

ACCEPTED AUTHOR'S VERSION OF THE MANUSCRIPT

***Carex distachya* (Cyperaceae) with both subspecies in Europe**

**DOI 10.37427/botcro-2025-013**

Jacob Koopman<sup>1</sup>, Helena Więclaw<sup>2</sup>, Sandro Bogdanović<sup>3</sup>, Teodor T. Denchev<sup>4</sup>

<sup>1</sup> ul. Kochanowskiego 27, 73-200 Choszczno, Poland

<sup>2</sup> University of Szczecin, Institute of Marine and Environmental Sciences, Adama Mickiewicza 18, 70-383 Szczecin, Poland

<sup>3</sup> University of Zagreb, Faculty of Agriculture, Department of Agricultural Botany, Svetošimunska cesta 25, HR-10000 Zagreb, Croatia

<sup>4</sup> Bulgarian Academy of Sciences, Institute of Biodiversity and Ecosystem Research, 2 Gagarin St., 1113 Sofia, Bulgaria

Please cite this article as: Koopman, J., Więclaw, H., Bogdanović, S., Denchev, T.T.: *Carex distachya* (Cyperaceae) with both subspecies in Europe. Acta Botanica Croatica, DOI: 10.37427/botcro-2025-013.

This is a PDF file of a manuscript that has been language edited and accepted for publication. The manuscript will be technically edited, formatted and checked by the author before publication in its final form.

Short communication

## ***Carex distachya* (Cyperaceae) with both subspecies in Europe**

Jacob Koopman<sup>1</sup>, Helena Więclaw<sup>2</sup>, Sandro Bogdanović<sup>3\*</sup>, Teodor T. Denchev<sup>4</sup>

<sup>1</sup> ul. Kochanowskiego 27, 73-200 Choszczno, Poland

<sup>2</sup> University of Szczecin, Institute of Marine and Environmental Sciences, Adama Mickiewicza 18, 70-383 Szczecin, Poland

<sup>3</sup> University of Zagreb, Faculty of Agriculture, Department of Agricultural Botany, Svetošimunska cesta 25, HR-10000 Zagreb, Croatia

<sup>4</sup> Bulgarian Academy of Sciences, Institute of Biodiversity and Ecosystem Research, 2 Gagarin St., 1113 Sofia, Bulgaria

\* Corresponding author e-mail: sbogdanovic@agr.hr

Running title: *CAREX DISTACHYA* IN EUROPE

**Abstract** – *Carex distachya* Desf. is a circum-Mediterranean species. Since 1985 two varieties have been distinguished, *C. distachya* var. *distachya* and *C. distachya* var. *phyllostachioidea* Ö.Nilsson. The former is widespread, while the latter is considered to be restricted to West Türkiye and the East Aegean Islands, but our research has revealed that *C. distachya* var. *phyllostachioidea* is much more widespread in the south-east of Europe, in Croatia, Bulgaria, Montenegro, and mainland Greece. It seems to have been overlooked in these countries so far. As *C. distachya* var. *phyllostachioidea* occurs in the East Mediterranean region, we have therefore raised this taxon to subspecies level. Our research has also shown that the differences between the two subspecies are less clear than initially suggested. An upgraded key is therefore added.

**Keywords:** *Carex*, herbarium revision, identification key, Mediterranean, morphology

### **Introduction**

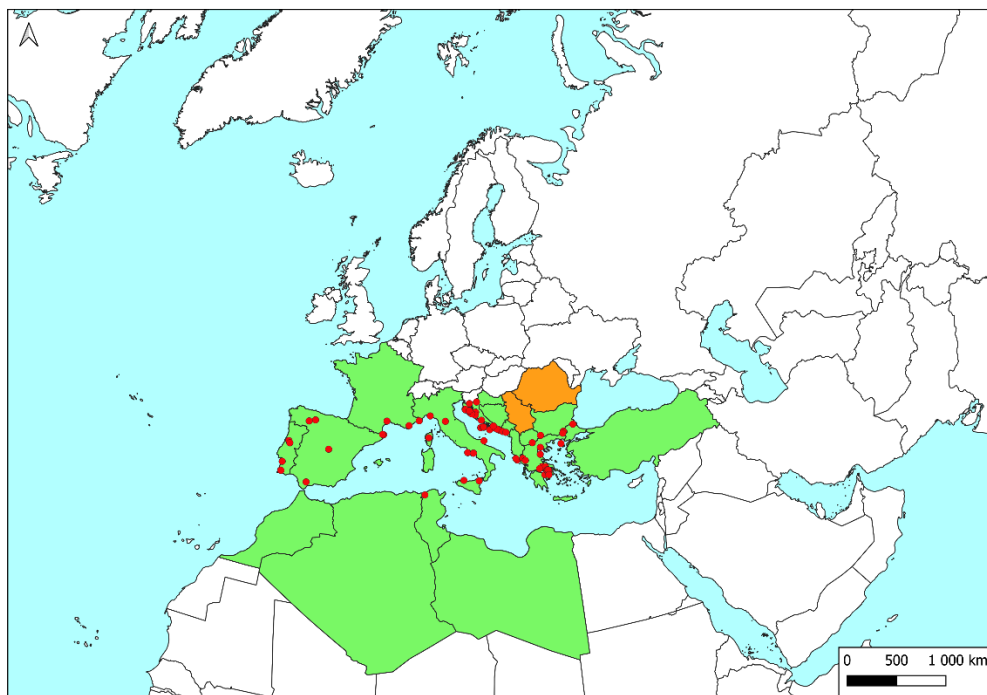
The genus *Carex* L. (Cyperaceae) is species-rich, with more than 2000 species worldwide (POWO 2023). In Europe, Chater (1980) mentioned 180 species of *Carex*, while Koopman (2022) presents 235 species. The difference is partly due to the arbitrary use of the borders of Europe. Koopman (2022) included the three Caucasus countries, Armenia, Azerbaijan and Georgia, where several carices specific for the Caucasus or more Asian species which have their western border in the Caucasus can be found. On the other hand, since 1980 several new species have been described for Europe as well, e.g. *C. randalpina* B.Walln. (Wallnöfer 1993), *C. pallidula* Harmaja (Harmaja 2005), and *C. castroviejoi* Luceño & Jim.Mejías (Jiménez-Mejías & Luceño 2009). Molina et al. (2008a, 2008b) described another ten taxa within the section *Phaestoglochin* Dumort., including seven new species. Finally, some species have been discovered recently as new for Europe, e.g. *C. kurdica* Kük. ex Hand.-Mazz. (Jiménez-Mejías et al. 2013).

Chater (1980) put *C. distachya* Desf. into subgenus *Indocarex* Baillon, together with *C. phyllostachys* C.A.Mey. The former occurs in dry places in South Europe, in France, Spain,

Portugal, Italy, Croatia, Bosnia and Herzegovina, Montenegro, North Macedonia, Albania, Greece, Bulgaria, and European Türkiye; the occurrence in Serbia and Romania needs confirmation (Koopman 2022; Fig. 1). It occurs also in North Africa (Algeria, Libya, Morocco, and Tunisia), as well as in Asian Türkiye. The last mentioned *C. phyllostachys*, a forest plant, was only known in Europe from W North Macedonia till 1980. More recently it has been found in several other (South) East European countries: Greece (Bergmeijer 1988, Authier 1997), Albania (Barina and Pifkó 2011), Italy (Wagensommer et al. 2014), and Croatia (Terlević et al. 2021). *Carex phyllostachys* is also known from Türkiye, Russia (Caucasus), Armenia, Azerbaijan, Georgia, and Iran (Koopman 2022).

Nilsson (1985) followed Chater (1980) by putting *C. phyllostachys* and *C. distachya* in subgenus *Indocarex* (Baillon) Kük., but added also *C. illegitima* Ces. to this subgenus. *Carex phyllostachys* and *C. illegitima* are both in section *Phyllostachys* (Torrey & A.Gray ex J.Carey) Bailey by Nilsson (1985), *C. distachya* is housed in section *Schiedeanae* Kük., although Nilsson (1985) is said to have treated this section within the subgenus *Indocarex* tentatively, and maybe it would be better to treat this section in subgenus *Carex*, close to section *Hallerianae* Asch. & Graebn. More recently, Roalson et al. (2021) placed *C. phyllostachys* in subgenus *Psyllophora* (Degl.) Peterm., in section *Psyllophorae* Degl.

Nilsson (1985) distinguished two varieties in *C. distachya*: *C. distachya* var. *distachya* and *C. distachya* var. *phyllostachioidea* Ö.Nilsson, the former being widespread in the Mediterranean (Fig. 1), the latter endemic to West Türkiye and the East Aegean Islands (Greece).



**Fig. 1.** Distribution of *Carex distachya* subsp. *distachya*. The map of the subspecies distribution (in green) follows Koopman (2022). It is also found on São Miguel, Azores. For the countries designated in orange, confirmation is needed. The red dots show the records indicated in the On-line Supplementary Material.

For many botanists the latter is a rather unknown taxon, as few botanists have ever visited the East Aegean Islands and/or do not have access to The Flora of Türkiye vol. 9, in which Nilsson described *C. distachya* var. *phyllostachioidea* (Nilsson 1985: 622). Moreover, as far as

we know, apart from the description by Nilsson (1985) there has never been anything else written about *C. distachya* var. *phyllostachioidea*. Therefore, this taxon has stayed almost unnoticed since its description in 1985. Nilsson (1985) distinguished the two varieties as follows: leaves 0.5–1.5 mm broad; utricles almost veinless, beak not scabrid – *C. distachya* var. *distachya*; leaves 0.9–2.5 mm broad; utricles with 2 distinct veins, beak somewhat scabrid – *C. distachya* var. *phyllostachioidea*. The two distinct veins on the utricles are often difficult to see, but the differences in leaf width as well as the tiny teeth on the beak of *C. distachya* var. *phyllostachioidea* are clearly visible. Besides, in our opinion, the inflorescences of *C. distachya* var. *phyllostachioidea* are often significantly larger than those of *C. distachya* var. *distachya*.

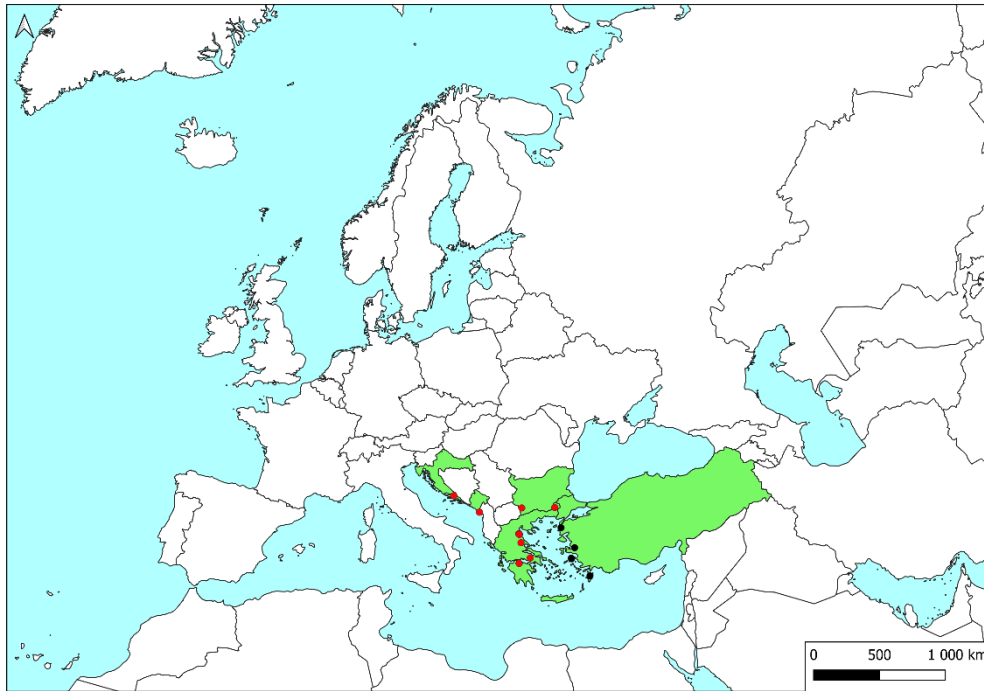
As, according to Nilsson (1985), *C. distachya* var. *phyllostachioidea* is restricted to West Türkiye and the East Aegean Islands near the West coast of Türkiye, we have reckoned so far “automatically” all the found and collected material in South Europe to *C. distachya* var. *distachya*. In this article, we present our current knowledge of the distribution of *C. distachya* var. *phyllostachioidea* in Eurasia, which is probably not complete yet.

### Material and methods

In this article we have analysed material of *C. distachya* s.l., available in B, BG, CL, CNHM, SOM, ZA, ZAGR, and the first author’s private herbarium, in total 95 collections (see On-line Supplementary material). In the Results below, collections with duplicates and exsiccates in several herbaria are counted only once. The herbarium acronyms follow Thiers (2024), the nomenclature Koopman (2022). All material has been checked against the characters of both *C. distachya* varieties given by Nilsson (1985), mentioned in the Introduction above.

### Results and discussion

In May 2023 we found *C. distachya* on the Croatian island of Vis. The material had very narrow leaves and rather small inflorescences, so it was obviously *C. distachya* var. *distachya*, with smooth beaks. However, when we compared this material with all our previous collections, we came soon to the conclusion that several of these older collections are significantly different, with wider leaves, tiny teeth on the outside of the beak, and a larger inflorescence, hence belonging without any doubt to *C. distachya* var. *phyllostachioidea*, which is therefore proved to occur over a much larger area than so far known. Of the 95 herbarium collections studied in total, 83 belong to *C. distachya* var. *distachya* and 12 to *C. distachya* var. *phyllostachioidea*. The latter has been found and collected in Bulgaria, Croatia, Greece, and Montenegro, and was originally given for West Türkiye and the East Aegean Islands (Greece) by Nilsson (1985) (Fig. 2). *Carex distachya* var. *phyllostachioidea* is restricted to the East Mediterranean (Fig. 2).



**Fig. 2.** Distribution of *Carex distachya* subsp. *phyllostachioidea*. Four black dots in Türkiye represent localities reported by Nilsson (1985). Red dots represent new localities found in this study, and they are reported in the On-line Supplementary Material.

We therefore raise this variety here to subspecies rank:

*Carex distachya* subsp. *phyllostachioidea* (Ö.Nilsson) Jac.Koopman, Więclaw, Bogdanović & T.Denchev **stat. nov.**

≡ *Carex distachya* var. *phyllostachioidea* Ö.Nillson in P.H.Davis (ed.), Fl. Turkey 9: 622 (1985)

Holotype: [Islands] Samos, valley W. of Leka, 200–400 m, Runemark & Snogerup 18861 (LD!)

However, the differences between the subspecies need some refinement. According to Nilsson (1985) the beak of *C. distachya* var. *distachya* is not scabrid, but smooth. A drawing of the utricles of both taxa is given by Nilsson (1985: p. 83). But in the material, we have studied we could see on several specimens a few tiny teeth on the beak of some utricles of further typical *C. distachya* var. *distachya*, i.e. with leaves (far) less than 1.5 mm wide. Often in one and the same spike or inflorescence there are utricles with a smooth beak and some have one or a few tiny teeth on the beak. On the other hand, material of typical *C. distachya* var. *phyllostachioidea*, i.e. with flat leaves mostly more than 2 mm wide, has several teeth on every utricle beak.

It is rather amazing that in the floristically best explored continent in the world, Europe, a new *Carex* taxon could be discovered, *C. distachya* subsp. *phyllostachioidea*. Of course, geographically, the East Aegean Islands, part of Greece, do belong to Europe. But Nilsson (1985) as well as Koopman (2022) count these islands as belonging botanically to West Asia. Anyway, our study has revealed that this taxon also occurs in several (other) South-eastern European countries, where it seems to have been overlooked so far. Further research is needed to find out the exact distribution of the two taxa, especially of *C. distachya* subsp. *phyllostachioidea*. The study of herbarium material in other countries may reveal the

occurrence of *C. distachya* subsp. *phyllostachioidea* there, too. Finally, its occurrence may not be restricted to Eurasia; it may occur also in North Africa, in the countries in which *C. distachya* subsp. *distachya* has been recorded (Fig. 1). Both taxa occur in all four countries where we could find *C. distachya* subsp. *phyllostachioidea*: Bulgaria, Croatia, Greece, and Montenegro, and also in Türkiye.

Key for identifying the two subspecies of *Carex distachya*

Leaves 0.5–1.5 mm broad; utricles almost veinless, beak smooth or some utricles with 1–4 tiny teeth at each beak side ..... *C. distachya* subsp. *distachya*  
Leaves 0.9–2.5 mm broad, flat; utricles with 2 distinct veins, all beaks scabrid, with more than 4 tiny teeth at each beak side ..... *C. distachya* subsp. *phyllostachioidea*

### Acknowledgments

We are grateful to the curators and staff of B, BG, CL, CNHM, SOM, ZA, and ZAGR for having access to their herbarium collections. Thanks also to Piotr Kobierski (Górzyń, PL) for compiling both the distribution maps, and to Zhivko Barzov (BG) for sending us some material of *C. distachya* subsp. *phyllostachioidea* from Bulgaria.

### References

- Authier, P., 1997: *Carex phyllostachys* C.A. Meyer, une rare et intéressante espèce de la flore de Grèce. *Lagascalia* 19(1–2), 927–936.
- Barina, Z., Pifkó, D., 2011: Distribution of *Carex distachya* in Albania. *Botanica Serbica* 35(2), 125–130.
- Bergmeijer, E., 1988: Floristic notes on the Kato Olimbos area (NE Thessaly, Greece). *Willdenowia* 17, 37–58.
- Chater, A. O., 1980: *Carex* L., In: Tutin, T. G., Heywood, V. H., Burges, N. A., Moore, D. M., Valentine, D. H., Walters, S. M., Webb, D. A., (eds.), *Flora Europaea*, vol. 5, 290–323. Cambridge University Press, Cambridge.
- Harmaja, H., 2005: *Carex pallidula*, nom. nov. *Annales Botanici Fennici* 42(3), 221–222.
- Jiménez-Mejías, P., Luceño, M., 2009: *Carex castroviejoi* Luceño & Jiménez-Majías (Cyperaceae), a new species from North Greek mountains. *Acta Botanica Malacitana* 34, 231–233.
- Jiménez-Mejías, P., Martín-Bravo, S., Amini-Rad, M., Luceño, M., 2013: Disentangling the taxonomy of *Carex acuta* s.l. in the Mediterranean basin and the Middle East: Reevaluation of *C. panormitana* Guss. and *C. kurdica* Kük. ex Hand.-Mazz. *Plant Biosystems* 148(1), 64–73. <http://dx.doi.org/10.1080/11263504.2012.758675>
- Koopman, Jac., 2022: *Carex* *Europaea*, vol. 1 (3<sup>rd</sup> ed.). Margraf Publishers, Weikersheim.
- Molina, A., Acedo, C., Llamas, F., 2008a: Taxonomy and new taxa in Eurasian *Carex* (Section *Phaestoglochin*, Cyperaceae). *Systematic Botany* 33(2), 237–250. <https://doi.org/10.1600/036364408784571563>
- Molina, A., Acedo, C., Llamas, F., 2008b: Taxonomy and new taxa of the *Carex divulsa* aggregate in Eurasia (section *Phaestoglochin*, Cyperaceae). *Botanical Journal of the Linnean Society* 156(3), 385–409. <https://doi.org/10.1111/j.1095-8339.2007.00760.x>
- Nilsson, Ö., 1985: *Carex* L. In: Davis, P. H. (ed.), *Flora of Turkey and the East Aegean Islands*, vol. 9. Edinburgh University Press, Edinburgh.
- POWO, 2023: Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. Retrieved September 17, 2023 from <http://www.plantsoftheworldonline.org/>.

- Roalson, E. H., Jiménez-Mejías, P., Hipp, A. L., Benítez-Benítez, C., Bruederle, L., Chung, K.-S., Escudero, M., Ford, B. A., Ford, K., Gebauer, S., Gehrke, B., Hahn, M., Hayat, M. Q., Hoffmann, M. H., Jin, X.-F., Kim, S., Larridon, I., Léveillé-Bourret, É., Lu, Y.-F., Luceño, M., 2021: A framework infrageneric classification of *Carex* (Cyperaceae) and its organizing principles. *Journal of Systematics and Evolution* 59(4), 726–762. <https://doi.org/10.1111/jse.12722>
- Terlević, A., Koopman, Jac., Więclaw, H., Rešetnik, I., Bogdanović, S., 2021: *Carex phyllostachys* (Cyperaceae), a new species in Croatia. *Acta Botanica Croatica* 80(1), 106–111. <https://doi.org/10.37427/botcro-2021-002>
- Thiers, B., 2024+ continuously updated. Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium. Retrieved January 10, 2024 from <http://sweetgum.nybg.org/science/ih/>.
- Wagensommer, R. P., Perrino, E. V., Silletti, G. N., 2014: *Carex phyllostachys* C.A. Mey. (Cyperaceae) new for Italy and phytogeographical considerations. *Phyton* (Horn, Austria) 54(2), 215–222. [https://doi.org/10.12905/0380.phyton54\(2\)2014-0215](https://doi.org/10.12905/0380.phyton54(2)2014-0215)
- Wallnöfer, B., 1993: Die Entdeckungsgeschichte von *C. randalpina* B. Wallnöfer spec. nov. (= "*C. oenensis*") und deren Hybriden. *Linzer Biologische Beiträge* 25(2), 709–744.

ACCEPTED MANUSCRIPT