Short communication

Confirmation of the presence of *Eleocharis mamillata* (H.Lindb.) H.Lindb. subsp. *austriaca* (Hayek) Strandh. (Cyperaceae) in Piedmont (Italy)

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Abstract - *Eleocharis mamillata* subsp. *austriaca* belongs to *Eleocharis* subser. *Eleocharis*. The presence of this entity in the Italian territory was known for almost all the Alpine administrative regions and for Calabria. According to the Portal to the Flora of Italy, this entity was reported for Piedmont based on erroneous records. Nevertheless, during a wide herbarium survey on the subseries *Eleocharis*, several old and recent specimens collected in Piedmont have been identified as *Eleocharis mamillata* subsp. *austriaca*. Therefore, we can confirm the presence of the *taxon* in this region and provide a distribution map on the basis of the analysed material.

Key words: herbarium, northern Italy, systematics, taxonomy.

Riassunto - Conferma della presenza di *Eleocharis mamillata* (H.Lindb.) H.Lindb. subsp. *austriaca* (Hayek) Strandh. (Cyperaceae) in Piemonte (Italia).

Eleocharis mamillata subsp. *austriaca* appartiene a *Eleocharis* subser. *Eleocharis*. La presenza di questa entità in Italia era nota per quasi tutte le regioni alpine e per la Calabria. Come riportato dal Portale della Flora d'Italia, per il Piemonte questa entità era stata indicata sulla base di segnalazioni erronee. Tuttavia nel corso di un'ampia indagine erbariologica sulla subserie *Eleocharis*, diversi campioni antichi e recenti sono stati determinati come *Eleocharis mamillata* subsp. *austriaca.* Possiamo quindi confermare la presenza di questo *taxon* in questa regione e fornire una mappa distributiva basata sul materiale analizzato.

Parole chiave: erbario, Italia settentrionale, sistematica, tassonomia.

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INTRODUCTION

Eleocharis mamillata (H.Lindb.) H.Lindb subsp. *austriaca* (Hayek) Strandh. belongs to *Eleocharis* R.Br. subser. *Eleocharis,* which includes species with Holartic distribution (Bureš *et al*., 2004). The subspecies is distributed, with some lacunae, mainly in upland regions of northern and central Europe from Great Britain and Spain to Ukraine reaching Norway and the Svalbard Islands to the North, and Azerbaijan to the East (see Walters, 1980; Jiménez-Mejías & Luceño, 2011). *E. mamillata* subsp. *austriaca* mainly develops in marshlands, on the banks of lakes and streams, usually on basic soils (Walters, 1980). From a phytosociological point of view, this taxon becomes part of the communities of the *Phragmition communis* Koch 1926 and *Glycerio-Sparganion* Br.-Bl. et Sissingh in Boer 1942 (Pignatti *et al*., 2017). This entity was reported for Piedmont in the first Check-list of the Flora of Italy (Conti *et al*., 2005) but shortly after Ercole *et al*. (2012) suggested to investigate in depth the actual presence of the taxon in the region. In the second Check-list of the Flora of Italy *E. mamillata* subsp. *austriaca* was reported for all the northern regions from Aosta Valley to Friuli Venezia Giulia with the exception of Piedmont (Bartolucci *et al*., 2018), where it was considered present in the past based on erroneous records (see also the Portal to the Flora of Italy, http:/dryades.units.it/floritaly: Galasso *et al*., 2020; Martellos *et al*., 2020). It should be noted, however, that Pignatti *et al*. (2017) indicated the presence of this subspecies also for the Cuneo territory (Piedmont). In addition, very recently Bartolucci *et al*. (2019) reported *E. mamillata* subsp. *austriaca* also for a mountain area of Calabria on the basis of an ancient herbarium specimen formerly identified as *E. palustris*. During a wide revision of the herbarium materials belonging to the subseries *Eleocharis* (see Lastrucci *et al*., 2018, 2020), the presence of some specimens attributable to *E. mamillata* subsp. *austriaca* from Piedmont was put in evidence, confirming the presence of the taxon in the region. In this work, we analyse the herbarium material from Piedmont determined as *E. mamillata* subsp. *austriaca,* highlighting the diagnostic morphological characters related to achenes and stomata, and mapping the distribution of the studied specimens.

MATERIALS AND METHODS

The analysed specimens come from the herbaria of Florence (FI) and Turin (TO, Herbarium codes according to Thiers, 2021). In particular, as regards FI, the Herbarium Centrale Italicum (hereafter FI-HCI; see: Moggi, 1993; Cuccuini & Lastrucci, 2007) was investigated, while as regards to TO, the General Herbarium and the Pedemontanum Herbarium were surveyed (hereafter TO-HG and TO-HP; see: Forneris, 1993).

The observation of achenes was performed under a binocular microscope Zeiss 47-50-52 9901 and a Dino-Lite Digital Microscope. For the stomata analysis, for each specimen we took a fragment of the middle part of the culm under the spikelet (see Strandhede, 1966) subsequently immerging it in a solution of glycerol and water (1:80 dilution), brought to a boil and then cooled for 15 minutes. Epidermis was then removed using lancets and tweezers, and some fragments were stained with toluidine (0.05% in water) and mounted on a slide. Stomata were thus observed and measured (µm) under an optical microscope at a magnification of 40×.

The distribution map of the analysed specimens was performed using the opensource software QGIS (version 3.18).

RESULTS

Nine specimens from several localities of Piedmont have been determined as *E. mamillata* subsp. *austriaca.* In addition, two ancient specimens coming from sites very close to the current Italian border were added at the list of records, testifying the presence of the taxon in the Moncenisio area. The distribution maps of the Italian specimens analysed is shown in Fig. 1.

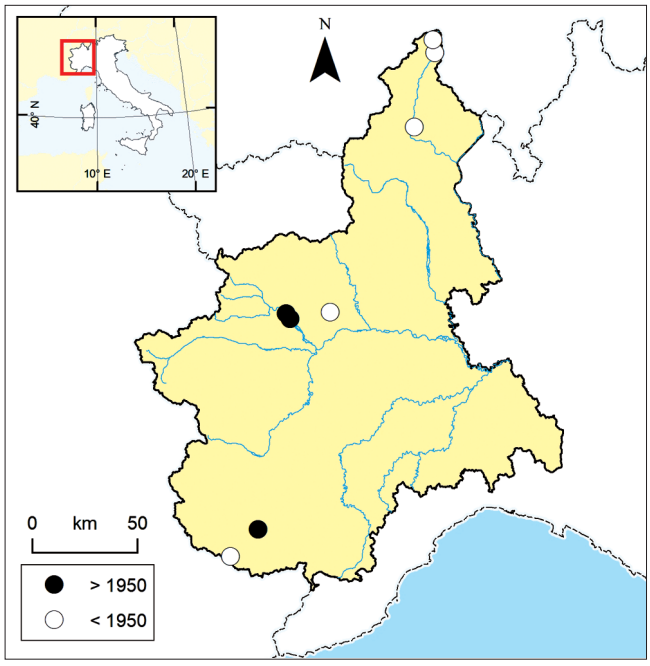

Fig. 1 - Distribution maps of the Italian specimens analysed. White dots: specimens collected before 1950. Black dots: specimens collected after 1950. / Mappa di distribuzione dei campioni italiani analizzati. Cerchio bianco: campioni raccolti prima del 1950. Cerchio nero: campioni raccolti dopo il 1950.

Specimina visa

France. Luoghi umidi alpini del Cenisio presso alla Gran Croce, 29/07/1834, *F. Parlatore* (FI-HCI barcode FI061866); M. Cenis. Nördlich vom See, 22/07/????, *F. Ungern-Sternberg* (TO-HP). **Italy, Piedmont.** Valle Gesso, pozza d'acqua stagnante al Piano del Vallasco presso la mulattiera, 1760 m, 14/07/1897, *O. Boggiani* (FI-HCI barcode FI061864); L. umidi a Beura (Ossola), 01/09/1897, *G. Gola* (TO-HP); Valle Formazza, acquitrini alla Fontana di S. Michele lungo la mulattiera da Chiesa a Valdo, 1259 m, 30/07/1914, *O. Boggiani,* (FI-HCI barcode FI061867); Destra dell'Orco tra Bosconero e S. Benigno, 16/09/1915, *E. Ferrari, F. Vallino & E. Mussa* (TO-HP); Valle Formazza, sotto Riale, 01/08/1924, *O. Boggiani* (FI-HCI barcode FI061865); Grange di Nole, lungo la Stura di Lanzo, 24/06/1986, *D. Rosenkrantz* (TO-HP); *ibidem*, 04/07/1986 (TO-HP); Stura River, Nole Canavese, province of Torino, NW Italy, along the river, 15/08/1992, *E. Martinetto* (TO-HP); Alpi Marittime, Valle Stura, Moiola, zona paludosa nell'alveo del fiume, 28/05/2002, *M. Pascale*, (TO-HP).

DISCUSSION

The distinction between *E. mamillata* subsp. *austriaca* and *E. palustris* s.l. is often critical because it is basically founded on the morphology of the achenium and the stylopodium, present only on mature specimens, or on micro-morphological characters that are difficult to observe (Strandhede, 1966; Jiménez Mejías & Luceño, 2008). In fact, in the *E. palustris* group the stylopodium is generally separated from the achenium by a sort of constriction that is missing in the *E. mamillata* subsp. *austriaca* in which sometimes, instead, the stylopodium rests on a short jamb (Jiménez Mejías & Luceño, 2008). The bristles surrounding the achenium can have a diagnostic value in the distinction between the two groups, because *E. palustris* has mainly 4 bristles while *E. mamillata* subsp. *austriaca* more than 4 bristles (mainly 5 or less frequently 6); nevertheless, especially in *E. mamillata* subsp. *austriaca*, there may be a certain variability and also 4 bristles can be present, leading to an overlap with *E. palustris* (Strandhede, 1966; Walters, 1980; Jiménez Mejías & Luceño, 2008).

Among the micro-morphological characters, the analysis of stomata plays a great importance, as in the *E. mamillata* group the stomatal guard cells are longer than the subsidiary cells, protruding at the end of the stomata (Strandhede, 1966) so that the short side of the stoma appears convex (Jiménez Mejías & Luceño, 2008), while the reverse situation occurs in the *E. palustris* group.

According to Jiménez Mejías & Luceño (2008) another differential micro-anatomical character lies in the number of epidermal cells separating the collenchyma strings, which are predominantly 1-3 in *E. palustris* group and mostly 3-5 (or more, see Strandhede, 1966) in *E. mamillata*, although also in in this case a certain variability may lead to overlaps between the two groups (Jiménez Mejías & Luceño, 2008). On the contrary, the number of vascular bundles, used in some dichotomous keys (e.g. Pignatti, 1982), does not have great taxonomic value as it strongly depends on the circumference of the stem (Strandhede, 1966).

The chromosomal number, useful to distinguish only *E. palustris* subsp. *waltersii* from the *E. mamillata* group and *E. palustris* subsp. *palustris,* is not a character suitable in a herbarium study.

Within the *E. mamillata* group, the stylopodium has a high diagnostic value, being mostly mamillate in *E. mamillata* subsp. *mamillata* and, on the contrary, conical and generally narrow and long in *E. mamillata* subsp. *austriaca* (Strandhede, 1966).

Based on the results of the analyzed characters, in particular the shape of the stylopodium and stomata (Fig. 2), several specimens from the two consulted herbaria can be determined as *E. mamillata* subsp. *austriaca*. This allows to confirm the presence of this taxon in Piedmont (Fig. 1), from which it was instead excluded in the recent checklist of the Italian vascular flora (Bartolucci *et al*., 2018) and subsequent updates (Portal to the Flora of Italy, http:/dryades.units.it/floritaly).

E. mamillata subsp. *austriaca* from Piedmont is present in the studied collections both with ancient specimens, collected by nineteenth-century and early twentieth-century botanists, but also with exsiccata dating back to the early twenty-first century, at least in TO-HP. Almost all the specimens were originally determined as *Eleocharis palustris,* except that collected in Nole Canavese, originally attributed to *E*. cfr. *palustris* but later attributed to *E. mamillata* subsp. *austriaca*, as stated on the label.

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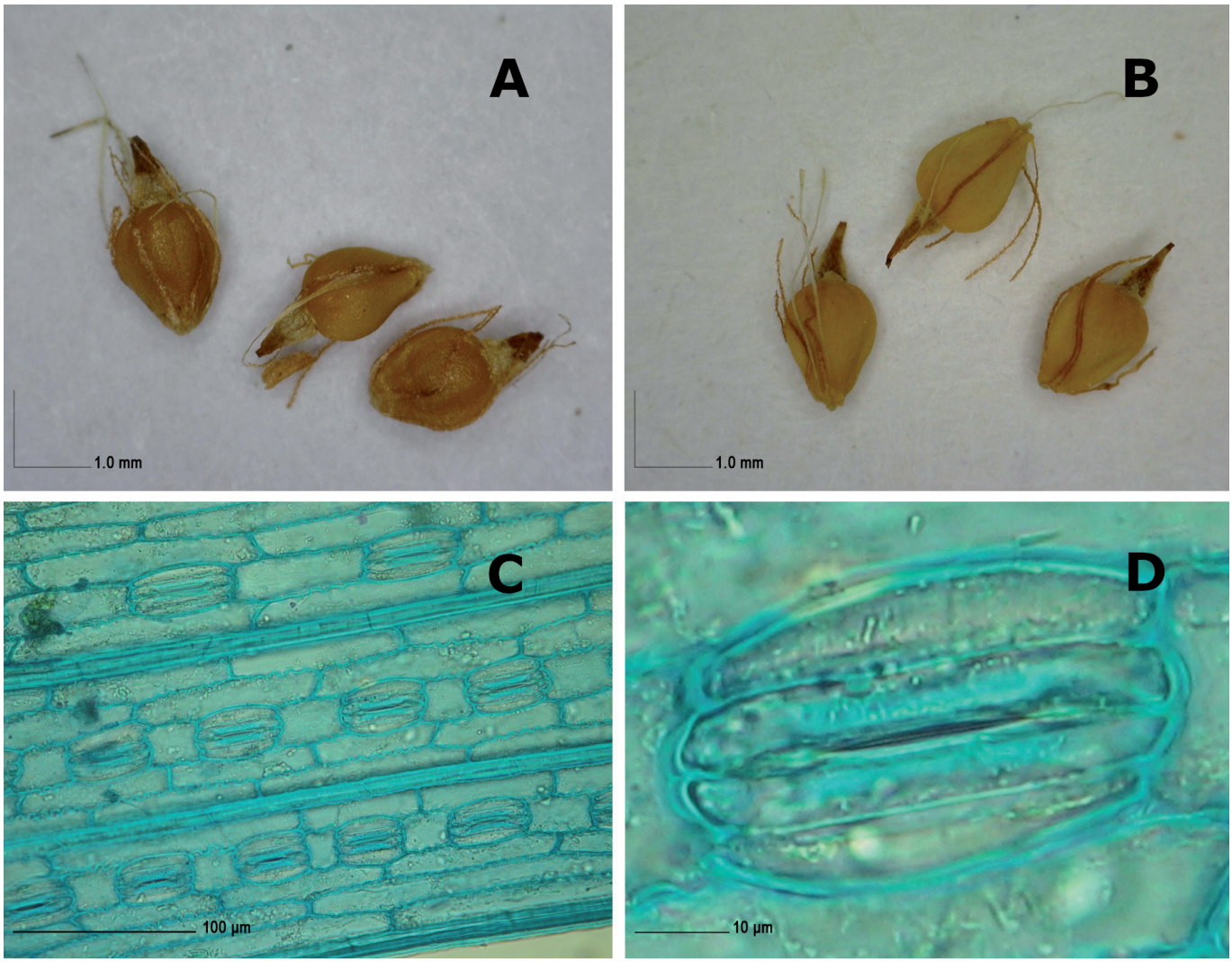

Fig. 2 - Particular of some diagnostic characters of *E. mamillata* subsp. *austriaca*. Achenes with stylopodia (A and B). Epidermid with stomata (C) and detail (D) showing the stomatal guard cells longer than the subsidiary cells, protruding at the end of the stoma. / Particolare di alcuni caratteri diagnostici di *E. mamillata* subsp. *austriaca*. Acheni con stilopodi (A e B). Epidermide con stomi (C) e dettaglio (D) che mostra le cellule di guardia stomatiche più lunghe delle cellule sussidiarie, sporgenti alla fine dello stoma.

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