

Discovery of a disjunct Iberian population and revision of the distribution of the western Mediterranean endemic *Carex olbiensis* (Cyperaceae)

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Abstract. In this paper we report the presence of *Carex olbiensis* (Cyperaceae) in the CW Iberian Peninsula (Sierra de Gredos, Extremadura region), which represents an important disjunction in relation to the known range of the species and its westernmost new limit. We revised the distribution of this species, which resulted in the likely exclusion of the species from the floras of Bosnia-Herzegovina and Morocco. Finally, we provide an illustration of the species and discuss some aspects of its ecology, morphology, and conservation status.

Keywords: *Carex olbiensis*, disjunction, Iberian Peninsula, Mediterranean basin, new record, Sierra de Gredos.

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Introduction

Carex L., with ca. 2000 species, is one of the three largest genera of angiosperms (Roalson *et al.*, 2021), along with *Astragalus* L. and *Bulbophyllum* Thouars (POWO, 2021; WFO, 2021). It displays a subcosmopolitan distribution (all continents except Antarctica), with greater diversification in the temperate and cold regions of the Northern Hemisphere (Reznicek, 1990). The genus originated in East Asia during the late Eocene, from where it dispersed throughout the Northern Hemisphere, later reaching the Southern Hemisphere (Martín-Bravo *et al.*, 2019). The infrageneric classification includes six subgenera, of which the most diversified is the subgenus *Carex*, which has about 1400 species (Villaverde *et al.*, 2020; Roalson *et al.*, 2021).

Carex olbiensis Jord., an endemic to the western Mediterranean basin, was described by the French botanist Claude Thomas Alexis Jordan (1814–1897) from the vicinity of Hyères (Provence, SE of France), current name of the ancient Greek settling called Olbia, which explains its specific epithet (Jordan, 1846). It has been reported from northeastern Spain, southeastern France, most Italy, Corsica, Sicily, Bosnia-Herzegovina, isolated points in northern Algeria and Tunisia, and Morocco (Maire, 1957; Chater, 1980; Duhamel, 1998; Luceño, 2008; Jiménez-Mejías & Luceño, 2011; Bartolucci *et al.*, 2018; Molina *et al.*, 2018; WCSP, 2021; Figure 1). A recent review of *Carex* infrageneric classification

based on molecular phylogenetic studies (Roalson *et al.*, 2021) included this species in subgenus *Carex* section *Paniccae* G. Don, unlike classical treatments primarily based on morphology, that included Jordan's species in section *Careyanae* Tuckerm. ex Kük. (Kükenthal, 1909; Chater, 1980; Luceño, 2008) or section *Siderosticta* Franch. ex Ohwi (Egorova, 1999).

In the course of fieldwork aimed to complete an updated checklist of the flora from the Iberian Central System, we discovered the new population of *Carex olbiensis* herein reported. It was located in CW Spain, on the southern slopes of Sierra de Gredos (Extremadura region).

Materials and Methods

Herbarium vouchers were collected and deposited at UPOS, and identification was achieved by using the relevant literature (Luceño, 2008). We also performed a revision of the reported distribution of *Carex olbiensis* (see introduction) by checking the species reports from databases (e.g. GBIF, JSTOR) and relevant herbarium specimens (if available; see Appendix 1), including countries in which the presence of the species was considered obscure and/or unproved (Bosnia-Herzegovina, Morocco). To evaluate the conservation status of the species at regional level the IUCN (2012a,b) red list categories and criteria were used.

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Figure 1. Distribution map of *Carex olbiensis* based on studied material (blue dots are the specimens from Appendix 1; yellow star is the new population).

Results and Discussion

We report the following new population of *Carex olbiensis*:

Spain: Cáceres: Sierra de Gredos, Jaraíz de la Vera, shady places in *Quercus pyrenaica* Willd. forest, with *Carex depauperata* Curtis ex Woodw. and *Hieracium sabaudum* L., 40°4'32.34"N, 05° 43'24.08"W, 425 m asl, 08-X-2021, R. Sánchez-Villegas, 234RSV21, M. Sánchez-Villegas & M. Luceño, UPOS14378 (see Figure 1).

In the Iberian Peninsula, *Carex olbiensis* was known so far only from northeastern Spain (Catalan Coastal Range), specifically in the coastal and sub-littoral mountain ranges located in Barcelona and Tarragona provinces: Montseny massif, Montnegre Park, Prades mountain range and Ports massif (Bolòs & Vigo, 2001; Royo Pla, 2006; Luceño, 2008). We have not found herbarium specimens supporting its presence in Baix Empordà (Gerona) as reported by Bolòs & Vigo (2001). The population reported here from CW Spain represents the new overall westernmost limit of *C. olbiensis* and an important disjunction in its distribution, since the nearest known populations, in Catalonia, are situated more than 500 km away (Figure 1), which implies a considerable expansion of the species range.

Carex olbiensis inhabits shady understories in Mediterranean forests, mainly of *Quercus ilex* L. subsp. *ilex*, although it can also grow in *Q. suber* L. and *Q. petraea* (Matt.) Liebl. woods (Luceño, 2008; Molina *et al.*, 2018; Viciani *et al.*, 2018). To our knowledge, this is the first time the species has been found in *Q. pyrenaica* Willd. forests, a characteristic tree of the oromediterranean vegetation belt on acid soils in the Iberian mountains (Rivas Martínez, 1985). It is interesting to note that the mean annual rainfall in Jaraíz de la Vera, the closest town to *C. olbiensis* population, is about 1000 mm, like that of the Catalan Coastal Range,

and the population elevation (425 m asl) is also in the known range of the species (between 50 and 1000 m asl). From the morphological point of view (Figures 2, 3), the plants of the Sierra de Gredos population do not show important differences with those studied from Catalonia, France and Italy, except that the leaves of the sterile shoots in the new population can reach 10(–12) mm in width, slightly wider than what is usual in the rest of the populations (up to 8 mm; cf. Chater, 1980; Luceño, 2008). Consequently, although its presence in Sierra de Gredos was not expected due to large disjunction with the nearest population, our finding is not entirely surprising, given the ecological similarities between the *Q. pyrenaica* forests of the southern slopes of Sierra de Gredos and the *Q. ilex* subsp. *ilex* forests of the Catalan Coastal Range; in fact, these forests share many plant species, e.g. *Cistus populifolius* L., *Filago carpetana* (Lange) Chrték & Holub and *Doronicum plantagineum* L. (Ll. Sáez, pers. com.).

Both the IUCN (Molina *et al.*, 2018; distribution map needs correcting) and the Spanish Red List of Threatened Flora (Moreno, 2010) consider the species under the category Least Concern (LC) at the global and Spanish level, respectively. Nonetheless, it is rarely an abundant plant throughout its Western Mediterranean range (Molina *et al.*, 2018). Thus, its distribution is very restricted in Spain (Luceño, 2008), and in Catalonia is considered a rare plant (Bolòs & Vigo, 2001; Royo Pla, 2006), although it is not listed among the threatened Catalan species (Aymerich & Sáez, 2021). The population we herein report from CW Spain has about 80 mature individuals distributed in two small subpopulations separated by about 1.5 km. According to IUCN (2012a,b) criterion D, the species could be considered as Endangered (EN) at the regional level in Extremadura, and, given that the population is located near farms, urgent measures should be taken for its protection.



Figure 2. *Carex olbiensis*. A, General aspect; B, Detail of the red-purple base of the plant; C, Hyaline, long aristate female glumes and utricles showing a short truncate beak; D, Inflorescence.

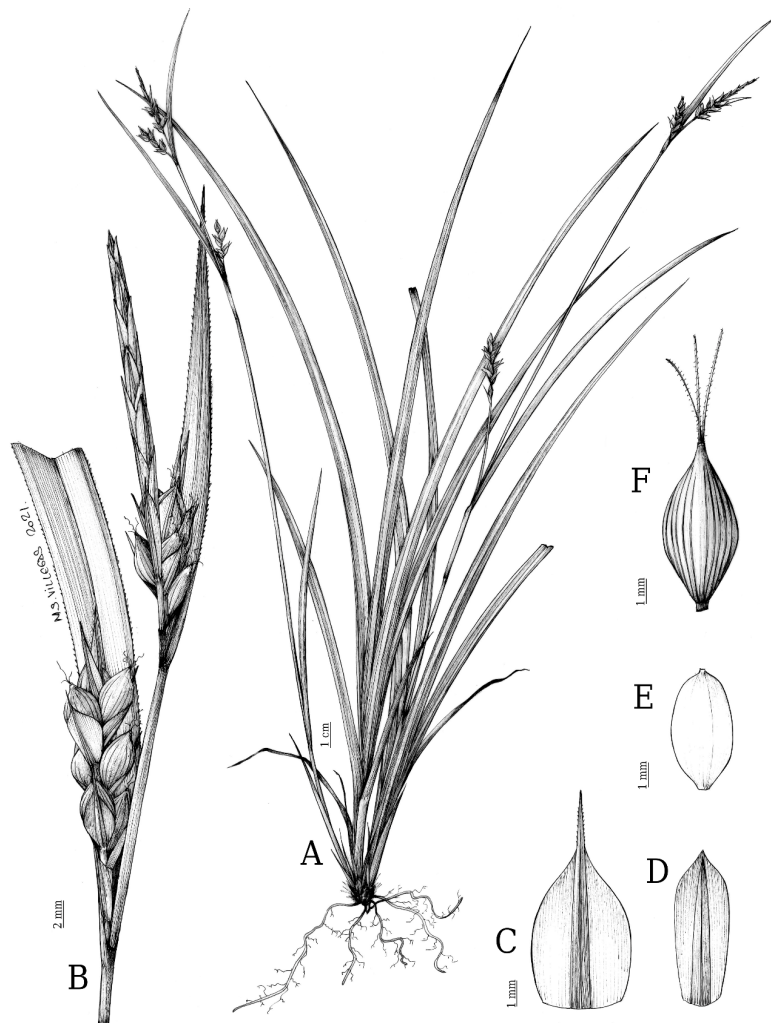


Figure 3. *Carex olbiensis*. A, General aspect; B, Inflorescence; C, Female glume; D, Male glume; E, Achene; F, Utricle.

Our revision of the known distribution of the species indicates that its presence in Bosnia-Herzegovina (Kükenthal, 1909; Chater, 1980; Jiménez-Mejías & Luceño, 2011; Molina *et al.*, 2018) is not confirmed and unlikely. On the one hand, there are no occurrences for this country among the 2155 *Carex olbiensis* records compiled by the GBIF database (GBIF, 2021), and on the other hand, Rohlena (1904), in the protologue of *C. olbiensis* var. *angustifolia* (a synonym of *C. distachya* Desf. (subgenus *Psyllophorae* (Degl.) Peterm.)), indicated that *C. olbiensis* itself had not been found in Herzegovina for 30 years before its work (“...sie wurde schon einmal vor 30 Jahren von Pantocsek in der Herzegovina entdeckt, aber seit dieser Zeit nicht mehr gefunden ce.”). In addition, Kükenthal (1909) reported the plant as present in Herzegovina (“Berge Gliva und bei Billek”) but did not study any vouchers from this country. With respect to Morocco, the only reference to the presence of *C. olbiensis* in that country (Jiménez-Mejías & Luceño, 2011) was probably due to a mistake in the interpretation of the localities provided by Maire (1957) and there are neither records from this country in GBIF (2021).

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Appendix 1. Studied specimens for the distribution map (see Figure 1).

Algeria: Tizi Ouzou: Yakouren, 36.73, 04.44, 16-V-1930, *R. Maire*, BC139328.

France: Corse: Aiacciu, ca. 2 km of Cauro, 41.92, 08.71, 07-V-1989, *M.V. Oosten*, L3776688; *Idem*, Luri, 42.89, 09.40, 10-V-1912, *M.F. Spencer*, US1379761; *Idem*, Sainte/Lucie, près de Bastia, 42.70, 09.42, *F. Schultz*, US3163131. Occitanie: Languedoc/Roussillon, 43.98, 03.50, 30-IV-1933, *J. Vlieger*, WAG305265; *Idem*, Montoliou, 43.32, 02.19, 23-V-1909, *F. Bru*, US2831935; *Idem*, Pyrénées/Orientales, Collioure, près Valbonne, 42.49, 03.05, 20-V-1891, *C. Copineau*, US203067. Provence/Alpes/Côte d'Azur: Var, Bois des Maures, près d'Hyères, 43.14, 06.13, 12-V-1843, *A. Jordan*, G191513 (lectotype!); *Idem*, Var, Gonfaron, 43.29, 06.29, 03-V-1997, *L. Delvosalle*, BR23253339; *Idem*, Var, Collobrières, 43.25, 06.29, 02-V-1996, *L. Delvosalle*, BR23253391; *Idem*, Alpes Maritimes, 43.94, 07.18, 11-IV-1876, *W. Barbey*, US 795138; *Idem*, Var, Les Mayons, 43.3, 06.36, V-1870, *Haure*, BR26124216; *Idem*, Var, Iles d'Hyères, 43.00, 06.22, 24-IV-1868, *Huet & A. Mailho*, MA17992; *Idem*, Alpes Maritimes, Biot, 43.64, 07.10, IV-1906, *C. Bertrand*, US3155174; *Idem*, Alpes Maritimes, Cannes, 43.56, 06.98, IV-1867, *G.C. Joad*, US131861; *Idem*, Var, Tanneron, 43.58, 06.84, 08-V-1968, *Gavelle*, MA274362; *Idem*, Var, Vallou de Mourrefrey, Commune del Mayons du Luc, 43.32, 06.38, 20-IV-1951, *J. Bouchard*, L1364450; *Idem*, Var, Les Mayons, 43.31, 06.36, 01-V-1882, *H. Hanry*, L1364452; *Idem*, Var, Massif des Maures, aux environs d'Hyères, 43.28, 06.38, 20-V-1860, *Chambeiron*, WAG1771337; *Idem*, Alpes Maritimes, Villeneuve/Loubet, 43.62523, 7.123824, 22-IV-2019, *A.H. Paradis*, iNaturalist photo; *Idem*, Var, Les Adrets/de/l'Estérel, 43.546678, 6.811697, *G. Rheas*, iNaturalist photo.

Italy: Marche: ca. of Castelfidardo, Sicilia road, 43.48, 13.54, 30-IV-1979, *S. Ballelli*, PI420720. Toscana: Livorno, Campiglia Marittima, 43.085, 10.628, 19-IV-2017, *D. Fontana*, PI9632; *Idem*, Provinz Grosseto, ca. 18 km N Grosseto, 42.91, 11.15, 30-IV-1999, *R. Karl*, GJO71416; *Idem*, Provinz Grosseto, Monte Argentario, 42.41, 11.15, 28-IV-1933, *W. Freiberg*, MA388140; *Idem*, Provinz Grosseto, Monte Argentario, Convento dei Padri Passionisti, 42.42, 11.16, 1908, PI28141; *Idem*, Provinz Grosseto, Monte Argentario, Porto Ercole, 42.39, 11.20, 1860, PI28136; *Idem*, Provinz Grosseto, La Campigliola, 42.52, 11.51, 13-VI-1973, PI489423; *Idem*, Provinz Grosseto, Le Cionce, 42.47, 11.44, 1908, PI28140; *Idem*, Provinz Grosseto, Roccalbegna, case Pezzano, 42.74, 11.51, 2005, PI28151; *Idem*, Provinz Grosseto, Scarlino, Monte d'Alma, 42.89, 10.86, VI-1995, PI484943; *Idem*, Provinz Grosseto, Monte Leoni, 42.89, 11.09, IV-1993, PI484938; *Idem*, Provincia di Siena, Iesa, 43.10, 11.25, 1991, PI28150; *Idem*, Provinz Grosseto, Roccastrada, Riserva naturale La Pietra, 43.09, 11.09, 2012, PI28149; *Idem*, Provincia di Livorno, Piombino,

case Castello, 42.97, 10.69, 27-IV-1993, PI484314; *Idem*, Provincia di Livorno, Piombino, La Sedia road, 42.96, 10.51, *F. Corti*, PI342098; *Idem*, Provincia di Livorno, Suvereto, 43.08, 10.68, VI-1995, PI484937; *Idem*, Pisa, Monteverdi Marittimo, 43.22, 10.75, 2003, PI28137; *Idem*, Provincia di Livorno, Poggio Pelato, 43.43, 10.43, 2011, PI28138. *Idem*, Pisa, Poggio di Mela, 43.39, 10.63, 22-V-2009, PI28131; *Idem*, Pisa, Castagnolo, 43.67, 10.35, 1860, PI28709. *Idem*, Luca, Via di Vicopelago e di Pozzuolo, 43.82, 10.47, 1860, PI28134; *Idem*, Pisa, San Giuliano Terme, Monte Agresto, 43.77, 10.44, 1908, PI28143; *Idem*, Luca, Monte Pisano, 43.75, 10.48, 2009, PI28147; *Idem*, Pisa, Monte Pisano, 43.78, 10.49, 2009, PI28146; *Idem*, Pisa, Vecchiano, Monte del Legnaio, 43.80, 10.38, 25-IV-2021, *L. Pinzani & A. Giaco*, PI628426. *Idem*, Luca, Monte San Quirico, 43.86, 10.50, 1860, PI28132; *Idem*, Prato, Poggio a Caiano, 43.82, 11.05, 1860, PI28708; *Idem*, Firenze, Impruneta, Scopeti road, 43.70, 11.22, 1908, PI28139; *Idem*, Firenze, Signa, Stazione road, 43.78, 11.06, 2012, PI28145; *Idem*, Prato, Monte Le Coste, 2013, PI28154; *Idem*, Arezzo, Castel San Niccolò, 43.73, 11.65, 1992, PI515014; *Idem*, Arezzo, Bandella road, 43.51, 11.66, 2003, PI515013. Sicilia: Mesina, Mirto, 38.08, 14.75, s.d., *A. Todaro*, PI27695.

Spain: Barcelona: Esparreguera, Montserrat massif, La Momia, 41.59, 01.83, 17-V-1966, *S. Rivas Martínez*, SALA1109; *Idem*, Tibidabo, 41.3895, 02.1517, 2-IV-1912, *J. Cadevall*, BC/Cadevall 823873; *Idem*, Arenys, 41.58, 02.54, 02-V-1948, *T.M. Losa España & J.M. Losa Quintana*, BCN1908; *Idem*, Arenys de Munt, between Subirachs and Creu de Rupit, 41.61, 02.49, 09-V-1948, *P. Montserrat*, SALA27737; *Idem*, Gualba, 41.7257, 02.5015, 13-V-1907, *J. Cadevall*, BC/Cadevall 823871, 823872; *Idem*, Montnegre massif, pr. Sta. Maria, 41.69, 02.58, 19-IV-2001, *A.L. Vallet & A.P. Haase* BCN3193; *Idem*, Montnegre massif, Casa Vella de Maspons, 41.6548, 02.576, 08-V-1949, *P. Montserrat* MA168234; *Idem*, Argentona, 41.55, 02.39, 10-V-1917, *Sennen* MA17983. *Idem*, Montseny massif, Vallcarca, pr. Figaró, 41.73, 02.29, 09-V-1916, *P. Font Quer*, MA17990; *Idem*, Sant Llorenç del Munt, 41.66, 02.05, 13-IV-1881, *J. Cadevall*, MA17989; *Idem*, Argentona, Sant Carles, Font Alvers d'En/Jová, 41.59, 02.38, 18-V-2013, *P. Jiménez Mejías, S. Martín Bravo, E. Maguilla & M. Luceño*, UPOS5111; *Idem*, Pineda de Mar, Montnegre massif, path to Can Domenech, 41.64, 02.63, 19-V-2013, *P. Jiménez Mejías, S. Martín Bravo, E. Maguilla & M. Luceño*, UPOS5110. Cáceres: Jaraíz de la Vera, 40.07565, 5.72335, 08-X-2021, *R. Sánchez-Villegas, M. Sánchez-Villegas & M. Luceño*, UPOS14378. Tarragona: Baix Ebre, Ports massif, costa al Port Roquetes, 40.7988, 0.2736, 21-IV-2000, *F. Royo Pla*, BCN12633; *Idem*, pr. Montroig, c. Muntanya Blanca, 41.08, 0.93, 13-V-1926, *Font Quer*, BC64414; *Idem*, Cornudella, Prades mountain range, Els Cogullons, 41.31, 01.03, 04-IX-

2005, *J. Molero Briones*, BCN37528; *Idem*, Cornudella, Prades mountain range, Siruana, 41.22, 0.91, 21-VI-2008, *J. Felip & J. Molero Briones*, BCN102665, 108171; *Idem*, San Carles de la Rapita, subida desde la Font de Burgá hacia Foradada, 40.6408667, 0.5455611, 11-VI-1999, *C. Aedo et al.*, MA626529.

Tunisia: Jendouba: Aïn Draham, 36.77, 08.66, 27-IV-1963, *M. Couteaux*, MNHNL27492; *Idem*, El Feija National Park, track from Jendouba direction Kroumirie, 36.52222, 08.32784, 25-V-2013, *P. Jiménez Mejías & J.E. Rodríguez*, UPOS5114; *Idem*, Oued Chaid (Oued Bata), 36.48666, 08.3086, 25-V-2013, *P. Jiménez Mejías & J.E. Rodríguez*, UPOS5115.