *C. acuta*, which has the stomata confined to the lower surface, the leaf margins roll outwards on drying. In hybrids, the distribution of stomata appears to combine that of the two parents, so that, for example, *C.* × *turfosa* (*C. elata* × *C. nigra*) have stomata abundant on both surfaces. In some species such as *C. flacca* and *C. panicea* (in which the stomata incidentally are not diagnostically helpful) it is papillae rather than stomata that show as white dots, but the papillae seem largely confined to the vicinity of the stomata so the character can still be assessed with a lens.

The character is especially valuable for distinguishing *C. rostrata* from *C. vesicaria*, and from their hybrid; vegetative *C. lasiocarpa* from *C. rostrata*; *C. bigelowii* from *C. nigra*; and *C. acuta* from

C. aquatilis and *C. nigra*.

1. *Carex paniculata* / *C. appropinquata* / *C. diandra*

Three closely related species, commonly tussock-forming, are given in descending order of size. Difficulties of identification really only arise with depauperate specimens; starved *C. paniculata* may resemble *C. appropinquata* and non-tussocky forms of *C. appropinquata* approach similar forms of *C. diandra*. The most certain distinction is in the utricle.

	C. paniculata L.	*C. appropinquata* Schumach.	*C. diandra* Schrank
Utricles	Greenish- to blackish-brown with a broad serrulate wing in the upper half	Greyish-brown, abruptly narrowed into an unwinged beak	Blackish-brown and shiny, more evenly tapered with an unwinged beak and markedly split at the back, the halves overlapping
Basal sheaths	Dark brown, shiny, not splitting into fibres	Black, matt, splitting into hair-like fibres (not always apparent unless dry)	Black- or grey-brown, not fibrous
Leaves	(2-)4-7 mm wide, dark, usually dull green	1-2 mm wide, yellow-green	1-2 mm wide, greyish or bronzy green
Inflore-scence	Compound; spikes pedunculate	Compound; spikes pedunculate	Simple; spikes sessile
Glumes	Greyish- or orange-brown	Reddish (especially on drying)	Brown or purple-brown, hyaline

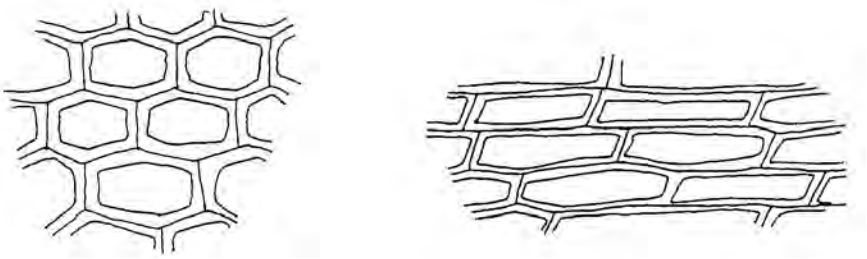
There is a hybrid, *C.* × *solstitialis* Figert, intermediate between *C. paniculata* and *C. appropinquata* and wholly sterile. Depauperate specimens of *C. paniculata* may be taken for the hybrid with *C. remota* (*C.* × *boenninghausiana* Weihe) but this has a long-extended inflorescence with the small spikes widely separated and conspicuous bracts. For *C. diandra* when not forming tussocks, see 4 below (page 342).

2. *Carex vulpina* / *C. otrubae*

C. vulpina is a rare but probably overlooked species, which should always be confirmed by microscopic examination of the epidermis of the utricle.

C. vulpina L.: Stems strongly winged; ligule truncate, shorter than width of leaf, its free border overlapping edge of leaf; inner face of leaf sheath transversely wrinkled; lowest bract always short, with blackish-brown auricles; all glumes usually dark or rusty brown; utricles minutely papillose (×20 lens), the epidermis with ± isodiametric cells.

C. otrubae Podp.: Stems scarcely winged; ligule pointed, at least as long as width of leaf, not overlapping edge of leaf; inner face of leaf sheath smooth; lowest bract often long and setaceous, usually pale at base; all glumes pale reddish- or orange-brown; utricles smooth, the epidermis with elongated cells.



C. vulpina ***C. otrubae***

Surface view of centre of adaxial face of utricle.

3. *Carex muricata* aggregate

The descriptions in the key below are of the extreme forms of the two subspecies of *C. divulsa* which are very distinct, but many intermediates occur, at least in southern Britain (please record intermediate plants as 'intermediates'). The hybrid *C. divulsa* × *C. muricata* has been found in Ireland (O'Mahony 1989).

1 Utricles with nut set well above the corky swollen base, and with narrow elongated serrate beak, the whole 4.5 mm or more long; glumes acuminate, ± tawny, giving, with the long-beaked utricles, a shaggy look to the inflorescence; leaves and stems slightly fleshy, ligule soft, narrow, 4-8(-10) mm long; roots, and sometimes (but not invariably) basal sheaths, ligules, and glumes tinged vinous-purple ***C. spicata*** Huds. (*C. contigua* Hoppe, *C. muricata* auct. non L.)

1 Utricles with nut arising from base of utricle, with less pronounced beak, often less than 4.5 mm long; glumes acute or acuminate; ligule less than 4 mm long; roots, basal sheaths, ligules and glumes not purplish tinged 2

2 Inflorescence not more than 3 cm long, spikes ± contiguous; ligule nearly ovate, slightly longer than broad; base of utricle flat or rounded with the nut set close upon it 3

2 Inflorescence distinctly interrupted, with intervals of 1-3 cm between the lowest two spikes; ligule as long as or shorter than broad; utricle narrowed at base as well as at beak (i.e. diamond shaped) 4

3 Flowering stems erect, rigid; glumes markedly shorter than utricles, dark, contrasting in colour with the utricles until these ripen and darken; utricles rounded, with a broad margin or flange, narrowing abruptly into a short beak; strongly calcicolous, flowering May
C. muricata L. subsp. ***muricata*** (*C. pairaei* F. W. Schultz subsp. *borealis* Hyl.)

3 Flowering stems flexuous; glumes ± as long as utricles, yellow or pale brown, concolorous with unripe utricles but becoming white and then contrasting with the brown ripe utricles; utricles ovoid, narrowly margined, narrowing evenly into the beak; calcifugous, flowering June
C. muricata L subsp. ***lamprocarpa*** Celak. (*C. pairaei* F. W. Schultz, *C. bullockiana* Nelmes)

4 Plant flaccid, dark- or grey-green; leaves often as long as the drooping flowering-stem; inflorescence very interrupted, up to 10 cm long or even more with intervals of 2 cm or more between the lowest spikes; utricles 3.5-4(-4.5) mm, appressed to the stem-axis, becoming greyish-black when fully mature ***C. divulsa*** Stokes subsp. ***divulsa***

4 Plants robust, erect, bright yellow-green; leaves shorter than flowering stem; inflorescence not more than 6 cm long, with the intervals of less than 2 cm between lowest spikes; utricles (4-)4.5-4.8 mm long, markedly divaricate, becoming red-brown when mature
C. divulsa Stokes subsp. ***leersii*** (Kneuck.) W. Koch (*C. leersii* F. W. Schultz *non* Willd., *C. polyphylla* Kar. & Kir.)

4. *Carex disticha* / *C. arenaria* / *C. divisa* / *C. diandra*

	C. disticha Huds.	*C. arenaria* L.	*C. divisa* Huds.	*C. diandra* Schrank
Leaf sheath	Inner face herbaceous with narrow hyaline margin at apex	Inner face wholly hyaline turning brown	Inner face wholly hyaline	Inner face wholly hyaline
Inflorescence	Untidy, narrowed in middle	Untidy, generally pyramidal	Compact, ellipsoid or pyramidal (spikes crowded at apex, often with long overlapping bract (note 1))	Compact, cylindrical
Terminal spike	Entirely female	Entirely male	Male at top and female below	Male at top and female below
Ripe utricles	Narrowly winged, red-brown	Broadly winged, greenish-brown	Unwinged, pale brown	Unwinged, blackish-brown, shiny

Note

1. The bract over-topping inflorescence, given in many keys as the distinguishing character of *C. divisa*, is NOT invariably present.

5. *Carex acutiformis* / *C. riparia* / *C. acuta*

These three sedges cannot be reliably separated vegetatively by the width of the leaf. Whilst *C. acuta* leaves are always relatively narrow, both *C. acutiformis* and *C. riparia* can reach 26 mm wide. The ligule shape, although distinctive in some cases, is often of intermediate character.

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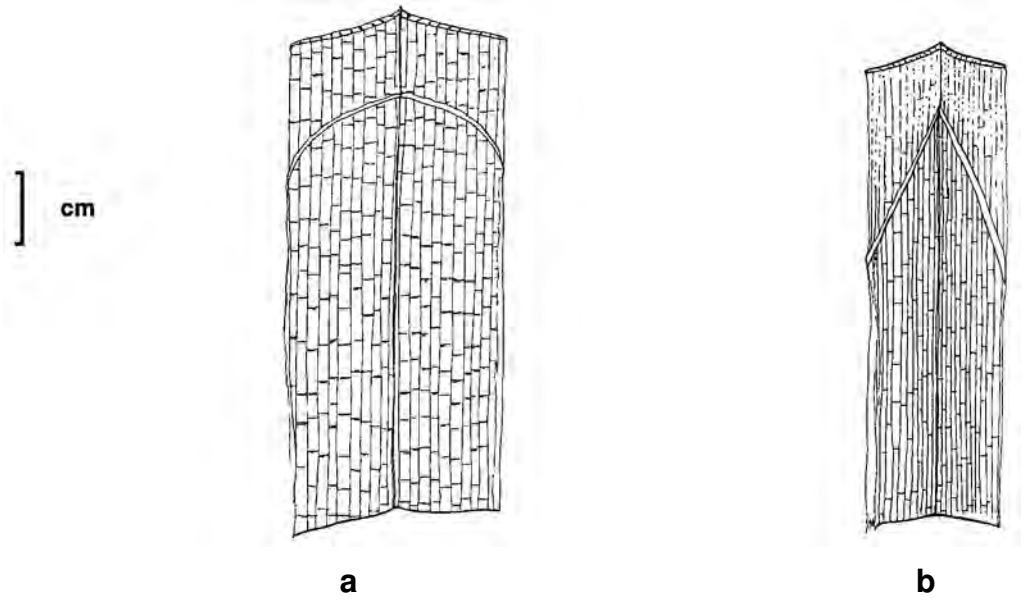
The structure of the leaf provides useful diagnostic characters. The leaves have air-filled tubes (aerenchyma) with cross-walls or diaphragms at intervals dividing them into sections. The pattern of the diaphragms is characteristic and may readily be seen through the hyaline inner surface of the sheath just below the ligule, as illustrated. The dimensions are tabulated below.

	Carex riparia Curtis	*C. acutiformis* Ehrh.	*C. acuta* L.
Leaf width	5-20(-26) mm	5-20(-26) mm	4-6 mm
Ligule length	5-10 mm	5-20 mm	4-8 mm
Ligule shape	Rounded	Acute	Obtuse
Aerenchyma width	0.4-0.7 mm	0.3-0.5 mm	*c.* 0.4 mm
Inter-diaphragm distance	1.5-2.0(-3.0) mm	3.0-8.2 mm	More than 5.0 mm

With familiarity it is not necessary to take measurements and there is an additional character which is indicative in fresh material. On the fully formed leaves of *C. riparia*, the aerenchyma pattern is equally easily seen above and below the ligule, and it is also visible on the outside of the leaf. In *C. acutiformis* and *C. acuta* the pattern becomes obscured just above the ligule and is not apparent on the outside of the sheath. However, *C. acutiformis* and *C. riparia* often cannot be reliably separated vegetatively and, certain identification depends on having inflorescences.



Leaf sheaths and ligules (a) *C. riparia,* (b) *C. acutiformis.*

	C. acutiformis	*C. riparia*
Male glumes	Obtuse to subacute, purplish-brown when fresh	Acuminate, dull brown when fresh
Utricles	3.5-5 mm, somewhat flattened, strongly ribbed, greyish-green	5-8 mm, somewhat inflated, obscurely ribbed, brown or yellowish-brown
Beak of utricle	Usually emarginate or weakly bifid	Strongly bifid

Authors A. O. Chater & R. M. Walls, December 1997.

6. *Carex rostrata* / *C. vesicaria* / *C. lasiocarpa*

C. rostrata and *C. vesicaria* are very variable and can often be extremely difficult to separate in the absence of good ripe fruit; vegetatively the distribution of stomata is the best character.

	C. rostrata Stokes	*C. vesicaria* L.
Leaves	2-7 mm wide, flat and folded to caniculate or inrolled, usually glaucous above; stomata confined to or much more abundant on upper surface	4-8 mm wide, flat or folded, mid- or yellowish-green above; stomata confined to lower surface
Ligule	Shorter than width of leaf	As long as or longer than width of leaf
Utricles	3.5-6.5 mm, usually more or less patent, abruptly contracted from ovoid body into very slender, parallel-sided beak	4-8 mm, ascending, gradually narrowed from ovoid-ellipsoid body into tapering beak

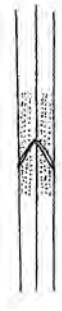
C. lasiocarpa Ehrh., which often grows with *C. rostrata* and when not flowering can be confused with it, has grey-green, not glaucous leaves with the stomata confined to the lower surface.

7. *Carex strigosa* / *C. sylvatica* / *C. pendula*, vegetative

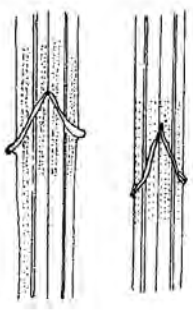
In flower the upright, unstalked inflorescences of *C. strigosa* are quite diagnostic, but it is the ligule in winter that is distinctive and makes the separation from *C. sylvatica* and young *C. pendula* relatively simply. The ligules of *C. strigosa* are short, with a slight point, free at the edges, and usually, and crucially, strikingly asymmetrical. Those of *C. sylvatica* are short, rounded and appressed, whereas

C. pendula are always pointed and elongated to some degree. When they start to grow in spring and flower these differences are somewhat blurred.

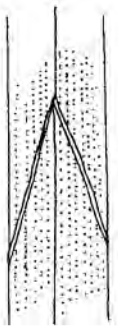
C. strigosa, although sometimes abundant, is often found in discreet colonies, even down to one or two plants. Its leaves, intermediate in size between those of *C. pendula* and *C. sylvatica*, have a more yellowish-green tinge, and become brown and tatty at the ends. They also lie flat in a flaccid, limp way that is diagnostic but difficult to describe.



***Carex sylvatica* Huds.**



***Carex strigosa* Huds.**



***Carex pendula* Huds.**

Reference Pearman, D. A. (1995). *BSBI News* **68**: 11.

Author D. A. Pearman, January 1998.

8. *Carex flacca* / *C. panicea*

The difference between these species are slight on paper but should rarely cause difficulties in the field once they are known, at least in fruiting material. Colour of leaves, often used in keys, is not a reliable character.

	C. flacca Schreb.	*C. panicea* L.
Basal sheaths and rhizome scales	Dark purplish-brown	Pale greyish-brown
Leaves	With midrib channel usually extending to extreme tip	With midrib channel ceasing before tip, the apical few mm trigonous, flat above
Lowest bract	Sheath 0-3(-10) mm long	Usually with a sheath 10-15 mm long
Utricles	Symmetrical, papillose, densely packed so that rachis of spike is not visible	Asymmetrical, smooth or minutely papillose, loosely arranged so that rachis is usually visible

9. Carex binervis / *C. distans* / *C. hostiana* / *C. laevigata* / *C. punctata*

These five species are closely related and can be similar in general appearance. They are best separated on a combination of characters, among which colour of basal sheaths, leaves and glumes is very important. Characters unique to one species are underlined.

C. binervis Sm.: leaves dark green, orange-tinged like basal sheaths when dead or injured, evenly tapered to apex; female glumes black or dark purplish-brown; utricles ascending at 45-60° to axis of spike, dark purplish-brown but often partly green.

C. distans L.: leaves dark or greyish-green, dull brown like basal sheaths when dead, evenly tapered to apex; female glumes pale brown or pale reddish-brown; utricles ascending at 45-60°, dull greenish-brown.

C. hostiana DC.: leaves light or yellowish-green, greyish-brown like basal sheaths when dead, usually abruptly contracted into a parallel-sided vein-less tip several mm behind apex; female glumes dark, usually reddish-brown, with conspicuous silvery-hyaline margins (absent in other species); utricles ascending at 45-60°, yellowish- to brownish-green.

C. laevigata Sm.: leaves light or yellowish-green, the widest usually 8-10 mm wide (rarely, except sometimes in *C. punctata*, over 6 mm in the other species), dull brown like basal sheaths when dead, evenly tapered to apex; female glumes pale reddish-brown; utricles ascending at 45-75°, greenish or brownish.

C. punctata Gaudin: leaves yellowish-green, brown or reddish-brown like basal sheaths utricles at 75-90°, shiny yellowish-green (whitish when young), abruptly contracted into beak (more gradually narrowed in other species).

10. *Carex flava* group

The revision of this group by Schmid (1983) (which was adopted by Stace 1991, 1997) so far as species and subspecies are concerned, has, by making most of the British and Irish taxa subspecies of *C. viridula* Michaux, reduced the need to separate the taxa as rigidly as was attempted in the past. The following key applies only to the taxa as they occur in our area. The old names are given in square brackets.

1 Ripe utricles 6-6.5 mm, gradually narrowed into a beak 2-3 mm long; leaves about as long as stems, 3.5-7 mm wide; ligule 3-5 mm ***C. flava*** L.

1 Ripe utricles 1.75-5 mm, with beak up to 2 mm long; leaves 1.5-5 mm wide; ligule *c.* 1 mm 2

2 Leaves of fertile tillers not more than ½ as long as stems, 2-3(-4) mm wide; utricles 3.5-5 mm, distinctly curved (as well as being deflexed in lower part of spike), with beak occupying at least 1/3 of total length ***C. viridula*** subsp. ***brachyrrhyncha*** (Celak.) B. Schmid [*C. lepidocarpa* Tausch]

2 At least some leaves of fertile tillers more than ½ as long as stems, 1.5-5 mm wide; utricles 2-4 mm, straight or weakly curved (though often deflexed), with beak occupying less than 1/3 of total length 3

3 Stems usually curved; leaves flat; lowest spike often widely separated from the others; utricles 3-4 mm, with beak usually 1 mm or more
C. viridula subsp. ***oedocarpa*** (Andersson) B. Schmid [*C. demissa* Hornem.]

3 Stems straight; leaves usually caniculate; female spikes usually all clustered at apex of stem; utricles 2-3(-3.5) mm, with beak less than 1 mm ***C. viridula*** subsp. ***viridula*** [*C. serotina* Mérat]

Sell & Murrell (1996) have all the taxa as subspecies of *C. flava* and include four not in Stace's *New Flora* (subspecies *jemtlandica*, *bergrothii*, *scotica* and *pulchella*). European experts tend neither to accept the first two as occurring in the British Isles, nor to accept the latter two as subspecies. A thorough revision of the whole group is needed.

Hybrids with *C. hostiana* (*C.* × *fulva* Gooden.)

Hybrids of subsp. *brachyrrhyncha*, subsp. *oedocarpa* and subsp. *viridula* with *C. hostiana* are frequent. They can be recognised by the spikes being tapered above and rather appressed to the stem with often erect bracts, the empty utricles, and the anthers which remain undehisced and hidden under the male glumes; which subspecies is the parent can best be judged by whichever is present in the locality (there is rarely more than one of them present).

11. *Carex digitata* / *C. ornithopoda*

These two species are instantly distinguished from all other sedges as the inflorescences arise laterally from the base of shoots rather than terminally.

When flowering or fruiting these species should be easily distinguishable, for the lowest spike of the inflorescence of *C. digitata* is clearly separated from the one above it, whereas in *C. ornithopoda* all the spikes originate from almost the same point; the inflorescence of *C. digitata* is sometimes at least tinged with crimson while that of *C. ornithopoda* is straw-coloured; and in *C. digitata* the female glumes are as long as the utricles whereas in *C. ornithopoda* they are markedly shorter. When the plants are in the vegetative state separation is not easy, for the intensity of the red coloration of the basal sheaths and the breadth and degree of hairiness of the leaves (the distinctions usually quoted) are relative. However the sheaths of *C. digitata* are, in general, more deeply and genuinely crimson (as opposed to mid- or dark-green). Furthermore, the new shoots of *C. digitata* are very distinctive. They begin to appear in October and are then tinged with deep red and tipped with green. In March they elongate and arch over at the tips, presenting a highly characteristic fountain-shape. None of these characters are found in *C. ornithopoda*. A good time to spot the latter is May when the young pale green leaves appear forming dense tufts in the middle of the clumps.

	Carex ornithopoda Willd.	*Carex digitata* L.
Leaves	Deeper green, 5-20 cm, glabrous	Lighter green, up to 25 cm, usually sparsely-hairy on upper surface
Inflorescence	1/8-1/10 length of stem, compact, ± digitate	1/5-1/4 length of stem
Male glumes	*c.* 2.5 mm, obovate	5 mm, rounded or even emarginate at apex
Female spikes	2-3, 5-10 mm, 2-4 flowered (rarely more), ± sessile	1-2, 10-20 mm, 5-10 flowered, pedunculate
Female glumes	2.0-2.5 mm	3.0-4.0 mm
Ripe utricles	3.0-4.0 mm, much exceeding glumes	3.0-4.0 mm, less tapered below, about equalling glumes

Author M. J. Wigginton & G. G. Graham (1981), updated T. C. G. Rich, 1998.

12. *Carex caryophyllea* / *C. ericetorum* / *C. montana* / *C. pilulifera*

The two common species can easily be distinguished in flower and fruit as the lowest bract has a sheath in *C. caryophyllea* but not in *C. pilulifera*, and vegetatively as the free margin of the ligule is entire in the former and minutely fimbriate (×20 lens) in the latter.

C. montana has a very distinctive growth habit, making widening tufts that often die out in the middle like fairy rings, with a woody rootstock covered with the reticulately fibrous remains of dead leaves and crimson-tinged basal sheaths (sometimes also seen in *C. pilulifera*); the leaves are soft, upright and pale whitish-green (but not glaucous).

	C. caryophyllea Latourr.	*C. pilulifera* L.	*C. ericetorum* Pollich	*C. montana* L.
Basal sheaths	Brown or blackish-brown	Brown or reddish-brown	Dark brown or blackish	Crimson
Stems	Rigid, erect	Wiry, often curved and prostrate	Rigid, erect	Filiform, drooping or prostrate
Leaves	Mid-green, often recurved, glabrous	Bronze-green, often recurved, glabrous	Usually dark green, with scarious margin, rigid, recurved, glabrous	Pale whitish-green, soft, usually upright, with sparse hairs on upper surface at least when young
Ligule (×20 lens)	Entire	Minutely fimbriate	± Entire	Minutely fimbriate
Lowest bract	With a sheath 3-5 mm long	Without a sheath	Without a sheath	Without a sheath
Male spikes	Clavate	Cylindrical	Cylindrical	Cylindrical
Female glumes	Reddish-brown or greenish, acute or apiculate	Reddish-brown	Purplish-brown to black, with fimbriate scarious margin	Reddish-purple to black, without a scarious margin
Utricles	Obovoid-ellipsoid, tomentose	Obovoid-subglobose, minutely tomentose	Obovoid-subglobose, minutely tomentose	Obovoid-pyriform, minutely tomentose

13. *Carex limosa* / *C. magellanica* / *C. rariflora*

C. limosa and *C. magellanica* are often confused, and *C. rariflora*. is also included here as it is similar in general habit. *C. limosa* grows in very wet bogs, often in standing water, producing tufts of few, inrolled, glaucous leaves on long rhizomes which grow sideways in a distinctive fashion; prostrate shoots late in the season may have leaves much wider than the earlier leaves. *C. magellanica* grows in wet but not submerged *Sphagnum* bogs on level shelves of moorland, producing larger more compact clumps of

broader, flat, yellow-green leaves. *C. rariflora* occurs with *Sphagnum* in wet alpine acid flushes/mires and on the silty banks of the headwaters of burns in the Cairngorms. The characteristic little fans of curved greyish leaves might be taken for a miniature iris.

C. magellanica is protected in Northern Ireland under Schedule 8 of the Wildlife (NI) Order 1985.

1 Lowest spike largely female but with 1 or few male flowers at base; female glumes much narrower than ripe utricles; lowest bract usually over-topping inflorescence; leaves 1.5-4 mm wide, yellow- or apple-green, flat ***C. magellanica*** Lam.
1 Lowest spike entirely female; female glumes almost as wide as or wider than ripe utricles; lowest bract shorter than inflorescence; leaves 1-2(-4) mm wide, grey-green or glaucous, flat, in-rolled or folded 2

2 Male spikes 3-4 mm wide, with 5-8 flowers; leaves flat ***C. rariflora*** (Wahlenb.) Sm.
2 Male spikes 5-7 mm wide, with 7-20 flowers; leaves folded or in-rolled ***C. limosa*** L.

14. *Carex nigra* / *C. elata* / *C. acuta* / *C. aquatilis* / *C. recta*

C. nigra, the commonest species of this group, is extremely variable and hybridises with all the other members. (Crosses are possible between every other pair, see Wallace in Stace (1975) *Hybridisation*, and most are partially fertile.) *C. elata* is best recognised by its tussocky habit and short, stiff bracts; *C. aquatilis* by its vein-less utricles, brittle stems and long, leaf-like bracts; *C. acuta* differs from *C. nigra* chiefly in the long bracts and general size, and from *C. aquatilis* most reliably in the veined utricles, and from both by the stomata being mostly confined to the lower surface of the leaf.

1 Plant forming stout tussocks 2
1 Plant forming stands of separate tufts 3

2 Rhizomes very short and erect within the tussocks; basal sheaths splitting to form fibrillae; leaves with stomata confined to lower surface; stems stout, rigid; lowest bract much shorter than inflorescence, rigid ***C. elata*** All.
2 Rhizomes longer, emerging from the tussocks; basal sheaths entire, membranous; stems slender, pliable; leaves with stomata mostly confined to upper surface, sometimes also a few scattered on lower; lowest bract variable but usually not much shorter than or somewhat exceeding inflorescence, pliable ***C. nigra*** (tussock form)

3 Leaves 1.5-3 mm wide; leaves with stomata mostly confined to upper surface; lowest bract shorter than or slightly exceeding inflorescence; male spikes 7-50 mm ***C. nigra*** (L.) Reichard
3 Leaves 3-7 mm wide; lowest bract much exceeding inflorescence; male spikes 20-100 mm 4

4 Leaves bright green and shiny beneath; stems brittle, usually breaking when folded, smooth; leaves with stomata mostly confined to upper surface; male glumes appressed to utricles giving spike a neat appearance; utricles veinless ***C. aquatilis*** Wahlenb. (note 1)
4 Leaves dull green beneath; stems not breaking when folded, rough above; leaves with stomata mostly confined to lower surface; males glumes stiff, often giving spike a prickly appearance; utricles faintly veined ***C. acuta*** L.

Note

1. *C. recta* Boott, which probably originated as a hybrid between *C. aquatilis* and the Scandinavian *C. paleacea*, occurs only in NE Scotland. It is distinguished by the lower female glumes bearing an arista at least half as long as the body of the glume; stomata are abundant on both surfaces of the leaf.

15. *Carex bigelowii* / *C. nigra*

Specimens of *C. nigra* from high altitudes, when stunted or sterile, are often confused with *C. bigelowii.*

C. bigelowii Torr. ex Schwein: Rhizome scales shiny, coriaceous, entire, persistent reddish- or purplish-brown (often best seen at the base of aerial stems); stems conspicuously stout, rigid; utricles vein-less; stomata confined to the lower surface of the leaf.

C. nigra (L.) Reichard: Rhizome scales less conspicuous less coriaceous, often soon becoming fibrous and usually paler; stems proportionally more slender; utricles distinctly though often faintly veined; stomata are confined to, or are much more abundant, on the upper surface of the leaf.

Reference O'Mahony, T. (1989). *Irish Naturalists' Journal* **23**: 137-141.

Authors for Carex unless otherwise stated

A. O. Chater & R. W. David 1988, revised 1997 by A. O. Chater.