

Carex hartmaniorum (Cyperaceae), a new species for the Spanish flora

Aaron Pérez-Haase^{1,2}, Pedro Jiménez-Mejías³, Frédérik Andrieu⁴, Lea Richard⁵, Jean-Marc Lewin⁶, Santiago Martín-Bravo³ & Modesto Luceño³

Received: 1 August 2023 / Accepted: 3 November 2023 / Published online: 22 April 2024

Abstract. *Carex hartmaniorum* (sect. *Racemosae*, Cyperaceae) is reported for the first time for Spain, from a single known population in the Cerdanya region (Eastern Pyrenees, Girona province). The main differences with closely related taxa are highlighted, a dichotomous key to differentiate this species from members of section *Racemosae* inhabiting the Iberian Peninsula and the Pyrenees is presented, and some comments on its distribution and ecology are made. A preliminary conservation assessment for Spain resulted in the proposal of the Endangered category of *C. hartmaniorum* for Spain.

Keywords. *Carex*, Cyperaceae, Iberian Peninsula, new record, eastern Pyrenees, Spain.

How to cite: Pérez-Haase, A., Jiménez-Mejías, P., Andrieu, F., Richard, L., Lewin, J.-M., Martín-Bravo, S. & Luceño, M. 2024. *Carex hartmaniorum* (Cyperaceae), a new species for the Spanish flora. *Mediterr. Bot.* 45(1), e90827. <https://doi.org/10.5209/mbot.90827>

Introduction

Carex hartmaniorum A. Cajander is the accepted name for a species that has been frequently named as *C. hartmanii*, but Cajander described this species in honour of the Swedish botanists Carl Johan Hartman and his son Carl Hartman, therefore “*hartmaniorum*” must be the applicable epithet (cf. Koopman, 2022). The species is included in the section *Racemosae* G. Don of the subgenus *Carex*. This section includes 74 accepted species (Roalson *et al.*, 2021) that are distributed mainly in the circumboreal regions, with its greater species diversity in high mountains and arctic tundra. In the southern hemisphere, only five species are disjunctly distributed in South America, which inhabit the Andes, Patagonia and Tierra del Fuego (Jiménez-Mejías *et al.*, 2021). *Carex hartmaniorum* is a western Palearctic species hitherto known from much of Europe, with the exception of Spain, Portugal, Andorra, the British Isles, Iceland, Moldova, most of the Balkans, and Turkey (Jiménez-Mejías & Luceño, 2011). However, the species becomes rarer and its populations more scattered towards Western Europe and Mediterranean peninsulas. Its global distribution extends eastward to central Asia (POWO, 2023).

Recent phylogenetic studies (Martín-Bravo *et al.*, 2019) show that sect. *Racemosae* is monophyletic and that *Carex hartmaniorum* is nested in it, forming a clade together with the morphologically similar *C. adelostoma* V.I. Krecz., *C. buxbaumii* Wahlenb., and *C. holostoma* Drejer. Only *C. hartmaniorum* and *C. buxbaumii* are known from the French Pyrenees. The first one was recently newly reported from some localities in the departments of Pyrénées-Orientales and Ariège (Kleszczewski, 2013), while *C. buxbaumii* is only known from the Gaube Valley (department of Hautes-Pyrénées; Sulmont & Duhamel, 2002).

In the Iberian Peninsula and the Pyrenees, sect. *Racemosae* is poorly represented, since only four out of 74 species included in this section inhabit this region: *Carex atrata* L., *C. buxbaumii*, *C. parviflora* Host and *C. hartmaniorum* (Luceño, 2008; Hamon, 2022; Luceño *et al.*, 2023).

The main goal of this article is to report the presence of *Carex hartmaniorum* in Spain (eastern part of the Pyrenees).

Materials and Methods

This contribution is the result of field work carried out by the authors, focused on the search of *Carex*

¹ Department of Evolutionary Biology, Ecology and Environmental Sciences, Faculty of Biology, University of Barcelona (UB), Barcelona, Spain.

² Biodiversity Research Institute (IRBio), University of Barcelona, Barcelona, Spain.

³ Department of Molecular Biology and Biochemical Engineering, Botany Area, Universidad Pablo de Olavide. Seville, Spain. Email: mlucgar@upo.es (ML: corresponding author).

⁴ National Mediterranean Botanical Conservatory of Porquerolles, Antenne Languedoc-Roussillon, Scientific Park Agropolis-B7, Montferrier on Lez, France.

⁵ Department of Biology, Ecology and Environment (BEE), Faculty of Human and Environmental Sciences (UFR 3), Paul-Valéry Montpellier 3 University, France.

⁶ Mycological and Botanical Society of Northern Catalonia, Perpignan, France.

hartmaniorum populations in the eastern part of the Pyrenees, both in the Spanish (Cerdanya region, Girona province), and in the French (departments of Pyrénées-Orientales and Ariège) sides. Herbarium specimens from *C. hartmaniorum* collected populations were deposited at UPOS (University Pablo de Olavide herbarium). The ecology and distribution of the species in the area are based on field observations compiled in the Simethis database of the National Mediterranean Botanical Conservatory of Porquerolles (<http://si.cbnmed.fr/>) for the Pyrénées-Orientales, as well as the Natural Heritage Inventory Information System (SINP) of Occitanie for additional data in Ariège (<https://sinp-occitanie.fr/>).

The distribution map of *Carex hartmaniorum* in this region has been made using free and open source QGIS. Finally, the conservation status of the species in Spain was evaluated at the national level, following IUCN categories and criteria (IUCN, 2017).

Results and discussion

Carex hartmaniorum A. Cajander

SPAIN: Girona, Cerdanya, Guils de Cerdanya, Clot de Fontamí, by the stream Mata de l'Ós, 42.451184 / 1.866552, 1535 m asl, tall meadow near a stream, 16-VII-2023, A. Pérez-Haase, P. Jiménez-Mejías, F. Andrieu, L. Richard, J.-M. Lewin, S. Martín-Bravo & M. Luceño (UPOS 17500).

As indicated above, *C. hartmaniorum* also inhabits in the French Pyrenees, in the departments of Ariège (only one population known; Natural Heritage Inventory Information System (SINP) of Occitanie: <https://sinp-occitanie.fr/>) and Pyrénées-Orientales (several localities: cf. Kleszczewski, 2013 and Simethis database of the National Mediterranean Botanical Conservatory of Porquerolles: <http://si.cbnmed.fr/>). The closest French locality to the new Spanish population is placed in the municipality of Latour-de-Carol (Pyrénées Orientales). The map in Figure 1 shows the distribution area of this species in the Pyrenees.

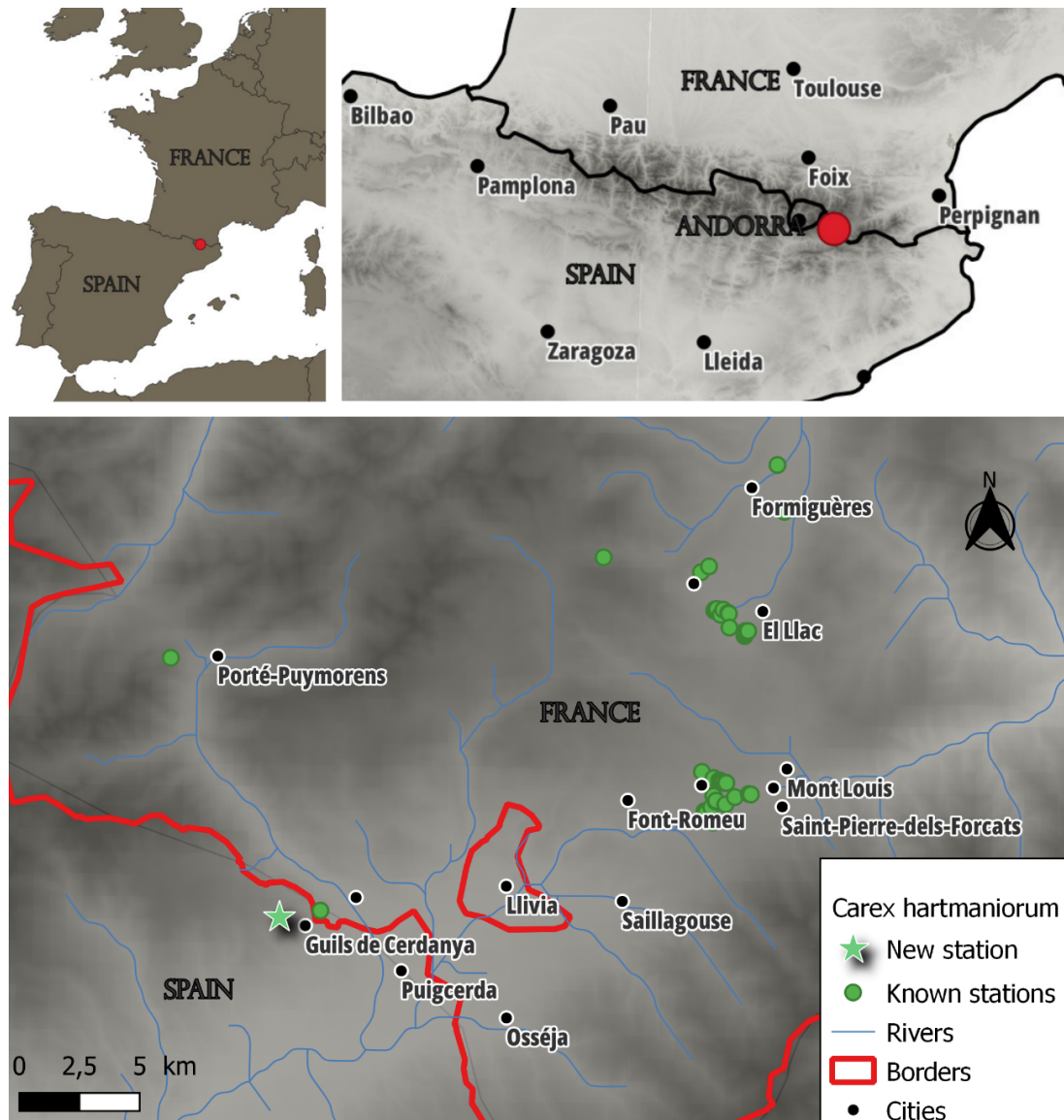


Figure 1. Distribution area of *Carex hartmaniorum* in the Pyrenees.

From a morphological point of view, *C. hartmaniorum* could be confused in the Pyrenees with *C. nigra* (L.) Reichard (sect. *Phacocystis*), from which it is easily differentiated because the latter shows the upper spike entirely male and female flowers with two stigmas, while in *C. hartmaniorum* the terminal spike is gynecandrous, although occasionally it may show a few male flowers at the apex, and the female flowers have three stigmas (Figure 2). Of the remaining species of section *Racemosae* inhabiting the Iberian Peninsula and French Pyrenees (*C. atrata*, *C. buxbaumii* and *C. parviflora*), the most similar is *C. buxbaumii*. The following dichotomous key shows the main morphological differences between the Cantabrian and Pyrenean species of the section *Racemosae*:

1. Spikes erect, in a more or less dense cluster; utricles black or very dark purple except at the margins, which are greenish *C. parviflora*
- Spikes erect, sloping or nodding, not clustered; utricles greenish or slightly dark purple tinged 2
2. At least the lowest spike sloping or nodding, with a peduncle more than 1 cm long *C. atrata*
- All spikes erect, sessile or subsessile 3
3. All spikes more or less oblong-terete, the upper one with male part much shorter than the female one; female glumes acute to shortly aristate; lowest bract much shorter to slightly longer than inflorescence *C. hartmaniorum*
- Lower spikes more or less narrowly ovate, the upper one distinctly obovate, with the male part \pm equaling the female one; lowest bract longer to slightly shorter than inflorescence *C. buxbaumii*

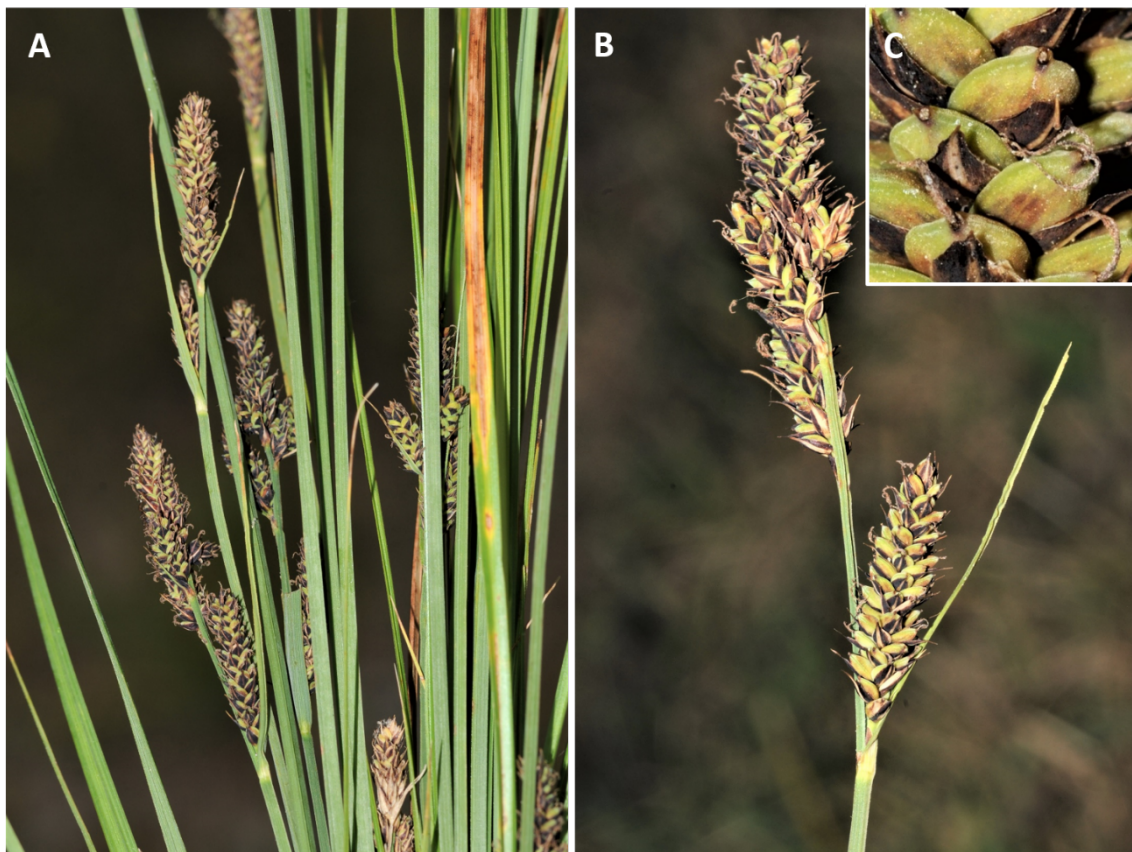


Figure 2. Photographic plate highlighting the main features of *C. hartmaniorum*. A. General aspect; B. Inflorescence; C. Detail of the female part of a spike.

Ecology

In the various *Carex hartmaniorum* habitats in the Pyrénées, the most frequent species are hygrophilous such as *Achillea pyrenaica* Sibth. ex Godr., *Bistorta officinalis* Delarbre, *Caltha palustris* L. *Carex nigra*, *C. disticha* Huds., *C. panicea* L., *Carum verticillatum* (L.) W.D.J. Koch, *Cirsium palustre* (L.) Scop., *Dactylorhiza majalis* (Rchb.) P.F. Hunt & Summerh., *Deschampsia cespitosa* (L.) P. Beauv. subsp. *cespitosa*, *Eriophorum latifolium* Hoppe, *Galium uliginosum* L., *Juncus acutiflorus* Ehrh. ex Hoffm., *J. effusus* L.,

J. conglomeratus L., *Lotus pedunculatus* Cav., *Potentilla erecta* (L.) Raeusch. and *Sanguisorba officinalis* L. In mesohygrophilic to mesophilic grassland, *Carex hartmaniorum* is accompanied with *Anthoxanthum odoratum* L., *Carex pallescens* L., *C. flacca* Schreb., *Danthonia decumbens* (L.) DC., *Genista tinctoria* L., *G. anglica* L., *Holcus lanatus* L. subsp. *lanatus*, *Prunella vulgaris* L., *Ranunculus acris* subsp. *despectus* M. Laínz and *Succisa pratensis* Moench. According to the altitudinal distribution of the main habitats, the species ranges from (1200–) 1400 to 1600 (–2000) m asl.

More precisely, in the new reported Spanish population at Guils de Cerdanya, the species grows at 1535 m asl, on a tall *Molinia caerulea* (L.) Moench (purple moor-grass) meadow, together with other dominant grasses and forbs as *Festuca rivularis* Boiss., *Holcus lanatus* subsp. *lanatus*, *Lotus pedunculatus*, *Betonica officinalis* L. subsp. *officinalis*, etc. The dominant lithology on the valley is formed by lutites from the Paleozoic. As for the land use, we found the population of *Carex hartmaniorum* on the non-grazed side of a livestock fence.

Conservation status of *Carex hartmaniorum* in Spain

The species is known from a single population in Spain with about 10 reproductive individuals. We prospected the area in search of more populations but most suitable habitats (wet meadows) on the valley are grazed by cattle and some signals of severe overgrazing are evident. Taking into account the habitat of the Spanish populations and that of other Pyrenean populations in the French part, it appears that the species require well-conserved tall meadows and probably its habitat could be negatively affected by livestock grazing. More information is required about the impact of grazing on the species habitat, since this is likely a crucial point to be monitored regarding its conservation status. Although considering the low number of mature individuals (a single population with about 10 mature individuals) and quality of habitat threatened in the area, it could be considered as Critically Endangered (CR), but taking into account the fact that there are several French populations in close proximity to it, and considering that propagule migration is highly probable (“rescue effect”), we think that the most appropriate category would be Endangered (EN). Interestingly, the species has also been catalogued as Near Threatened (NT) in France, where it shows an overall demographic decline (Monocorps *et al.*, 2019).

Authorship contribution

AP-H: Conception, design, analysis and interpretation of the data, writing; PJ-M: Conception, design, analysis and interpretation of the data; FA: Analysis and interpretation of the data; LR: Analysis and interpretation of the data, drawing up the distribution map; L-ML: Analysis and interpretation of the data; SM-B: Conception, design, analysis and interpretation of the data, writing; ML: Conception, design, analysis and interpretation of the data, writing, composition of the photographic plate.

All authors participated in the field works, contributed to the critical revision of the text, and approved de final version.

Conflict of interest

None.

References

Hamon, D. 2022. *Carex* de France. Biotope Éditions. Mèze.
IUCN 2017. Guidelines for using the IUCN Red List Categories and Criteria, 13th ed. Standards and Petitions

- Subcommittee. Species Survival Commission. IUCN. Gland. doi: 10.2305/IUCN.CH.2016.RLE.3.en
- Jiménez-Mejías, P., Saldivia, P., Gebauer, S. & Martín-Bravo, S. 2021. A New Remarkable Dwarf Sedge (*Carex phylloscirpoides*) from Northern Chile, with Insights on the Evolution of Austral *Carex* section *Racemosae*. *Syst. Bot.* 46: 34–47. doi: 10.1600/036364421X16128061189567
- Kleszczewski, M. 2013. La Laiche de Hartman (*Carex hartmanii* Cajander), taxon nouveau pour la chaîne pyrénéenne. Poster du CEN Languedoc-Roussillon. In: Bulletin de la Société d’histoire naturelle de Toulouse. Hors-série. 10th International Symposium of Pyreneo-Cantabric Mountains Botany. Pp. 41–52. Société d’histoire naturelle. Toulouse.
- Koopman, J. 2022. *Carex* Europaea. The genus *Carex* L. (Cyperaceae) in Europe, vol. 1, 3rd ed. Margraf Publishers. Weikersheim.
- Luceño, M. 2008. *Carex* L. In: Castroviejo, S., Luceño, M., Galán, A., Jiménez-Mejías, P., Cabezas, F. & Medina, L. (Eds.). *Flora ibérica*, vol. 18. Pp. 109–250. Real Jardín Botánico – CSIC. Madrid.
- Luceño, M., Sánchez-Villegas, R., Quirós-de-la-Peña, B., Sánchez-Villegas, M., Martín-Bravo, S., Maguilla Salado, E., Escudero Lirio, M., Benítez-Benítez, C., Villaverde Hidalgo, T., Jiménez-Mejías, P., Márquez-Corro, J.I., Sanz Arnal, M. & Míguez Ríos, M. 2023. Guía de campo de las ciperáceas de España y Portugal. Ed. Jolube. Jaca.
- Martín-Bravo, S.; Jiménez-Mejías, P., Villaverde, T., Escudero, M., Hahn, M., Spalink, D., Roalson, E.H., Hipp, A.L. & Global *Carex* Group. 2019. A tale of worldwide success: Behind the scenes of *Carex* (Cyperaceae) biogeography and diversification. *J. Syst. Evol.* 57: 695–718. doi: 10.1111/jse.12549
- Monocorps, S., Sibley, J.P., Colas, H., Gigot, G., Arzhvaël, J. & Kirchner, F. (Coord.). 2019. La liste rouge des espèces menacées en France. Chapitre Flore vasculaire de France métropolitaine. IUCN Comité Français - Conservatoires Botaniques Nationaux - Agence Française pour la Biodiversité - Muséum National D’Histoire Naturelle. Paris.
- Roalson, E.H., Jiménez-Mejías, P., Hipp, A.L., Benítez-Benítez, C., Bruederle, L.P., Chung, K.-S., Escudero, M., Ford, B.A., Ford, K.A., Garner, M., Gebauer, S., Gehrke, B., Hahn, M., Hayat, M.Q., Hoffmann, M.H., Jim, X.-F., Larridon, I., Lévêille-Bourret, É., Lu, Y.-F., ... & Zhang, S.-R. 2021. A framework infrageneric classification of *Carex* (Cyperaceae) and its organizing principles. *J. Syst. Evol.* 59: 726–762. doi: 10.1111/jse.12722
- Sulmont, E. & Duhamel, G. 2002. Découverte de *Carex buxbaumi* Wahlenb. en vallée de Cauterets (Hautes-Pyrénées). *Le Monde des plantes* 7(474): 27–28.

Websites

- Jiménez-Mejías, P. & Luceño, M. 2011. *Cyperaceae*. In: Euro+Med Plantbase - the information resource for Euro-Mediterranean plant diversity. <https://www.emplantbase.org/home.html> [Accessed 30 July 2023]
- POWO. 2023. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. <http://www.plantsoftheworldonline.org> [Accessed 30 July 2023]