FIELD GUIDE OF SPANISH AND PORTUGUESE SEDGES (CYPERACEAE)

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Iberian Botany Monographs Collections

Field guide of Spanish and Portuguese sedges (Cyperaceae)

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Jaca, 2023

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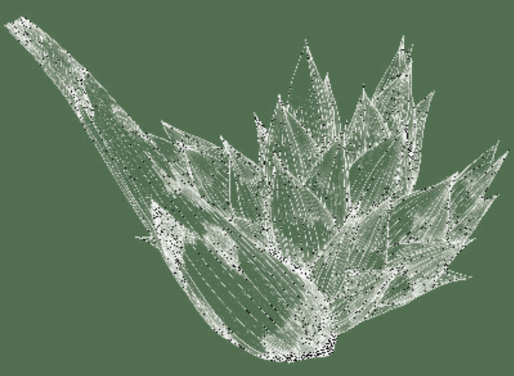
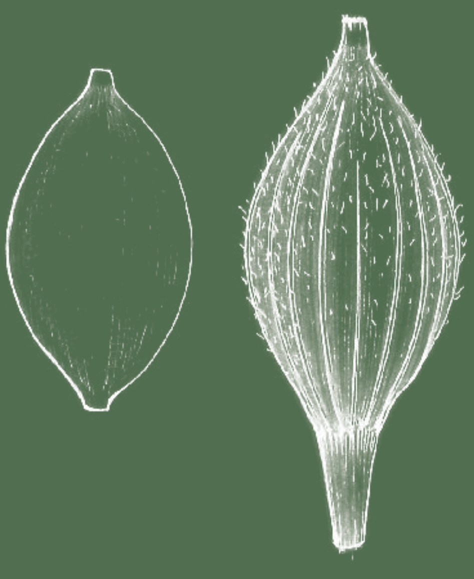


Introduction



The Cyperaceae family, which encompasses around 5700 species, is the eighth most biodiverse angiosperm family and the third most biodiverse monocotyledon family, after Orchidaceae (=orchids; ca. 26000 species), Asteraceae (=composite; ca. 25000), Rubiaceae (ca. 13500), Poaceae (=grasses; ca. 11400), Lamiaceae (=Labiatae; ca. 7300), Euphorbiaceae (ca. 6750) and Myrtaceae (ca. 5900). It is composed of 96 genera which are spread all over the world, except for Antarctica. Tropical regions harbor the highest diversity of genera, although *Carex*, the genus with the largest number of species (more than 2000), mainly inhabits the temperate and cold regions of the northern hemisphere. It is followed by *Cyperus*, with more than 950 species, mainly tropical.

Available fossil records and molecular clocks, which estimate times of divergence using DNA sequences, show that the family dates back to the Paleocene (Early Cenozoic), more than 60 million years ago, and that large genera, such as *Carex* and *Cyperus*, were already established by the late Eocene, approximately 35-40 million years ago. Reconstruction studies of ancestral areas based on molecular phylogenies suggest that the Cyperaceae family probably originated in South America.

Although most species inhabit on humid soils, and there are even some that complete their life cycle almost entirely submerged, such as the tropical *Eleocharis confervoides*, Cyperaceae thrive in a wide range of habitats. One clear example is *Cyperus conglomeratus*, which can live on the torrid dunes of the Sahara desert. They are usually common in forests and meadows, but many species also tolerate the meagre soils of stony grounds and cracks in rocks. In terms of soil preferences, some species are known to prefer very high pH values, such as those living on saline soils, and others develop well on extremely acidic peat boglands, but it is also not uncommon to find species that tolerate very broad pH ranges. As for altitude, the different species can grow from sea level up to elevations as high as 5700 m (e.g., *Carex moorcroftii* is found on the slopes of the Himalayas).

Morphological characterisation

Most of the species included in the Cyperaceae family have a graminoid appearance, that is, superficially similar to that of grasses (Poaceae) and rushes (Juncaceae). In fact, the three families are related and classified in the same order (Poales) of Monocotyledons, and they are sometimes hard to identify visually for beginners and even for those with more advanced knowledge. However, Cyperaceae, Poaceae, and Juncaceae are distinguishable in a relatively simple way by a series of easily observable characteristics if we look closely.

	Cyperaceae	Poaceae	Juncaceae
Stems	Usually trigonous, solid (pith filled)	Usually terete, ± hollow	Terete, solid (pith filled)
Leaf sheath	Closed	Open	Open or closed
Glumes per flower	1	Usually 2	Absent
Flowers	Unisexual or bisexual	Unisexual or bisexual	Bisexual
Perianth	Absent or reduced to bristles or scales that do not conceal the sexual organs	Absent or consisting of three scales (lodicules) which do not conceal the sexual organs	Present, sepaloid, actinomorphic, formed by six pieces that hide the sexual organs when the flower is closed.
Anthers	Basifixed	Dorsifixed	Basifixed
Fruit	Indehiscent (achene)	Indehiscent (caryopsis)	Dehiscent (capsule)

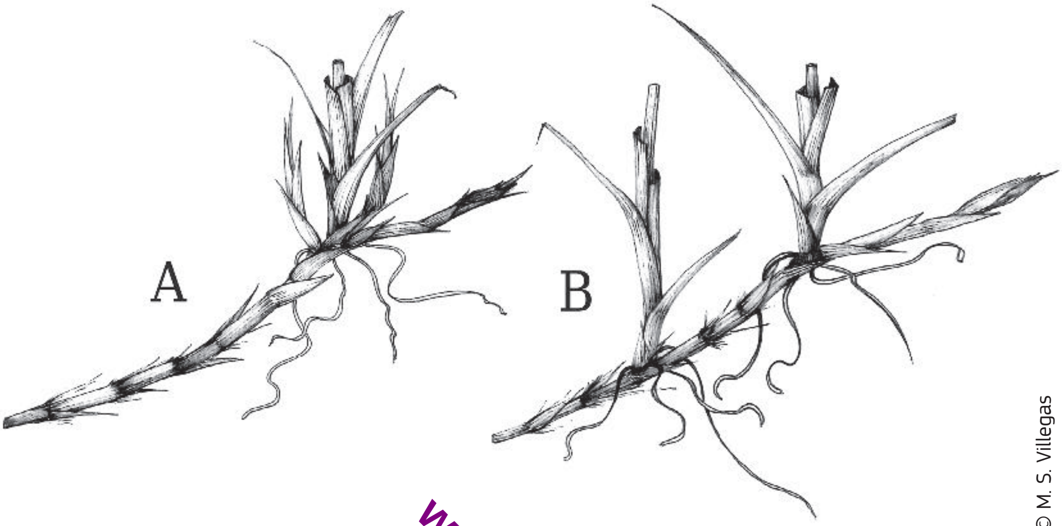
Main morphological differences between Cyperaceae, Poaceae and Juncaceae.

Although the graminoid or grass-like appearance of Cyperaceae might lead us to assume uniformity within the family, it is essential to note that this family encompasses species with highly diverse growth habits: from annual plants with an ephemeral growing cycle, such as *Bulbostylis glaberrima* that grow in Kenya and Uganda or *Isolepis inconspicua* from the region of Cape Town (South Africa), which barely reach 2 and 3 cm in height, respectively, to long-lived shrub forms - such as *Microdracoides squamosa* (native to Cameroon, Guinea, Nigeria and Sierra Leone), *Afrotrilepis pilosa* (tropical Africa) and the genus *Chamaedendron* (endemic to New Caledonia)- or climbing plants that can reach 12 m in length (*Scleria boivinii*, native to tropical Africa and Madagascar). However, most species are annual or perennial plants with underground rhizome that, fundamentally, respond to two types:

a) **Sympodial branching** occurs when the terminal bud has limited growth; this bud generates an aerial shoot, from the base of which it branches out laterally and horizontally, producing in turn new vertical aerial shoots (fertile or sterile) and horizontal rhizome. This results in ± less caespitose plants depending on the length of the internodes.

b) **Monopodial branching** occurs when the terminal bud continues to grow horizontally with very separate lateral buds, from which fertile (with flowers) and sterile (without flowers) aerial stems emerge at ± regular intervals. The result is that the stems are very far apart from each other, so they do not result in caespitose plants.

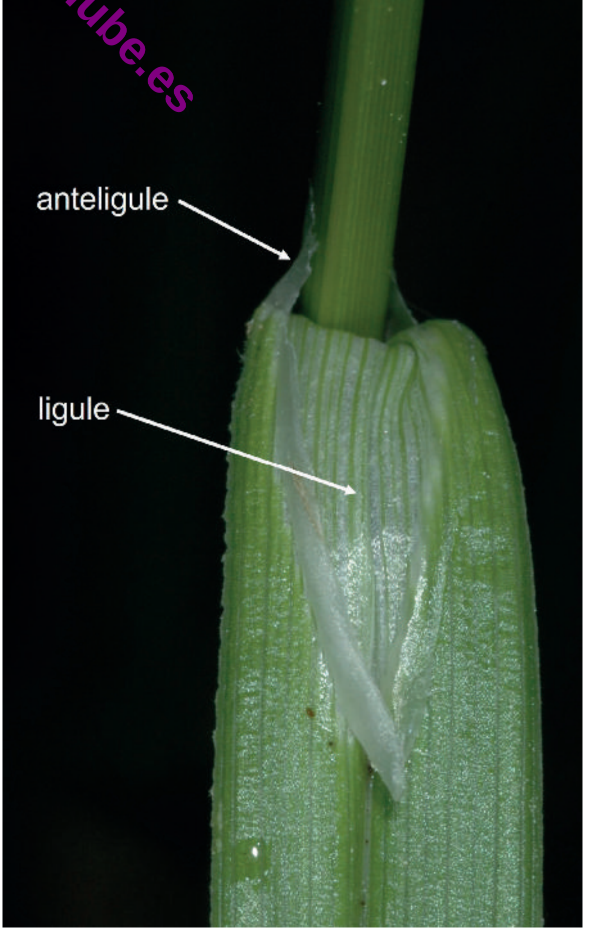
For practical purposes, in this guide we simplify terminology and use the following expressions to indicate the habit of plants: (1) **annual plants**, (2) **not caespitose perennials**, (3) **laxly caespitose perennials**, and (4) **densely caespitose perennials**.



Rhizome branching in Cyperaceae: **A**, Sympodial; **B**, Monopodial.

The **fertile stems** are generally solid, and the nodes are frequently concentrated at the bottom. They are usually trigonous, although there are numerous examples of cylindrical stems and, in species from outside Spain and Portugal, polygonal or ± compressed and even flat. The angles of the trigonous stems can be rounded or obtuse to very sharp, and even extended in a wing form. The absence or presence of ± dense epidermal expansions (papillae and/or prickles) is often useful to distinguish species.

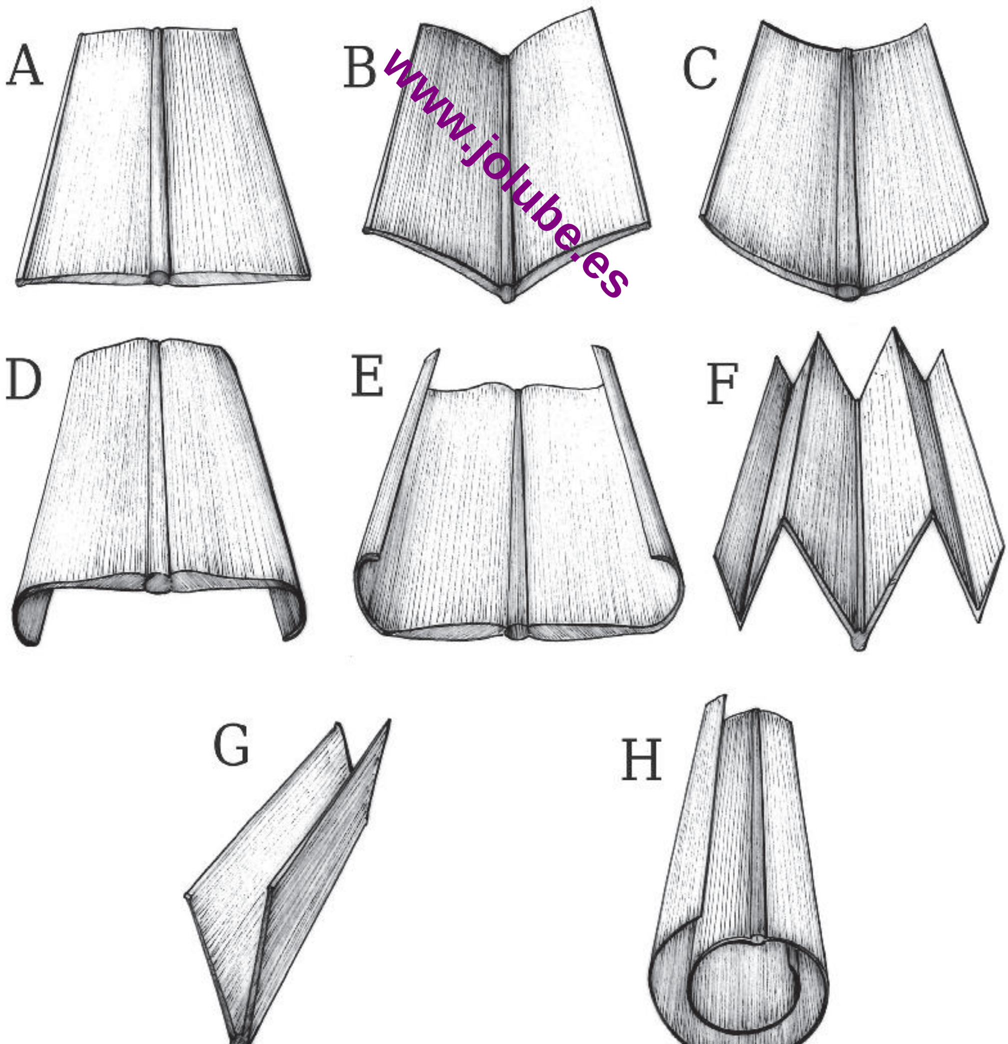
The **leaves** are usually sessile, rarely -in non-Iberomacaronesian species- narrowed at the base forming a false petiole (**pseudo-petiole**) in some broad-leaved species of the genera *Carex*, *Cyperus* and *Mapania*. The appearance is similar to that of grasses, although in general the consistency is more rigid. They consist of a **closed sheath** surrounding the stem and a **limb** (=**lamina**). At the base of the upper surface of the limb, where it separates from the sheaths, the **ligule** is attached, a translucent membrane whose length, width, edges, and apex may be helpful in characterising species. The face of the sheath opposite to the insertion



Ligule and anteligule of *Carex laevigata.*

point of the limb is hyaline in its upper section, and sometimes its apex is prolonged forming the so-called **anteligule**. The foliar limb is entire and usually linear, although there are species with filiform leaves or -especially in the tropics- lanceolate, ovate, elliptic, obovate or ensiform (=isobilateral; in the shape of a sword in which there is no distinction between the adaxial and the abaxial surface). Sometimes the leaves are reduced to sheaths or have a very short limb, as is the case with the genera *Eleocharis*, *Trichophorum*, *Schoenoplectus*, *Schoenoplectiella*, etc.

According to cross-section, foliar blades can be flat, keeled (=carinate), canaliculate, revolute, involute, plicate, conduplicate or inrolled. Stomata are most often found on the lower side (hypostomatic leaves), but numerous species also display them on both surfaces (amphistomatic leaves) and, more rarely, only on the upper face (epistomatic leaves). The leaves may be glabrous or ± hairy (always single-celled hairs), smooth or with prickles and/or papillae on the surface, at the edges and/or at the midrib.



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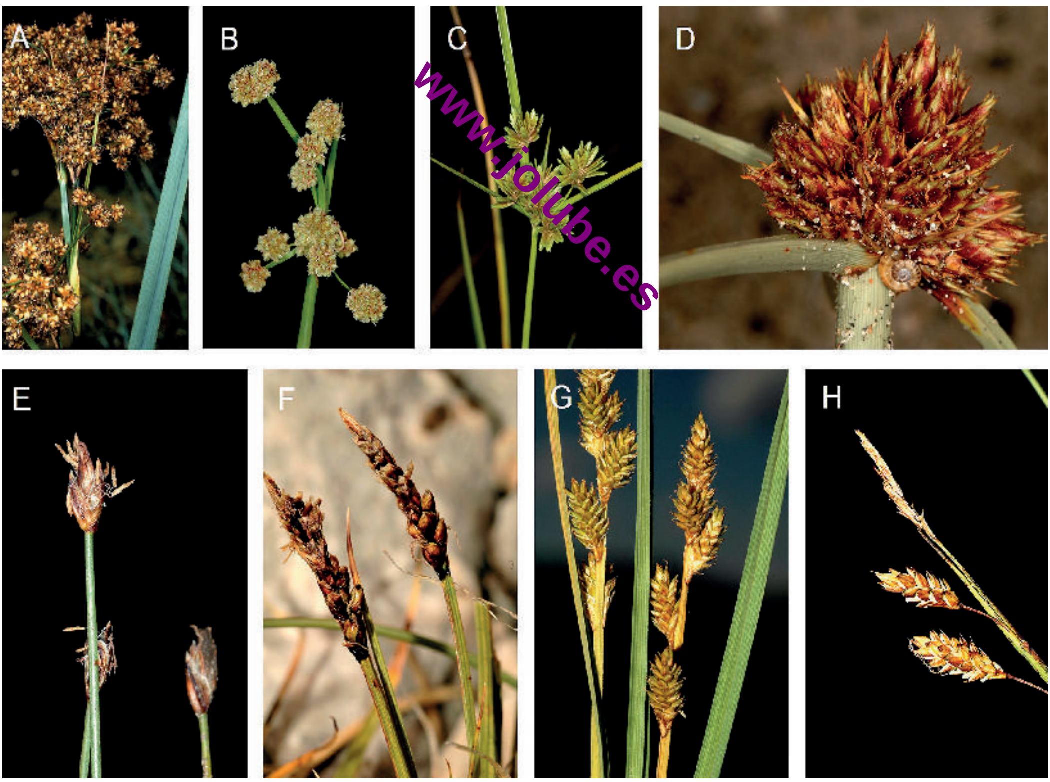
Types of leaf lamina according to their cross section: **A**. flat; **B**. keeled or carinate; **C**. canaliculate; **D**. revolute; **E**. involute; **F**. plicate; **G**. conduplicate; **H**. inrolled.

The **inflorescence** can be simple or variably branched; its basic unit is the **spikelet**, made up of one to numerous flowers, each in the axil of a scale (**glume**) that originates from the axis of the spikelet (**rachilla**). The manner in which spikelets are grouped determines the main types of inflorescences. There are **solitary spikelets**, as in *Eleocharis* and *Trichophorum*, or they can be grouped together into **spikes**, **racemes or panicles**. Spikes can be solitary or multiple, in which case they are arranged into spikes (**spicate inflorescence**) or racemes (**racemose inflorescence**). On the other hand, panicles (**paniculate inflorescences**) can be simple (a single branch order) or compound (several branch orders) and ± dense. When they form approximately spherical groups, they are called **glomerules**, while if they constitute umbelliform structures they are called **anthelae**. When the paniculate inflorescence forms a single group that is ± dense in the form of a capitulum or head, it is known as **capituliform inflorescence**. Some species have more than one type of the described inflorescences, forming mixed inflorescences.



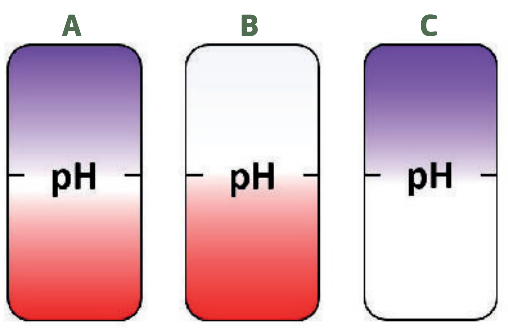
Different types of inflorescences in Cyperaceae (see text): **A**. *Cladium mariscus* (paniculate with lax glomerules; Guadalajara, Spain); **B**. *Scirpoides holoschoenus* subsp. *holoschoenus* (paniculate with dense glomerules; Valladolid, Spain); **C**. *Cyperus eragrostis* (anthela; Cáceres, Spain); **D**. *Cyperus capitatus* (capituliform; Alto Alentejo, Portugal); **E**. *Eleocharis quinqueflora* (solitary spikelet; Gerona, Spain); **F**. *Carex rupestris* (solitary spike; Gran Sasso, Italy); **G**. *Carex canescens* (spicate; Tierra de Fuego, Argentina); **H**. *Carex limosa* (racemose; Sierra de Gredos, Spain).

The inflorescence is accompanied by one or more bracts, which can be foliaceous (leaf-like), setaceous or glumaceous (squamiform), the lowest of which can provide characteristics of taxonomic importance. Sometimes, when the lowest bract is foliaceous and arranged vertically, resembling a stem extension, it is referred to **pseudolateral** inflorescence; otherwise, it is called terminal inflorescence.

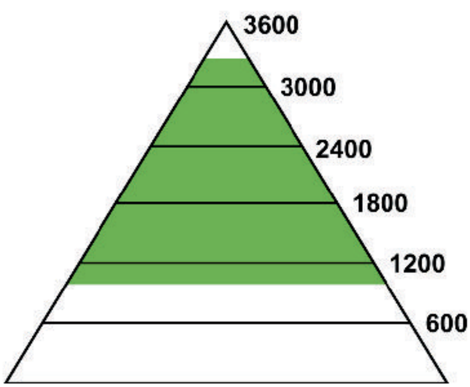
allochthonous. Subsequently, an essentially diagnostic description is presented, seeking to highlight only the useful features to identify the taxon. At the end of each diagnosis, the known chromosome numbers are given, indicating in bold the chromosomal counts carried out on Iberian populations. When there is a question mark (?) after the number, this indicates uncertainty about the count. Finally, in italics, we describe the habitat or habitats where the taxon lives in particular. A distribution map displays the presence of each taxon across provinces and archipelagos (see below), and the symbols corresponding to the flowering time, soil preferences, altitude range and, where appropriate, the conservation category at regional level (Spain and Portugal), according to the categories and criteria of the International Union for Conservation of Nature (IUCN), are shown. The illustrations of each native taxon and most of the introduced taxa include a photographic sheet with a main image and, often, one or two close-up pictures of details (usually the utricle and the female glume for *Carex*, and the achenes for the other genera). There is also a drawing representing the general size and the main diagnostic organs (glumes, fruits, utricles, etc.).

The distribution map has been developed by shading in green the province or archipelago where the taxon is present. In the few cases where the presence of a taxon in a certain province or archipelago is doubtful, we have shaded this territory in blue. Finally, a terminology glossary is provided (Appendix I), which includes the technical words cited in the text.

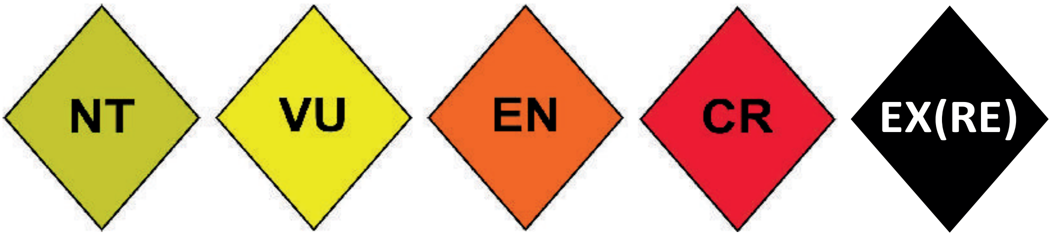
Indication of flowering time.



Symbols indicating the edaphic preferences of the Iberian-Macaronesian Cyperaceae.
A: indifferent; **B**: acidophilic taxon; **C**: basophilic taxon.



Example of an altitudinal range indicator symbol. The green shading indicates the range.



Symbols used to indicate the degree of regional threat according to IUCN categories and criteria.
NT: Near Threatened; **VU**: Vulnerable; **EN**: Endangered; **CR**: Critically Endangered; **EX(RE)**: Regionally Extinct.

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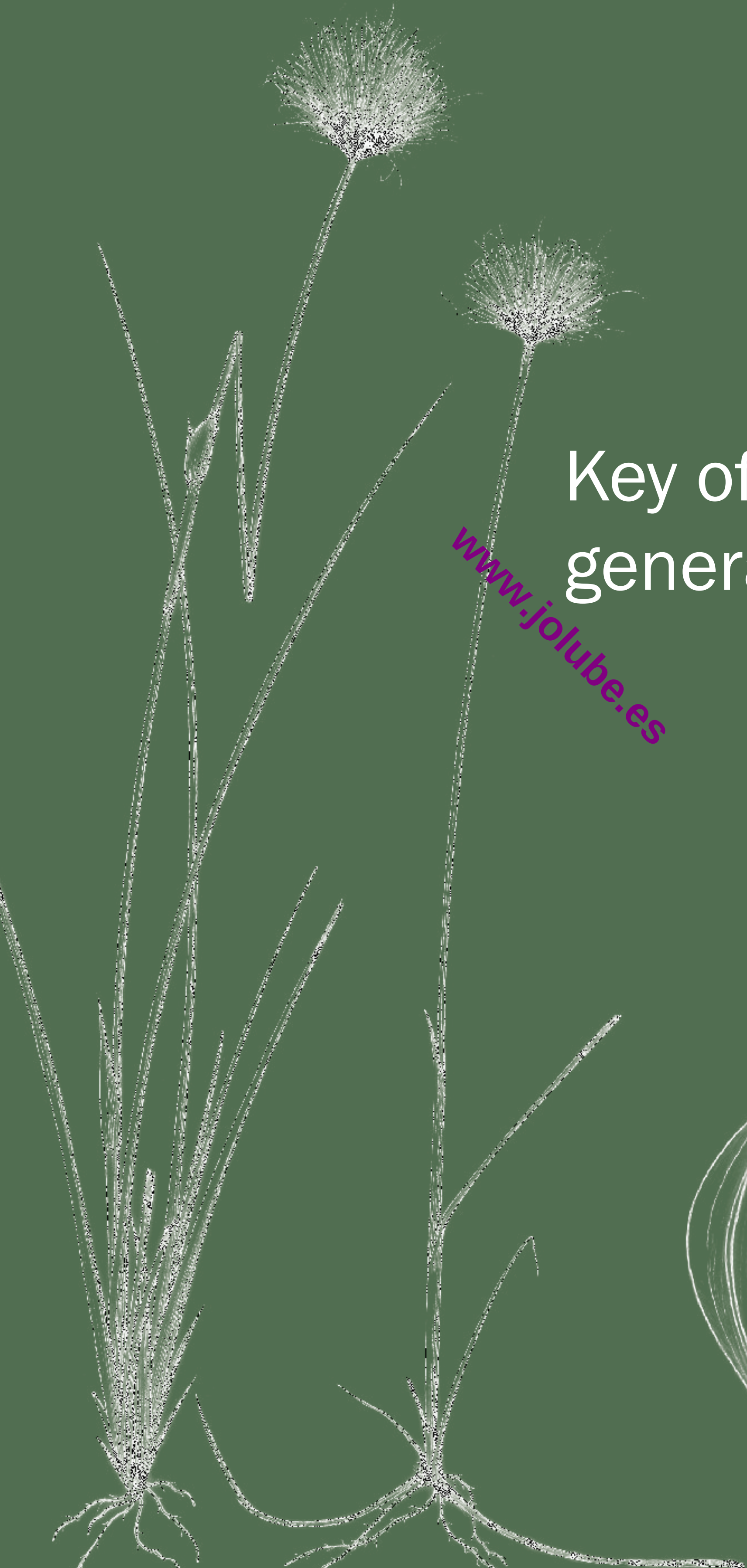

Key of the genera

1. Flowers all unisexual; achenes enclosed in a lageniform prophyll (utricle), more rarely enfolded by a scale, the margins of which are free or slightly connate at the base (glumiform perigynium) .... 8. ***Carex*** (p. 69)

— At least some bisexual flower; achenes neither enclosed by an utricle nor enfolded by a scale 2

2. Inflorescence with a cottony appearance in fruiting .... 6. ***Eriophorum*** (p. 58)

— Inflorescence not cottony-looking 3

3. Spikelets sessile, arranged in two opposite rows on the spike axis (distichous) .... 4. ***Blysmus*** (p. 51)

— Spikelets sessile or ± pedunculate, never distichous 4

4. Inflorescence consisting of a solitary terminal spikelet, without bracts 5

— Inflorescence consisting of several spikelets, rarely of a solitary spikelet, but then inflorescence lateral in appearance, subtended by a foliaceous bract resembling an extension of the stem (pseudolateral inflorescence) 6

5. Leaves without lamina, reduced to sheaths .... 9. ***Eleocharis*** (p. 432)

— Uppermost leaf with a lamina (1.5)3-6(8) mm long .... 7. ***Trichophorum*** (p. 66)

6. Spikelets very densely grouped in spherical glomerules; stems terete, shiny; inflorescence pseudolateral; leaves frequently reduced to sheaths; glumes denticulate, spirally arranged, aculeolate .... 16. ***Scirpoides*** (p. 502)

— Without the above combination of characters 7

7. Glumes arranged in two rows (distichous) 8

— Glumes spirally arranged 9

8. Inflorescence capituliform, black, subtended by two bracts embracing the spikelets; basal sheaths shiny; perennial plant .... 2. ***Schoenus*** (p. 40)

— Inflorescence frequently anthelate, if capituliform, then not black or/and without two bracts embracing the spikelets or/and basal sheaths dull or annual plants .... 18. ***Cyperus*** (p. 515)

9. Style base swollen, persistent or falling at maturity 10

— Style base not swollen 14

Keys and datasheets of species

C. mariscus subsp. ***mariscus***: A) general aspect of the plant; B) achene; C) glume; D) spikelet; E) glomerule of spikelets.

2. *SCHOENUS* L.

The latest classification of the family Cyperaceae, based on phylogenomic studies, includes *Schoenus* in the tribe Schoeneae, and it is the only genus in the subtribe Schoeninae. About 150 species are currently accepted, distributed mainly in Australasia, although a few occur in Europe, Japan, western and south-east Asia, as well as southern North and South America, and Central America. It is represented in the territory by a single species, *Schoenus nigricans*. The genus is characterised by densely caespitose plants; frequently terete stems; inflorescence usually terminal; distichously arranged, deciduous glumes, only the upper ones fertile; perianth almost always present and 3 stigmas.

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1. *Schoenus nigricans* L.

Densely caespitose, tussock forming. **Stems** 15-65(85) cm, terete. **Leaves** up to 1.2(1.4) mm wide, canaliculate to conduplicate, rigid, usually shorter than stems; basal sheaths without lamina, blackish, shiny. **Lowest bract** glumaceous at the base, ending in a long, setaceous or leaf-like tip, usually much longer than inflorescence. **Inflorescence** dense, capituliform, consisting of (2)4-8(9) spikelets up to 15 mm, lanceolate or narrowly elliptic in outline, compressed. **Glumes** lanceolate or narrowly elliptic, coriaceous, dark brown or blackish, shiny, scabrid on the keel, frequently with narrow scarious margins, the 2-3 lower ones empty, acute or acuminate, the remaining ones bearing a bisexual flower, obtuse. **Perianth bristles** (0)3-6, much shorter than the achene, retrorsely scabrid. Stamens 3. Stigmas 3. **Achenes** 1.4-2.1 mm long, obtusely trigonous, whitish, shiny. 2n= 44, **54**. *Wet meadows and other flooded places*.

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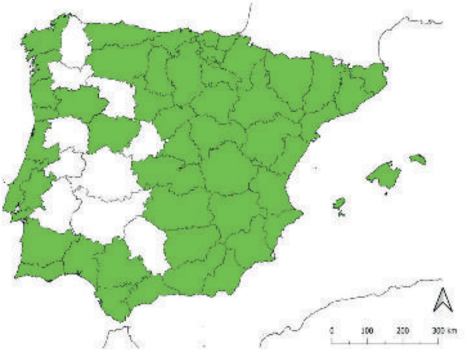
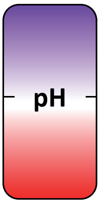
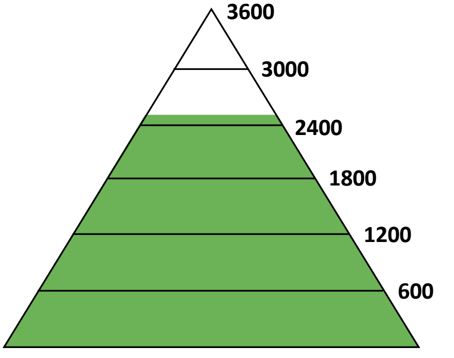
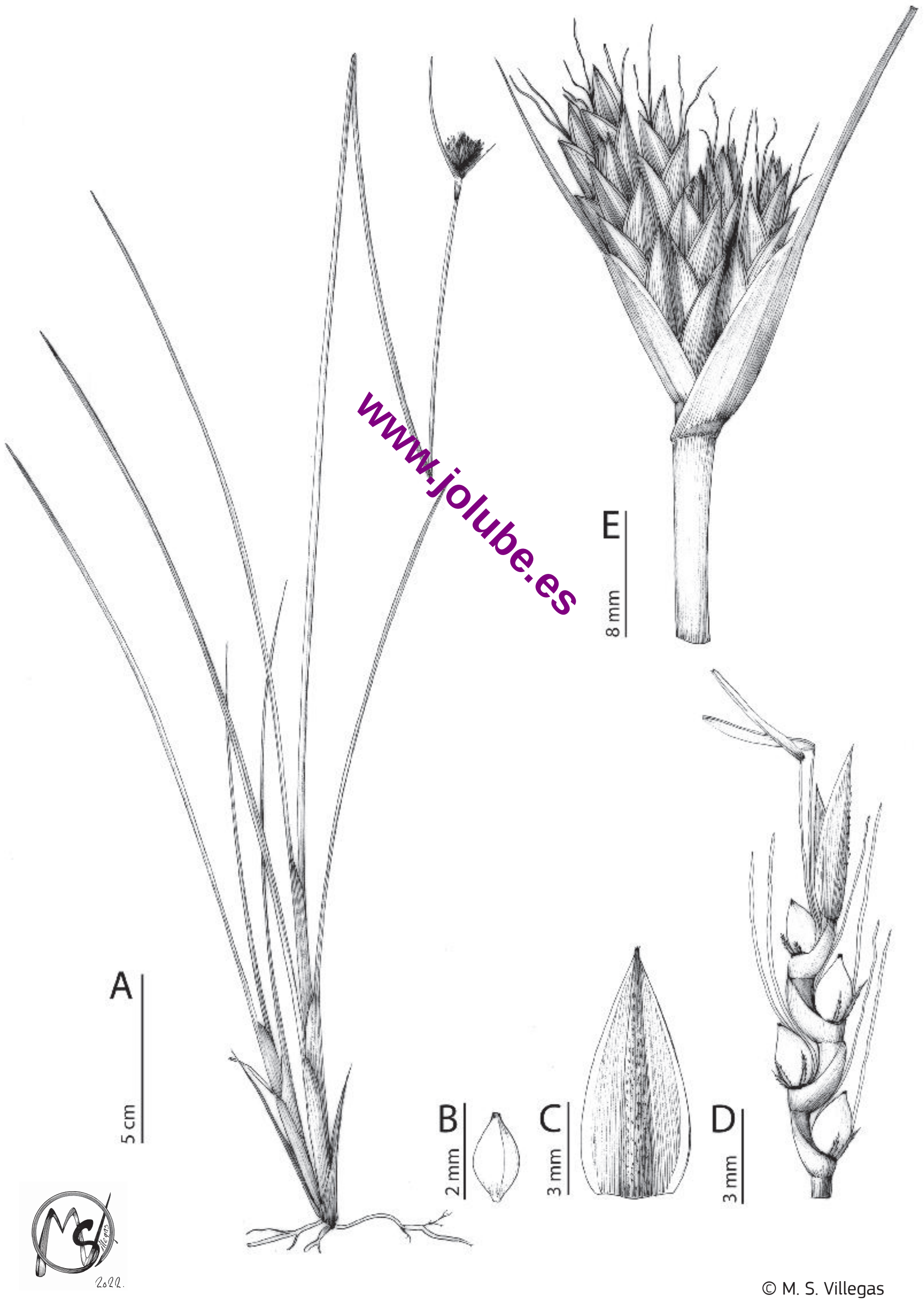






Schoenus nigricans



Schoenus nigricans: A) general aspect of the plant; B) achene; C) sterile glume; D) achenes and rachilla; E) inflorescence.

3. *RHYNCHOSPORA* Vahl

Rhynchospora is the only genus included in the tribe Rhynchosporeae (subfamily Cyperoideae). It includes c. 400 species distributed over all continents except Antarctica, although its greatest diversity is found on the American continent, especially in Brazil. In the territory, it is represented only by three species scattered across the Iberian Peninsula but absent from the islands. The genus is characterised by terete or obtusely trigonous stems; highly variable inflorescences, usually with numerous spikelets whose glumes are spirally arranged, the lower ones sterile and the upper ones bearing a bisexual flower each; (0)1-13 perianth bristles; 2 stigmas (in species from the territory) and biconvex achenes, with persistent, triangular or deltoid style base. Many American species and the European *R. alba* are entomophilous.

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KEY OF SPECIES

1. Spikelets white or whitish at anthesis .... 1. ***R. alba*** (p. 43)

— Spikelets brown to blackish at anthesis 2

2. Perianth bristles (0)1-3(5), shorter than the achene; achenes with fine transversal wrinkles; stems (35)40-70(90) mm .... 3. ***R. modesti-lucennoi*** (p. 48)

— Perianth bristles (4)5-6, most of them longer than the achene; achenes smooth; stems (10)15-25 cm .... 2. ***R. fusca*** (p. 46)

1. *Rhynchospora alba* (L.) Vahl

Densely caespitose. **Stems** (10)15-40(46) cm. **Leaves** 0.5-1.5(2) mm wide, canaliculate or ± involute, shorter than stems. **Lowest bract** shorter than inflorescence. **Inflorescence** consisting of (1)2-4 corymbiform panicles of spikelets, approximate above or the lower panicles distant; spikelets 4.3-5.3 mm long, fusiform, not or scarcely compressed. **Glumes** ovate to obovate, mucronate or acuminate, more rarely acute, white or whitish at anthesis, sometimes yellowish at maturity, the lower ones sterile, the upper one having a bisexual flower. **Perianth bristles** 8-13, usually longer than the achene, retrorsely scabrid. Stamens 2. Stigmas 2. **Achenes** 1.3-1.5 mm long, ellipsoid to obovoid, smooth, rarely with minute, hardly perceptible, transversal striations, greenish or pale brown; style base 0.8-1.5 mm long, triangular-subulate in outline, smooth. 2n=26. *Peat bogs and flooded meadows*.

6. *ERIOPHORUM* L.

The genus *Eriophorum* includes 18 species distributed in almost all temperate and cold regions of the northern hemisphere. In our territory there are only 4 species that inhabit the peat bogs of the mountains of the northern half of the Iberian Peninsula. The genus is easily recognized by its cotton-like inflorescences, hence its popular name of cottongrass. This appearance is due to the presence of numerous flattened, white (reddish in certain boreal species) perianth bristles. Its species are also characterised by the presence of basal and cauline leaves and hermaphrodite flowers with 3 stamens and 3 stigmas. The inflorescence, depending on the species, may consist of one or more spikelets.

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KEY OF SPECIES

1. Inflorescence consisting of a solitary spikelet; lowest bract glumaceous 2

— Inflorescence consisting of several spikelets usually pedunculate, lowest bract leaf-like 3

2. Plants densely caespitose; sheath of the upper leaf strongly inflated; anthers c. 2.5(3) mm long .... 4. ***E. vaginatum*** (p. 64)

— Plants not or laxly caespitose; sheath of upper leaf not or scarcely inflated; anthers c. 1 mm long .... 3. ***E. scheuchzeri*** (p. 63)

3. Peduncles of the spikelets strongly scabrid; achenes pale to medium brown .... 2. ***E. latifolium*** (p. 61)

— Peduncles smooth; achenes dark brown to blackish .... 1. ***E. angustifolium*** (p. 59)

1. *Eriophorum angustifolium* Honck. subsp. *angustifolium*

Not or very laxly caespitose; rhizome with long internodes. **Stems** (10)20-60(90) cm, subterete or obtusely trigonous towards the apex. **Leaves** 2-6(8) mm wide, carinate or canaliculate, more rarely flat. **Lowest bract** glumaceous, ending in a leaf-like tip, shorter than to ± equaling inflorescence. **Inflorescence** umbelliform, consisting of 3-5(7) spikelets with peduncles up to 8 cm, smooth, arcuate; spikelets obovoid and nodding at maturity. **Glumes** ovate to ovate-lanceolate, obtuse, acute or acuminate, reddish-brown to blackish, with scarious margins, spirally arranged. **Perianth bristles** numerous, accrescent, much longer than the achene, not papillose at the apex. Stamens 3. Stigmas 3. **Achenes** (1)2-3(3.4) mm long, obovoid, inflated-trigonous, dark brown to blackish, dull to scarcely shiny. 2n= 54, 58, 60. *Peat bogs.*

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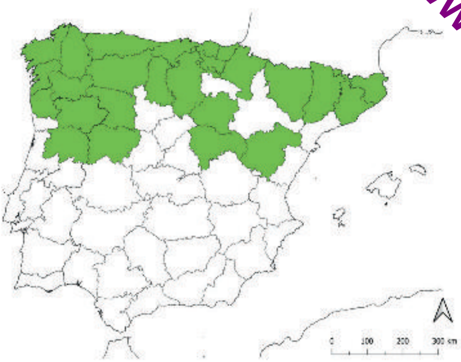

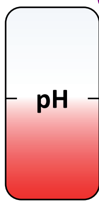

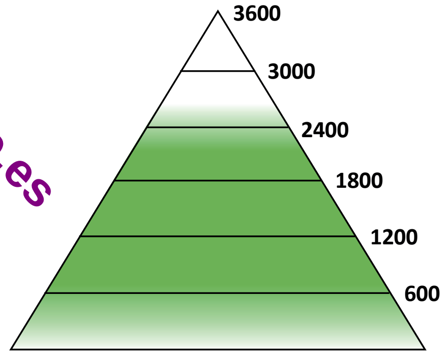


Eriophorum angustifolium subsp. *angustifolium*

Eriophorum angustifolium subsp. *angustifolium*

2. *Eriophorum latifolium* Hoppe

Not or very laxly caespitose; rhizome with ± long internodes. **Stems** 20-60(90) cm, obtusely trigonous. **Leaves** (2)3-5(6) mm wide, flat or slightly carinate. **Lowest bract** glumaceous, ending in a leaf-like tip, ± equaling inflorescence. **Inflorescence** umbelliform, consisting of (2)4-10(12) spikelets with peduncles up to 9 cm, densely scabrid, arcuate; spikelets obovoid and nodding or sloping at maturity. **Glumes** ovate to ovate-lanceolate, obtuse, ± acute, dark olive-green to blackish, with scarious margins, spirally arranged. **Perianth bristles** numerous, accrescent much longer than the achene, papillose at the apex. Stamens 3. Stigmas 3. **Achenes** 3-3.5 mm long, slightly obovoid, inflated-trigonous, dark brown, dull. 2n= 54, 58, 72. *Peat bogs*.

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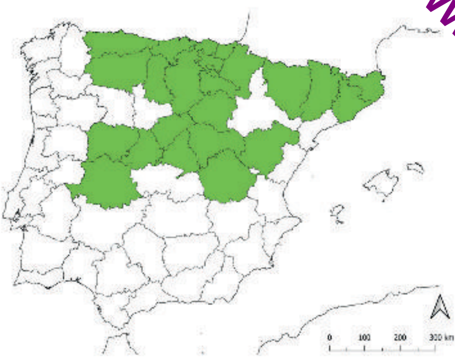
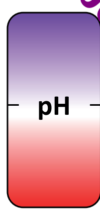
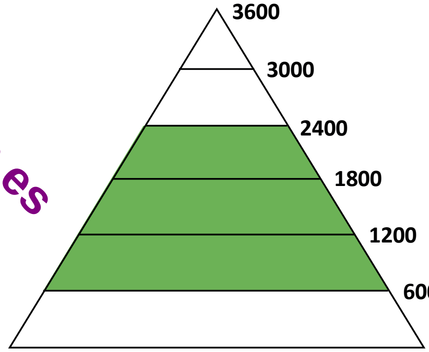
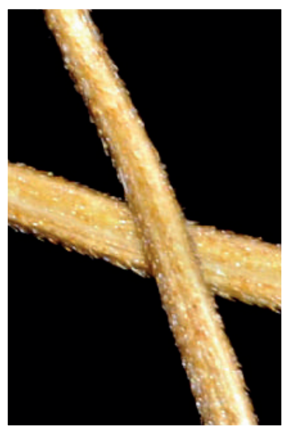








Eriophorum latifolium

8. *CAREX* L.

Origin, distribution and habitat

With just over 2000 accepted species, *Carex* is the third most biodiverse genus of angiosperms, only surpassed by *Bulbophyllum* (Orchidaceae; ca. 3200) and *Astragalus* (Fabaceae; ca. 3000). It has a cosmopolitan distribution and is only absent from continental Antarctica, some warm deserts, and lowland equatorial jungles. However, its species richness is not uniformly distributed, so it has a greater number in temperate and cold regions of the northern hemisphere, especially in East Asia and the NE of North America. In the west of the Palearctic, which spans the area covered by this guide, the number of species is considerably lower than in Asia and North America, although far exceeding 200. Meanwhile, in the southern hemisphere, although the number of species is lower than in the north, there are also areas of high relative diversity, such as Patagonia and New Zealand. This general pattern of species richness distribution is broadly adjusted to the latitudinal gradient, with more species found at higher latitudes (except extreme polar latitudes). This is surprising because it is contrary to the behaviour shown by most large groups of living beings, including many other genera of Cyperaceae, whose species diversity is greater in regions near the Equator.

Fossil evidence and dating analysis of molecular phylogenies indicate that the genus probably originated in East Asia in the late Eocene, about 35–40 million years ago. It is likely to have remained there for a long period (at least 10 million years) during which the main lineages diversified, before initiating colonisation of the rest of the world, which must have taken place from the final stages of the Oligocene onwards (ca. 23-24 millions of years ago). Recent research has shed light on the evolutionary history that explains the exciting biogeography of *Carex*. Thus, the current distribution of the genus is the result of enormous diversification in the northern hemisphere, fostered by an extraordinary ability to disperse over long distances. This has allowed it to reach multiple territories despite the lack of specialised mechanisms for such dispersion (except the subgenus *Uncinia*, not present in the territory covered by this guide -see the general Introduction-, and some species from several sections: *C. collinsii*, with hook-like utricle beak teeth; *C. vesicaria*, *C. rostrata* and others, with inflated and floating utricles; and *C. leporina, C. praecox*, etc., whose winged utricles facilitate their dispersal by the wind). Thus, *Carex* has managed to colonise the major land masses of the southern hemisphere (except Antarctica, although it is present in several Sub-Antarctic islands) on multiple independent occasions as well as the main oceanic archipelagos of volcanic origin (except the Galapagos).

Although *Carex* displays great morphological and ecological variability throughout the territories in which it is present, it generally has an affinity for habitats with high water availability in temperate and cold areas. In fact, throughout its evolutionary history, the diversification of *Carex* seems to have been favoured during geological periods characterised by global climate cooling, such as the late Miocene. These circumstances lead us to believe that, in all likelihood, the current global warming caused by anthropogenic activity is not positive for genus diversification and conservation. Many habitats where there is a large abundance of *Carex* species, or where *Carex* species even play a key ecological role because of their dominance, are already suffering the negative effects of climate change, including high mountain ecosystems (peat bogs, communities where snow long lasts, alpine meadows, etc.). This is particularly worrying in areas most vulnerable to climate change, such as mountains in tropical regions or the Mediterranean basin, including the main Iberian mountain ranges.

Carex in the Iberian Peninsula, Balearic Islands and Macaronesia

In the Iberian Peninsula and the archipelagos of the Azores, the Balearic Islands, the Canary Islands and Madeira there are 113 species and 9 subspecies of *Carex*. The continental territory, along with the Balearic Islands, is home to 103 species and 6 subspecies, all native; while in Macaronesia only 27 species (9 endemic) and 2 subspecies (endemic) are known, all native except perhaps *C. debilis* Michx., which could have been introduced by humans from North America. These taxa fall into 4 subgenera (out of the 6 accepted) and 47 sections and/or clades. The exact location of a few species is still pending further systematic studies, so in such cases we have preferred to indicate the name of the lineage (clade) to which they belong, according to the latest phylogenetic studies.

Subgenus	Section / Clade (no. species)	Species
Psyllophorae (6)	*Psyllophorae* (5)	*C. distachya*, *C. macrostyla*, *C. oedipostyla*, *C. peregrina*, *C. pulicaris*
	Baldenses (1)	*C. curvula*
Euthyceras (4)	Clado Kobresia (2)	*C. myosuroides*, *C. simpliciuscula*
	Clado Capitata (1)	*C. rupestris*
	Clado Pauciflora (1)	*C. pyrenaica*
Vignea (25)	*Stellulatae* (1)	*C. echinata*
	Foetidae (1)	*C. foetida*
	Glareosae (4)	*C. canescens*, *C. furva*, *C. lachenalii*, *C. lucennoiberica*
	Paniculatae (1)	*C. paniculata*
	Divisae (1)	*C. divisa*
	Phaestoglochin (7)	*C. canariensis*, *C. divulsa*, *C. leersii*, *C. muricata*, *C. otrubae*, *C. pairae*, *C. spicata*
	Ammoglochin (4)	*C. arenaria*, *C. brizoides*, *C. praecox*, *C. pseudobrizoides*
	Remotae (1)	*C. remota*
	Clado Annectens (1)	*C. diandra*
	Physoglochin (1)	*C. davalliana*
	Holarrhenae (1)	*C. disticha*
	Cyperoideae (2)	*C. bohemica*, *C. leporina*

Subgenus	Section / Clade (no. species)	Species
Carex (78)	*Albae* (1)	*C. alba*
	Aulocystis (1)	*C. sempervirens*
	Clado Ericetorum (1)	*C. ericetorum*
	Secalinae (1)	*C. hordeistichos*
	Clado Liparocarpos (1)	*C. liparocarpos*
	Digitatae (2)	*C. digitata, C. ornithopoda*
	Mitratae (3)	*C. basilaris, C. caryophyllea, C. depressa*
	Clado Conica (1)	*C. umbrosa*
	Rhomboidales (1)	*C. brevicollis*
	Chlorostachyae (1)	*C. capillaris*
	Clandestinae (1)	*C. humilis*
	Hallerianae (2)	*C. halleriana, C. rorulenta*
	Acrocystis (2)	*C. montana, C. pilulifera*
	Clado Carex (6)	*C. hirta, C. lasiocarpa, C. pseudocyperus, C. riparia, C. rostrata, C. vesicaria*
	Phacocystis (7)	*C. acuta, C. cespitosa, C. elata, C. nigra, C. quixotiana, C. reuteriana, C. trinervis*
	Limosae (1)	*C. limosa*
	Hispanicae (1)	*C. durieui*
	Clado Tomentosa (1)	*C. tomentosa*
	Paniceae (3)	*C. bicolor, C. olbiensis, C. panicea*
	Clado Flacca (8)	*C. asturica, C. austroalpina, C. brachystachys, C. caudata, C. depauperata, C. flacca, C. grioletii, C. hispida*
	Racemosae (3)	*C. atrata, C. hartmaniorum, C. parviflora*
	Frigidae (1)	*C. frigida*
	Rhynchocystis (3)	*C. leviosa, C. pendula, C. sequeirae*
	Ceratocystis (6)	*C. demissa, C. flava, C. hostiana, C. lepidocarpa, C. nevadensis, C. oederi*
	Strigosae (1)	*C. strigosa*
	Sylvaticae (3)	*C. paui, C. sylvatica, C. vulcani*
	Spirostachyae (13)	*C. binervis, C. camposii, C. distans, C. extensa, C. helodes, C. hochstetteriana, C. laevicaulis, C. laevigata, C. lainzii, C. lowei, C. mairei, C. perraudieriana, C. punctata*
	Clado Castanea (1)	*C. debilis*
	Clado Mollicula (1)	*C. pallescens*
	Paludosae (1)	*C. acutiformis*

Taxonomic classification of the *Carex* species present in the territory. In brackets the number of species.

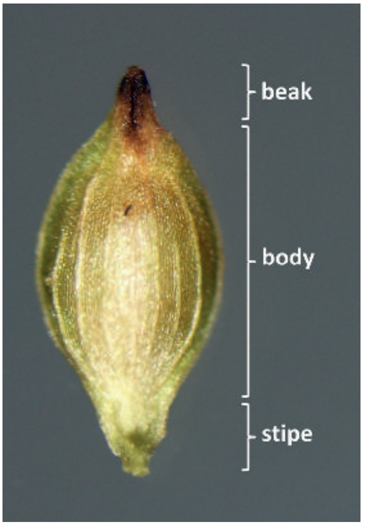
Morphological characteristics

All species of *Carex* are perennial plants, although sometimes, as in the case of *C. oederi*, their life cycle is short. Depending on the length of the rhizome internodes (see Introduction), the **habit** can be densely caespitose (very short internodes), sometimes even forming big tussocks, as in *C. paniculata* and certain species of the *Phacocystis* section (*C. reuteriana* and *C. acuta*, for example). However, other species (for example, *C. arenaria* and *C. divisa*) exhibit aerial stems that are widely spaced out from each other, because the rhizome internodes are very long. The **fertile stems** are trigonous (more rarely cylindrical or almost) and, in species from the territory covered for this guide, they range between 2 cm in height in certain alpine specimens of *C. capillaris* and more than two metres in some robust specimens of *C. pendula and C. leviosa*. The shape and consistency of the leaves conform to the characteristics described for the whole family.

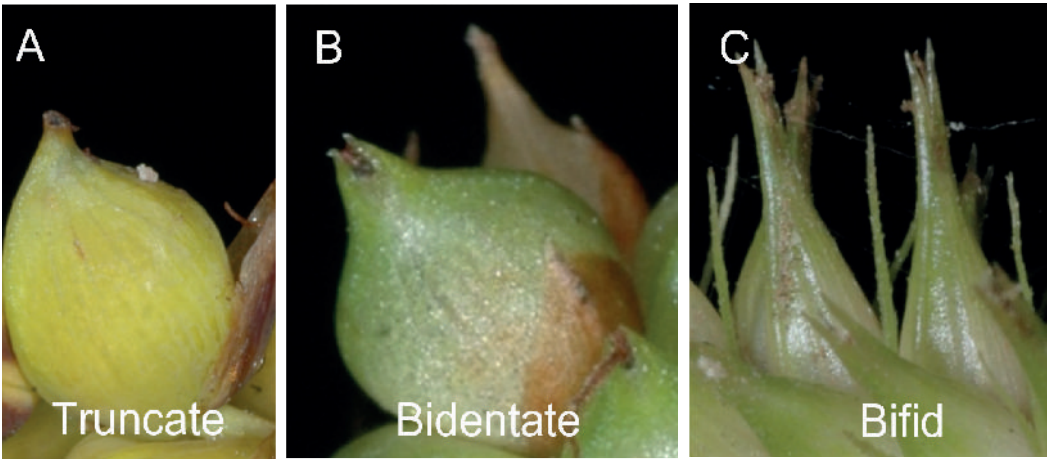
The **flowers** are always unisexual and achlamydeous (without perianth). The male ones are reduced to three stamens arranged in the axil of a glume and the female ones are reduced to a bi- or tricarpellary syncarpous ovary (exceptionally with 4 carpels in some species not present in the territory). The shape, colour, apex, and number of nerves of the glumes provide interesting taxonomic characteristics.

The basic unit of **inflorescence** is the spike, comprising one to numerous spikelets, grouped in turn in spikes, racemes, or panicles. **Spikes** can be **male**, **female**, **androgynous** (with male flowers at the top of the spike and female at the bottom) or **gynecandrous** (female flowers at the top of the spike and male at the bottom). In rare cases, spikelets with male flowers in the apical area, female in the middle and male in the basal area (**androgynecandrous**) or with female flowers at the apex, male in the middle part and female flowers at the base (**gynandrogynous**) may be observed; much more rarely, certain species present an irregular distribution of the sex of the flowers in the spikes (for example *C. bequaertii*, absent from the territory covered by this guide).

The very small female spikelet consists of a rudimentary or short axis (**rachilla**) from which the ovary emerges laterally, and which is fully surrounded by a prophyll which, when the edges are fused and shaped like a small bottle, it is called **utricle**, and when it is squamiform and ± free edged, it is called **glumiform perigynium**, as is the case of the one surrounding the ovary of certain species of *Carex* formerly included in the genus *Kobresia*. The prophyll is also frequently present in branches of lower orders, in which case it is usually hyaline and tubular. In short, the presence of prophyll is indicative of branching. The utricle is perhaps the organ that provides the most characters for the separation of the different *Carex* taxa. It can be divided into three parts: **stipe** or lower part, often very short or rudimentary; **body** or middle part, which is the main part; and **beak** or upper part, sometimes very short or absent and which, broadly speaking, can be one of three types: truncated apex, bidentate, or bifid. When the ovary has three carpels the body of the utricle is trigonous, while when it has two carpels its shape is lenticular (plano-convex or biconvex). The outline, the number of nerves and their greater or lesser prominence, as well as the presence or absence (smooth utricle) of epidermal expansions (papillae, aculei/prickles, or hairs) are also important characteristics for the classification of the species.

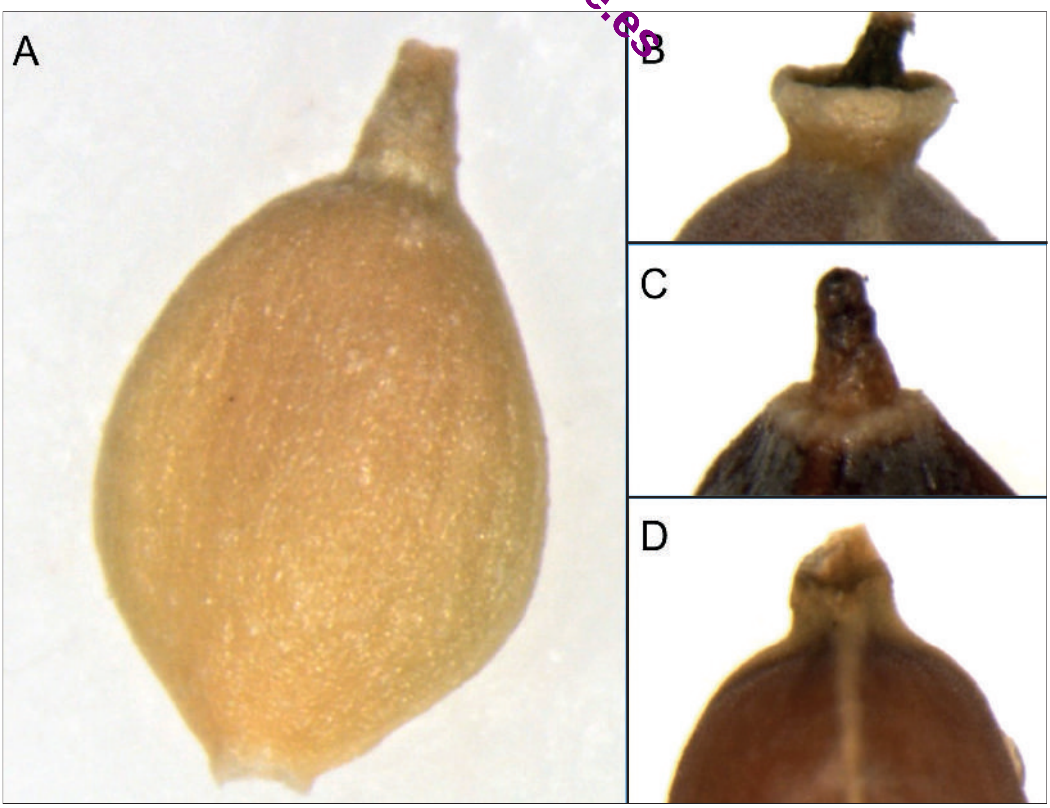


Parts of the utricle in *Carex lucennoiberica*.



Types of utricle beaks according to their apex.
A. *Carex panicea*; **B**. *Carex extensa*; **C**. *Carex vesicaria*.

The **fruit** is an achene whose outline and apex (column-like, cup-like, truncate, etc.) can be useful for separating species.



A. Achene of *Carex praecox* showing a column-like apex. **B**. Cup-like achene apex of *Carex basilaris*. **C**. Truncate achene apex of *Carex caryophyllea*. **D**. Trigonous-columnar achene of *Carex umbrosa* subsp. *umbrosa*.

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KEY OF SPECIES

1. Achenes enfolded by a scale, the margins of which are free or slightly connate at the base (glumiform perigynium) 2

— Achenes enclosed in a bottle-like scale with completely connate margins (utricle) 3

2. Stems terete throughout their length; inflorescence apparently unbranched; sheaths of old leaves accumulated at the base of the plant, very shiny, pale brown .... 7. ***C. myosuroides*** (p. 110)

— Stems ± trigonous above; inflorescence obviously branched; sheaths of old leaves not accumulated at the base, dull, usually dark brown .... 8. ***C. simpliciuscula*** (p. 113)

3. Inflorescence consisting of a solitary terminal spike; lowest bract squamiform, much shorter than spike 4

— Inflorescence consisting of 2-several spikes, very rarely some unispicate stem, but then lowest bract longer than spike 9

4. Dioecious, densely caespitose plants; beak of the utricle curved .... 32. ***C. davalliana*** (p. 184)

— Monoecious, caespitose or not plants; beak of the utricle straight 5

5. Most female flowers showing 3 stigmas 6

— All female flowers showing 2 stigmas 7

6 Utricles suberect, widely ellipsoid to obovoid, abruptly contracted into a beak up to 0.4 mm; spike with up to 8(15) female flowers; rhizome with long internodes; glumes persisting on the spike axis after the fall of the utricles .... 9. ***C. rupestris*** (p. 115)

— Utricles patent or slightly deflexed at maturity, lanceolate, narrowly ovate or elliptic in outline, gradually narrowed into a beak 0.8-1 mm; spike with (12)20-45(67) female flowers; rhizome with very short internodes; glumes falling ± at the same time as the utricles .... 10. ***C. pyrenaica*** (p. 118)

7. Beak of the utricle 0.3-0.5 mm; leaves setaceous; laxly caespitose plants; lower male glumes acute .... 4. ***C. pulicaris*** (p. 101)

— Beak of the utricle 1-2 mm; leaves canaliculate, never setaceous; densely caespitose plants; lower male glumes obtuse 8

8. Utricles ± abruptly contracted into the beak, with at least two prominent veins; female glumes with scarious margins along their entire length; stems (10)20-40 cm; spike (20)25-35 mm long .... 6. ***C. peregrina*** (p. 107)

— Utricles gradually narrowed into the beak, with scarcely perceptible veins; female glumes with narrow scarious margins towards the apex; stems (3)8-20(30) cm; spike (11)15-26 mm long .... 5. ***C. macrostyla*** (p. 104)

9. Spikes similar in appearance, the terminal one always with flower male and female or only female (rarely only male) 10

— Upper spike(s) different in appearance, the terminal one only with male flowers or with a few female flowers at the base or/and the apex 40

10. Stigmas 3 11

— Stigmas 2 16

11. Utricles papillose 12*

— Utricles not papillose 13

12. Utricles black or dark reddish-brown, except the green margins and base; spikes 5-11(16) mm long, always erect .... 82. ***C. parviflora*** (p. 341)

* See page 581.

SECT. *PSYLLOPHORAE*

2. ***Carex distachya*** Desf.

Caespitose. **Stems** (4)15-40(46) cm, trigonous. **Leaves** (0.2)0.5-2(2.8) mm wide, canaliculate, more rarely flat, usually exceeding stems. **Lowest bract** leaf-like, much exceeding inflorescence, with a sheath up to 5 mm. **Inflorescence** oblong, consisting of (1)2-3(4) spikes similar in appearance, distant, pedunculate or the lowermost subsessile; male flowers densely grouped above, and female ones laxly grouped below. **Female glumes** about as long as utricles, acute, hyaline to brownish. **Utricles** (4)4.5-6(7) mm long, suberect, with two prominent veins, gradually narrowed into a truncate, hyaline at the apex, brown in the central parts and green below beak (0.2)0.5-1 mm. **Style base** column-like. Stigmas 3. 2n=68, 70-72, **74**. *Undergrowth of holm oak, cork oak, Pyrenean oak and pine forests, as well as their substitution stages*.

Carex distachya

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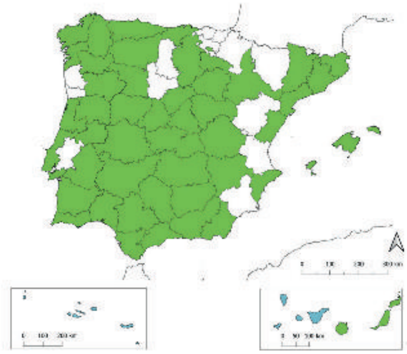
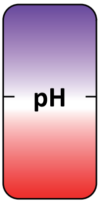
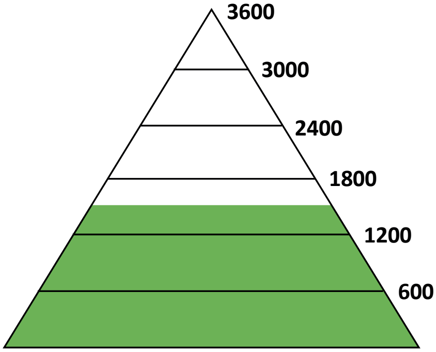
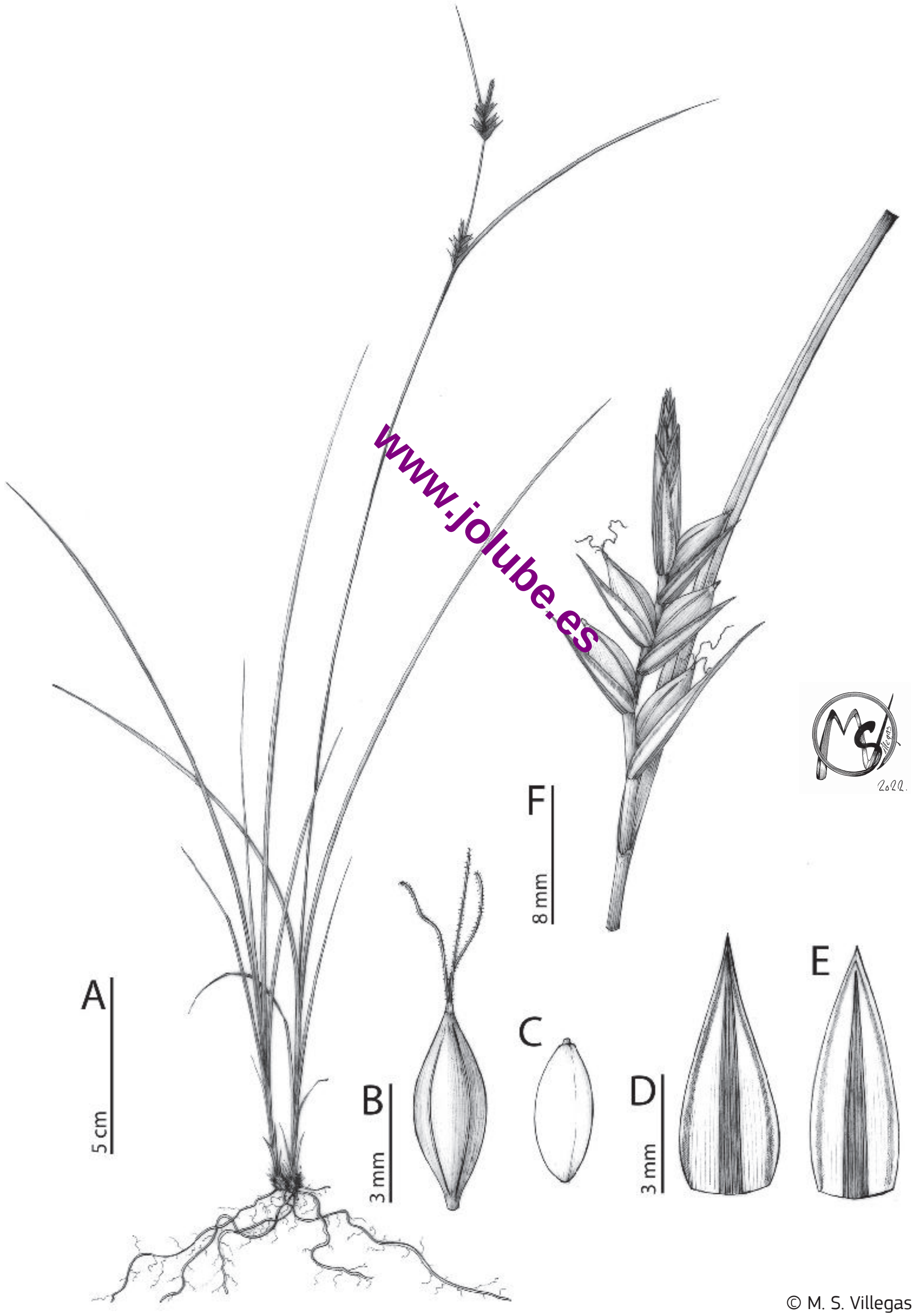






Carex distachya



Carex distachya: A) general aspect of the plant; B) utricle; C) achene; D) female glume; E) male glume; F) androgynous spike.

3. *Carex oedipostyla* Duval-Jouve

Caespitose. **Stems** 11-20(27) cm, trigonous. **Leaves** 1-2.6(3) mm wide, ± flat, exceeding stems. **Lowest bract** leaf-like, much exceeding inflorescence, not sheathing. **Inflorescence** consisting of 2-5 spikes similar in appearance, ± distant, the (1)2(3) upper ones subsessile, the (1)2 lower ones basilar or subbasilar; male flowers densely grouped above, and female ones laxly grouped below. **Female glumes** (excluding the mucro) shorter than utricles, hyaline to greenish, long-mucronate. **Utricles** 3-4(4.5) mm long, suberect, prominently veined, not beaked or with a rudimentary beak up to 0.1 mm. **Rachilla** well developed, shorter than utricles. **Style base** pyramidal. Stigmas 3. 2n=**68**. *Heaths and undergrowth of holm oak, cork oak and pine forests.*

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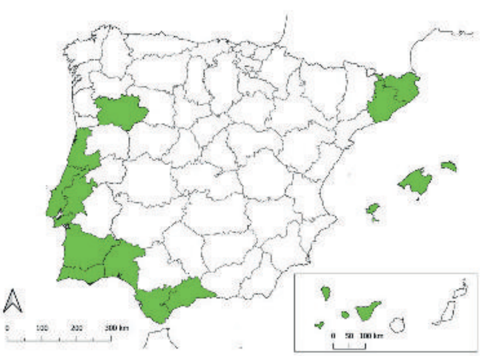
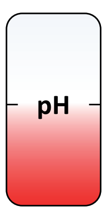
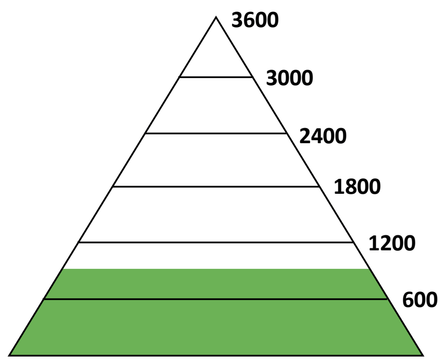
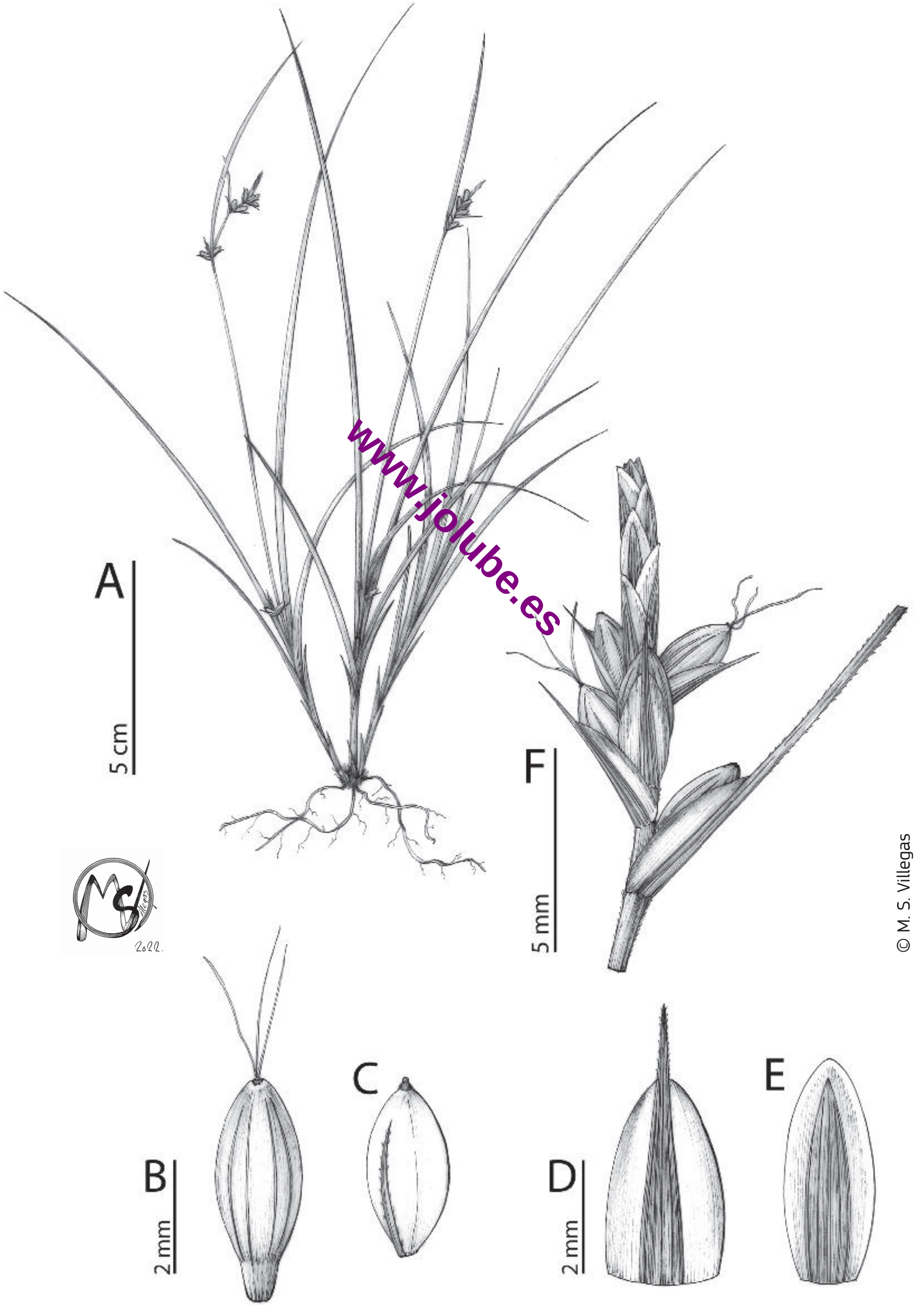






Carex oedipostyla



Carex oedipostyla: A) general aspect of the plant; B) utricle; C) achene and rachilla; D) female glume; E) male glume; F) androgynous spike.

4. *Carex pulicaris* L.

Laxly caespitose. **Stems** (4)10-25(40) cm, obtusely trigonous or terete. **Leaves** 0.2-0.9 mm wide, setaceous, narrowly canaliculate to inrolled, shorter, more rarely longer, than stems. **Lowest bract** glumaceous, having an utricle. **Inflorescence** consisting of a solitary spike 1-3 cm long; male flowers densely grouped above, and female ones laxly grouped below. **Female glumes** soon deciduous, brown, acute or obtuse, with scarious margins. **Utricles** 4-5 mm long, finally deflexed, narrowly fusiform, dark brown to ferruginous, veinless, gradually narrowed into a 0.3-0.5 mm, ± split, truncate, hyaline at the apex beak. Stigmas 2. 2n=58, **60**. *Peat bogs*.

Carex pulicaris

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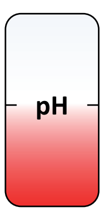

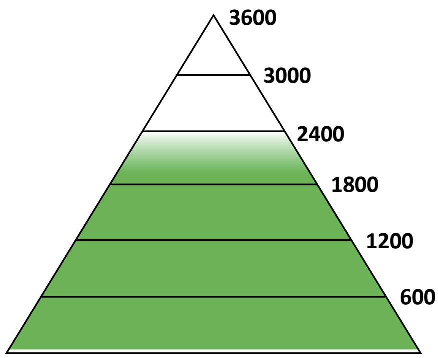

9. *ELEOCHARIS* R. Br.

Molecular data, as well as micromorphological data related to embryo type, indicate that *Eleocharis* should be considered as the only genus of the tribe Eleocharideae, therefore, genera classically accepted due to their characteristic appearance, such as *Egleria* L.T. Eiten and *Websteria* S.H. Wright, are now included in *Eleocharis*. Some recent studies show that the sections that have been accepted are not monophyletic, and future efforts are needed to get an infrageneric classification according to their evolutionary history. For this reason, in the present guide we have not grouped the taxa in sections, but according to their morphological similarity, so that similar species appear close to each other in the text and figures.

Eleocharis shows leaves without a lamina or with a lamina reduced to a short mucro, inflorescence consisting of a solitary spikelet at the end of the stem, with spirally arranged glumes (rarely subdistichous), without involucral bracts, perianth formed by retrorsely scabrid bristles and thickened style base. This genus includes c. 300 species distributed in all regions of the globe except Antarctica. In the territory inhabit 11 species, 3 of which have probably been introduced by humans.

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KEY OF SPECIES

1. Stigmas 2; achene biconvex 2

— Stigmas 3; achene trigonous or subcircular in transverse section 7

2. Upper sheath distinctly inflated and wrinkled above; only the lowest glume sterile 3

— Upper sheaths not inflated nor wrinkled above; the two lowest glumes sterile, more rarely only the lowermost 4

3. Achenes black at maturity .... 7. *E. caduca* (p. 450)

— Achenes pale to dark brown, never black .... 8. *E. flavescens* (p. 452)

4. Only the lowermost glume sterile, surrounding completely the base of the spikelet .... 3. ***E. uniglumis*** (p. 441)

— The two lowest glumes sterile, exceptionally only the lowermost, but then not completely surrounding the base of the spikelet 5

5. Annual, without rhizome; anthers up to 0.5 mm long .... 9. ***E. ovata*** (p. 453)

— Perennial; rhizome with ± long internodes; anthers 1-2.5 mm long 6

6. Style-base arising from a ring or a short neck placed at the apex of the achene; perianth bristles (4)5(6) .... 1. ***E. mamillata*** (p. 433)

— Style-base separated from the apex of the achene by a ± wide groove; perianth bristles (3)4(5) .... 2. ***E. palustris*** (p. 437)

7. Achenes with distinct longitudinal ribs and more faintly marked transverse grooves 8

— Achenes almost imperceptibly reticulate, without prominent ribs 9

8. Stems up to 11(22) cm long; sheaths distinctly scarious, the upper one frequently inflated and split above, obtuse or rounded at the apex; spikelets with (2)5-9(14) flowers .... 5. ***E. acicularis*** (p. 446)

— Stems (8)15-40(57) cm; sheaths herbaceous or scarcely scarious, the upper one not inflated nor split above, subacute or subobtuse at the apex; spikelets with (5)16-35(42) flowers .... 6. *E. bonariensis* (p. 449)

9. Style base separated from the apex of the achene by a ± wide groove; spikelet with (8)14-30(40) flowers .... 4. ***E. multicaulis*** (p. 443)

— Style-base not separated from the apex of the achenes by a groove; spikelet with (3)4-8(9) flowers 10

10. Achenes (1.5)2-2.5 mm long; lower glume usually fertile .... 10. ***E. quinqueflora*** (p. 454)

— Achenes up to 1 mm; lower glume usually sterile, exceptionally fertile .... 11. ***E. parvula*** (p. 456)

1. ***Eleocharis mamillata*** (H. Lindb.) H. Lindb. subsp. ***austriaca*** (Hayek) Strandh.

Not or laxly caespitose; rhizome with long internodes. **Stems** (10)15-50 cm, with stomata whose occlusive cells are longer than subsidiary ones, so that the upper and lower ends of the stomata are convex. **Sheaths** ± herbaceous, the uppermost horizontally truncate at the apex, usually ending in a minute mucro. **Spikelet** 5-13 mm, ellipsoid, ovoid or, more rarely, conical or subglobose, obtuse, rarely acute, dense, with 20-60(86) flowers. **Glumes** 2.5-3.5 mm, lanceolate to ovate, acute or subacute, with scarious margins, the two lower ones sterile, somewhat shorter than the remaining ones, obtuse or rounded at the apex. **Perianth bristles** (4)5(6). Stamens 3. Stigmas 2. **Achenes** 1.2-1.5 mm long, obovoid, more rarely ellipsoid, biconvex, yellowish or reddish-brown, slightly shiny, finely punctate or ± smooth; style-base triangular, distinctly longer than wide, arising from a ring or short neck placed at the apex of the achene, hardly contracted in the area of attachment to the achene. 2n=16, 18. *Lagoon edges and peat bogs in mountains*.

Note: In the territory we have only observed typical forms of this species in the Pyrenees and isolated points in the Cantabrian Mountains; however, in the Iberian System (provinces of Soria and Teruel) there are intermediate forms between this taxon and *E. palustris* which, pending of systematic studies, we provisionally attribute to hybridization events.

Eleocharis mamillata subsp. *austriaca*

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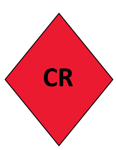

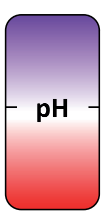

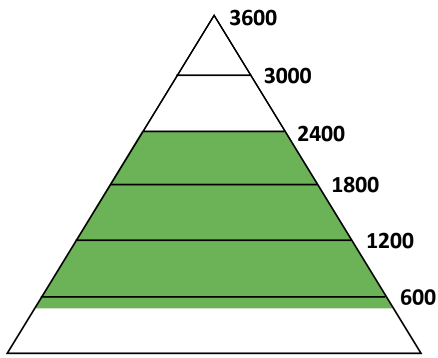

Eleocharis mamillata subsp. *austriaca*

10. *BULBOSTYLIS* Kunth

The genus *Bulbostylis* includes c. 230 species, distributed mainly in tropical and subtropical regions, with a few species in temperate regions of North America, southern Europe and western Asia. After *Fimbristylis*, it is the most biodiverse of the 10 genera that make up the tribe Abildgaardieae. *Bulbostylis* is represented in the territory exclusively by two species, one of them sporadically naturalised. The genus is characterised by the presence of long white hairs at the apex of the sheaths, the inflorescence usually anthelate, the perianth absent and the style glabrous, the base of which is almost always thick and persistent on the achene at maturity.

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KEY OF ESPECIES

1. Stems hairy; inflorescence lax; glumes 2.5-3.5(4.5) mm; achenes (0.8)1-1.3 mm .... 1. ***B. cioniana*** (p. 457)

— Stems glabrous; inflorescence quite dense; glumes 1.7-2.3 mm; achenes 0.7-1 mm ..... 2. *B. thouarsii* (p. 461)

1. ***Bulbostylis cioniana*** (Pi. Savi) Lye

Annual or short-lived perennial, caespitose. **Stems** 5-10 cm, pubescent, prominently ribbed. **Leaves** 0.4-0.5 mm wide, filiform, shorter than stems, usually ciliate towards the apex; basal sheaths ± entire, pale brown. **Bracts** 2, the longer one usually longer than inflorescence.

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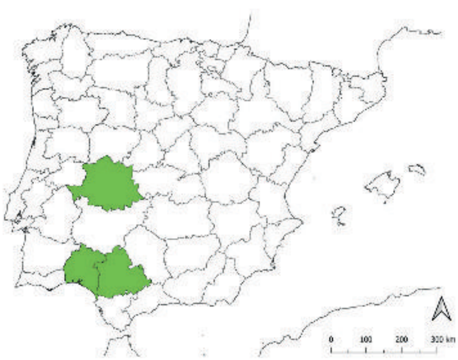
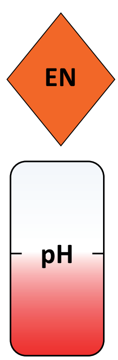
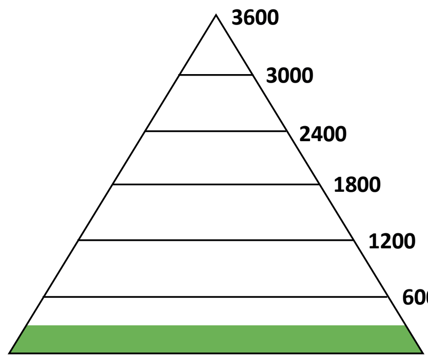






Inflorescence consisting of a simple or compound anthela with (3)5-20 spikelets 3-7 mm long, ovoid or ovate-lanceolate in outline, with 10-15 flowers, usually pedunculate, except often that of the base of the anthela which is sessile. **Glumes** 2.5-3.5(4.5) mm, ovate, slightly keeled, mucronate, shortly pubescent. Stamens 3. Stigmas 3. **Achenes** (0.8)1-1.3 mm long, widely obovoid, trigonous, with each angle highlighted by a rib and very prominent transverse wrinkles; style-base pyramidal, late deciduous. 2n=**10**. *Sandy temporarily flooded soils in stream banks*.

Note: this species was described from northern Italy, from where, in addition to have been considered a non-native plant, it seems to have become extinct. Its native distribution area includes, apart from the central-western and south-western Spain, central and western Africa. Both this species and the following one belong to a group of *Bulbostylis* whose achenes show the style-base deciduous, although very late, which separates them from *Fimbristylis* species, whose stylopodium falls early.


Bulbostylis cioniana


Bulbostylis cioniana

2. *Fimbristylis dichotoma* (L.) Vahl

As in the case of *Bulbostylis thouarsii*, as already mentioned, the presence of *F. dichotoma* in the territory is reduced to a single population recently naturalised in the nurseries of El Saler (Valencia). It is also known as introduced in France, Switzerland and Italy; its autochthonous character in Morocco remains still in doubt. It is included in this guide because it is a crop weed and could spread in the future in the warm areas of the Iberian Peninsula, Balearic Islands and Macaronesia. The species is native from southern two thirds of Africa, Madagascar, Indonesia, Australasia and the American tropics and subtropics, extending as far as the central and eastern United States. Although it is closely related to *F. bisumbellata*, can easily be distinguished from the latter by its perennial life cycle, its stems up to 80 cm and its (2)2.5-3 mm wide spikes, among other characters. 2n=10, 12, 20, 30, 32.

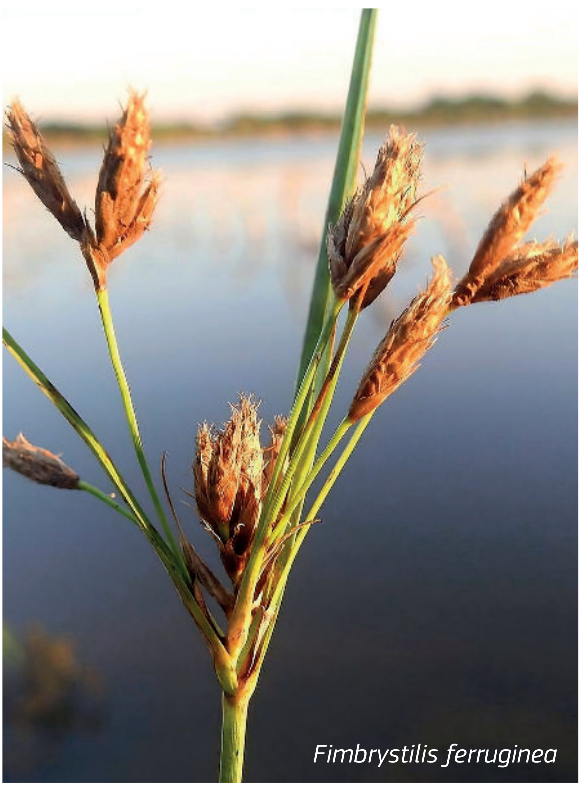

Fimbristylis dichotoma

3. *Fimbristylis ferruginea* (L.) Vahl s.l.

Of the *F. ferruginea* complex at least three species have been accepted, whose taxonomic treatment is far from being resolved: *F. ferruginea* s.s., *F. sieberiana* Kunth and *F. turkestanica* (Regel) B. Fedtsch. All have in common the narrowly winged achenes, without longitudinal ribs or marked transverse grooves. The first two would be characterised by straight stems up to 100 cm, and would be distinguished from each other because *F. ferruginea* s.s. would have coriaceous hairy

basal sheaths, the leaves with a short lamina (up to 10 cm or little longer) and spikelets with an acute apex, while *F. sieberiana* would show herbaceous and glabrous basal sheaths, a much longer lamina (10-20 cm) and subobtuse spikelets; however, recent works consider both taxa as synonyms, so the priority name would be *F. ferruginea* and its natural distribution would cover most of the tropical and subtropical regions, especially those of the Old World.

The name *F. turkestanica* has been applied to plants distributed mainly in Egypt and south-central and south-west Asia. We have had the opportunity to study the type of the latter species and, although it contains plants that are not fully developed, their stems are barely more than 6 cm long and some of them are noticeably curved; however, tall plants with straight stems seem to be the predominant morphotypes in the regions indicated as the homeland of this species. The materials from the territory, both those from Gran Canaria and those from the Spanish Levante, which we included in the MedChecklist and *Flora iberica*, respectively, as *F. turkestanica*, are also plants with long, straight stems. Therefore, pending systematic studies that shed light on this difficult group, we consider the materials from the territory as *F. ferruginea* s.l. Finally, although the populations from the south of Gran Canaria have been sighted recently, the Levantine ones have not been found since their collection in the 1950s in the provinces of Alicante and Valencia. Moreover, the habitat where they were found (mainly rice fields or nitrified reed beds) seems to suggest that these are non-native plants in the territory.



Fimbrystilis ferruginea

12. *BOLBOSCHOENUS* (Asch.) Palla

The genus *Bolboschoenus* is the only representative of the tribe Bolboschoeneae. Fifteen species are currently accepted and their distribution area includes the tropical, subtropical and temperate regions of the world. Only three of them are found in the territory, living on the edges of lagoons and watercourses on predominantly basic substrates, especially saline or sub-saline. The genus is characterised by its rhizome with long, thick internodes ending in ± ovoid tubers; its trigonous and foliose stems; its terminal, anthelate or capitate inflorescences subtended by several foliaceous bracts; its spikelets with spirally arranged glumes; its bisexual flowers with perianth formed by several retrorse-scabrid bristles and their obovoid, smooth achenes, the pericarp of which is made up by three well differentiated layers (exocarp, mesocarp and endocarp).

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KEY OF SPECIES

1. Stigmas 2(3); achenes biconcave or plano-concave, with the outer layer (exocarp) ± as thick as the central one (mesocarp) .... 3. ***B. planiculmis*** (p. 470)

— Stigmas 3(2); achenes plano-convex or subtrigonous, with the exocarp much thicker or much thinner than the mesocarp 2

2. Exocarp much thicker than the mesocarp; inflorescence with 0-2(5) rays up to 35(47) mm; spikelets up to 40(80) mm long .... 2. ***B. maritimus*** (p. 469)

— Exocarp much thinner than the mesocarp; Inflorescence with (1)2-7 rays up to 62(70) mm; spikelets up to 28 mm long .... 1. ***B. glaucus*** (p. 467)

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

Not caespitose; rhizome with long and stout internodes. **Stems** 45-100(150) cm, with acute angles. **Leaves** 2.1-7.2(8) mm wide, flat or carinate, more rarely plicate. **Inflorescence** anthelate, consisting of a basal fascicle of 4-5(6) sessile spikelets and usually (1)2-7 rays 12-62(70) mm ending in fascicles of 1-9(11) spikelets each. **Spikelets** 4-28 mm, oblong-terete or lanceolate in outline. **Glumes** 4-7 mm long, elliptic to ovate, bifid to tetrafid and mucronate at the apex. **Perianth bristles** 4-6, of unequal length, usually persistent. Stamens 3. Stigmas 3. **Achenes** 1.8-3 mm long, usually obovate, obtusely trigonous or plano-convex, brown, shiny, smooth, with the exocarp consisting of a layer of ± isodiametric cells, much thinner than the mesocarp. 2n=108, **110**. *Edges of lagoons and streams often in freshwater, although it may also grow in salt-rich waters*.

Bolboschoenus glaucus

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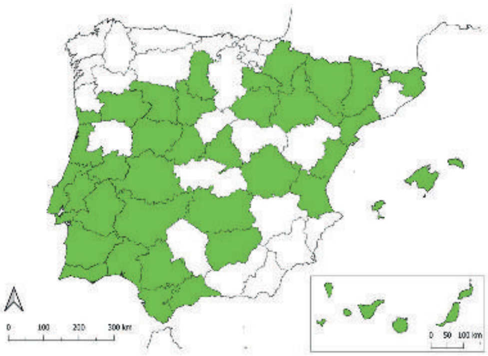
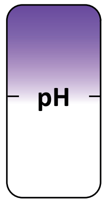
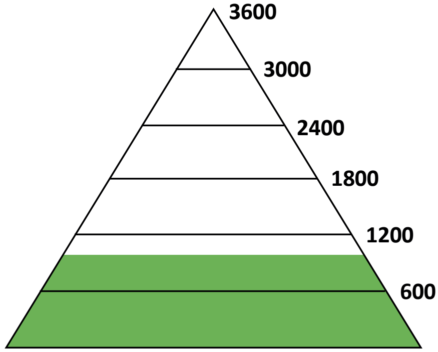


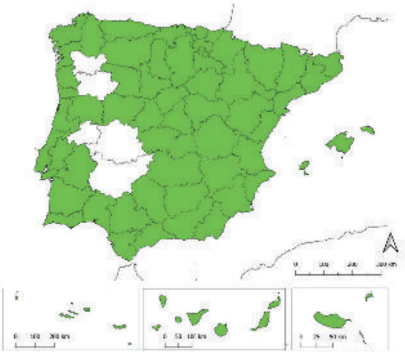


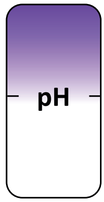


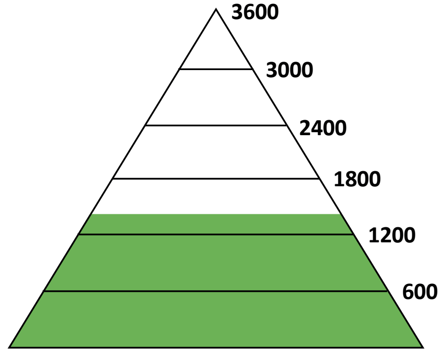
2. *Bolboschoenus maritimus* (L.) Palla

Not caespitose; rhizome with long and stout internodes. **Stems** (10)40-115 cm, with acute angles. **Leaves** 2-7.5(9.5) mm wide, flat or carinate, more rarely plicate. **Inflorescence** capitate, consisting of 1-11 sessile spikelets, or anthelate, with a basal fascicle of 4-5(6) sessile spikelets and 1-2(5) rays 10-35(47) mm, ending in fascicles of 1-4 spikelets each. **Spikelets** 7-40(80) mm, oblong-terete or lanceolate in outline. **Glumes** (4)4.5-8.5 mm long, elliptic to ovate, bifid to tetrafid and mucronate at the apex. **Perianth bristles** 4-6, of unequal length, usually soon deciduous. Stamens 3. Stigmas (2)3. **Achenes** 2.1-3.2(3.4) mm long, usually obovate, subtrigonous or, more rarely, plano-convex, usually dark brown, shiny, smooth, with the exocarp consisting of a layer of much longer than wide cells, much thicker than the meso-carp. 2n=80, 86, 104, 108, 110. *Edges of lagoons and streams often in salt-rich waters.*

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec







3. *Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova

Not caespitose; rhizome with long and stout internodes. **Stems** (20)50-100(110) cm, with acute angles. **Leaves** 2-5.5 mm wide, flat or slightly carinate. **Inflorescence** capitate, consisting of 2-5 sessile spikelets, or anthelate, with a basal fascicle of (2)3-6 sessile spikelets and 1-3 rays 7-30(40) mm, ending in fascicles of 1-3 spikelets each. **Spikelets** (7)10-20(25) mm, ovoid, more rarely ellipsoid or oblong-terete. **Glumes** 5-7 mm long, elliptic to ovate, emarginate to bifid, rarely laciniate or entire, mucronate at the apex. **Perianth bristles** 4-6, of unequal length, usually soon deciduous. Stamens 3. Stigmas 2(3). **Achenes** 2.1-3.2 mm long, usually obovate, biconcave, more rarely, plano-convex, usually dark brown, shiny, smooth, with the exocarp consisting of a layer of longer than wide cells, as thick as the mesocarp. 2n=100-104, 108, 110, 112. *Rice fields*.

Note: this species has been recently discovered on the Iberian Peninsula and Balearic Islands. Although there is no evidence as to whether it is native or introduced, given its geographic proximity to populations considered to be native (France and Italy), and until molecular studies are available to elucidate this, we consider this plant to be native to the territory.

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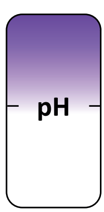
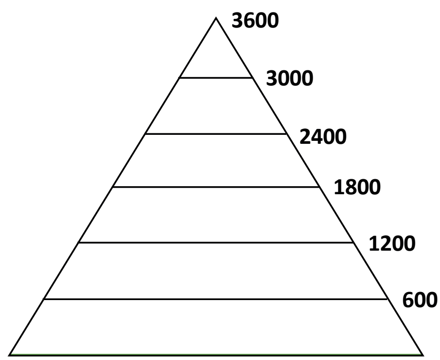
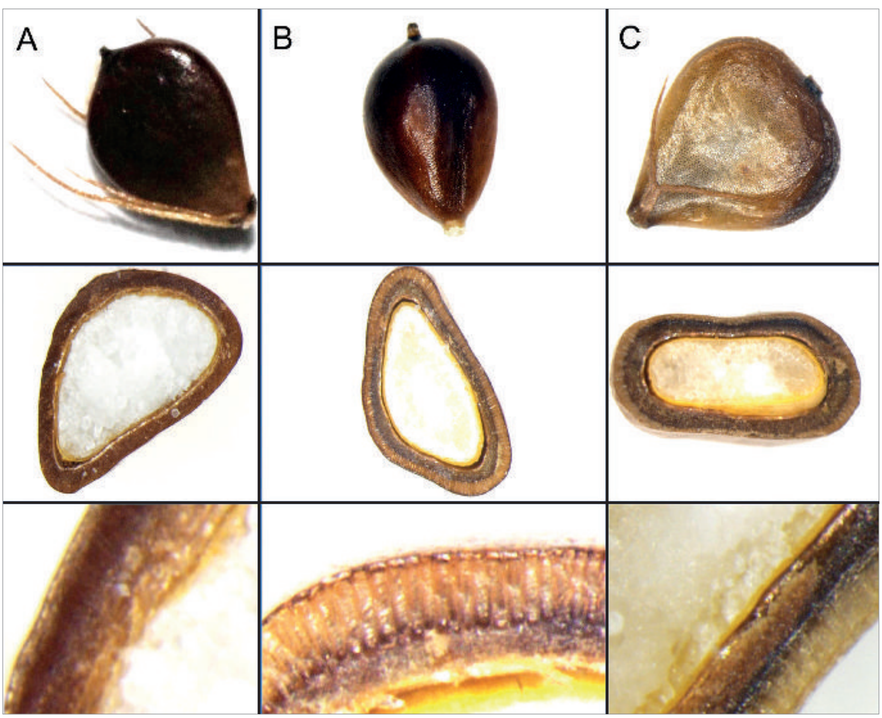
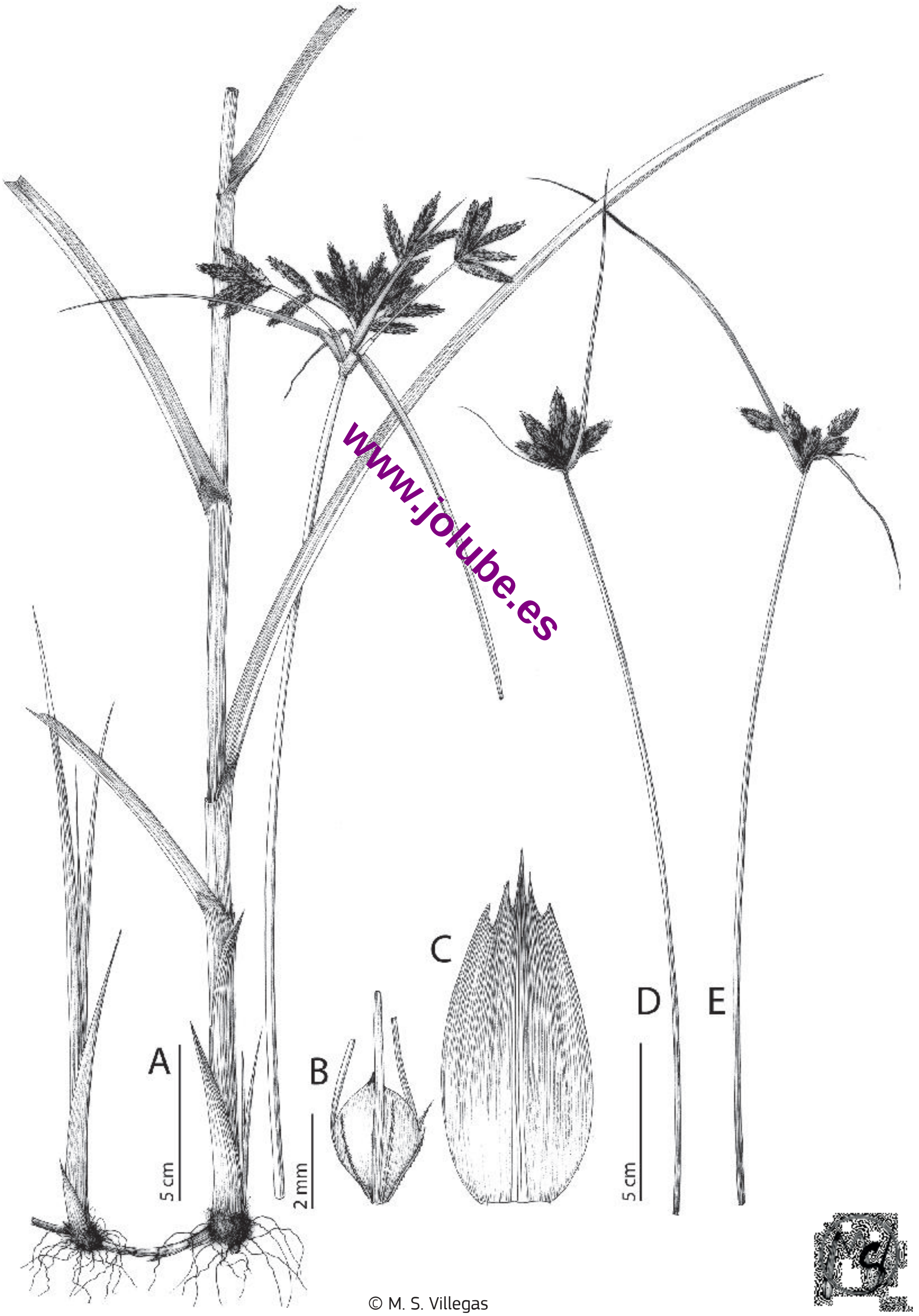




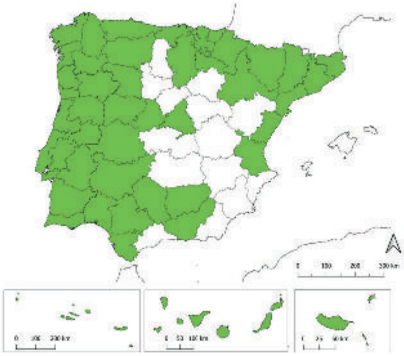
Bolboschoenus planiculmis

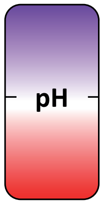


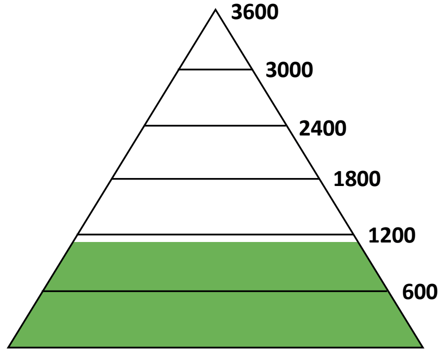
Achene and its cross-section. **A**: *Bolboschoenus glaucus*; **B**: *B. maritimus*; **C**: *B. planiculmis.*



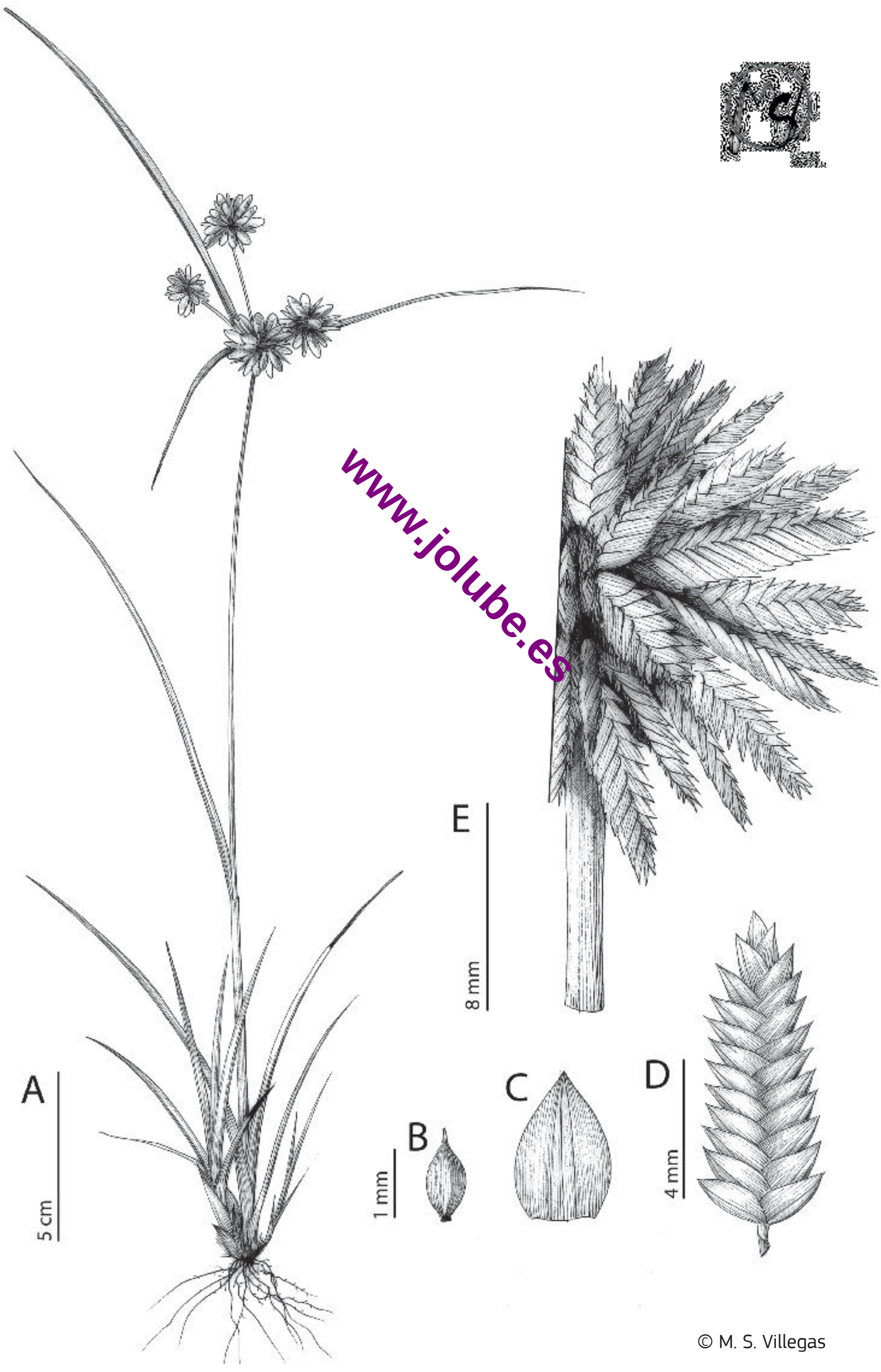
Bolboschoenus glaucus: A) general aspect of the plant and inflorescence; B) achene; C) glume. ***Bolboschoenus maritimus***: D) inflorescence. ***Bolboschoenus planiculmis***: E) inflorescence.







Cyperus eragrostis



Cyperus eragrostis: A) general aspect of the plant; B) achene; C) glume; D) spikelet; E) partial view of a glomerule of spikelets.

Appendix I. Terminological Glossary

A

Abaxial: The surface furthest from the axis in an organ of foliar origin. In leaves, it is synonymous with the underside.

Accrescent: Continuing to increase in size after maturity.

Achene: A dry indehiscent fruit originated from a superior monocarpic or syncarpous ovary containing one seed.

Achlamydeous: Flower lacking perianth (calyx and corolla).

Acidophilous: With affinity for acid soils.

Actinomorphic: Flower radially symmetrical, with more than one plane of symmetry.

Aculeolate: Having pricklets.

Acuminate: Tapering gradually to a long point.

Adaxial: Of the side or surface of an organ, facing towards the axis, e.g., the upper or ventral surface of the lamina.

Adpressed (=appressed): Pressed closely against a surface, but not united with it.

Amphistomatic: Leaves with stomata on both surfaces.

Androecium: Male part of the flower formed of the stamens.

Androgynous (spike): With male flowers at the top and female at the bottom.

Androgynecandrous (spike): With male flowers at the top, female in the middle and male at the bottom.

Anemochory: Wind dispersal of propagules: seeds and fruits, fragments of rhizomes, etc.

Anthela: Cymose, umbel-like inflorescence type with often unequal rays.

Anteligule: Hyaline membrane opposite to the ligule.

Antera: Fertile part of a stamen.

Antrorse: Pointing towards the apex.

Antrorse-scabrid: With pricklets or small teeth pointing towards the apex.

Apiculate: Ending in a short sharp point.

Arista: An awn or stiff bristle.

Articulate: Jointed.

Axil: Angle formed by an organ and its insertion element.

B

Basifixed: Anther which is inserted at its base into the filament of the stamen.

Basilar: Arising from the base of the stem.

Basophilic: Showing affinity for basic soils.

Beak: Apical part of an utricle.

Biconcave: Bifacial organ with concave sides.

Biconvex: Bifacial organ with convex sides.

Bidentate: Ending in two teeth.

Bifid: Divided up to about half-way into two parts.

Bract: Organ of foliar origin arising on the peduncles of an inflorescence.

Bracteole: A small bract arising on the pedicel of a flower.

C

Canaliculate: Organ of foliar origin, the cross-section of which has the shape of a canal.

Capitate: Referring to a dense inflorescence, whose width is ± similar to its length.

Index of taxa: species and subspecies