



# An evaluation of the UK distribution of Common Spike-rush *Eleocharis palustris* subspecies *palustris* (L.) Roem. & Schult. using herbaria material

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## INTRODUCTION

*Eleocharis* R.Br. Perennials with worldwide distribution (GBIF). They are mainly marsh-dwellers growing in aquatic or mesic habitats.

*Eleocharis palustris* (L.) Roem. & Schult. has a northern circumboreal distribution (GBIF).

Clonal, forming often extensive stands through a dense network of long rhizomes.

Potentially long-lived populations, preserving distinctiveness. Giving rise to a genus & species with an unusual breadth of chromosome numbers & sizes (Strandhede S.-O. & Dahlgren R., 1968).

Håkansson (1928) first described two different chromosome nos. in *E. palustris*,  $2n=16$  and  $2n=38$

Stomata size:  $2n=16$  are smaller  $2n=38$  are larger

*Eleocharis palustris*, subsps. *palustris* & *waltersii*. Walters (1949) divided the cytotypes into subsps. on the difference in chromosome nos. & morphological features (table 1.).

The lack of ease of identification means that distribution is still being determined in many countries. Subsp. *palustris* appears more common in Eastern Europe and the drier Mediterranean. Rarer in the west.

Do we know the UK distribution of subsp. *palustris*? Is it rare?

Table 1. Subsp. characteristics

Feature	Author	subsp. <i>palustris</i>	subsp. <i>waltersii</i>
Chromosome number	Strandhede (1966)	$2n=16$	$2n=(37) 38 (39)$
Stomata size	Strandhede & Dahlgren (1968)	39-49 $\mu$ m	54-70 $\mu$ m
Achene length	Walters (1949)	(1.1) 1.2-1.4(1.5) mm	(1.3) 1.45-1.8(2.0) mm
	Strandhede (1966); Strandhede & Dahlgren (1968)	(1.1-) 1.2-1.5 (-1.6) mm	(1.3-) 1.4-1.8 (-1.9) mm
	Stace (2019)	1.2-1.4 (1.5) mm	(1.3) 1.5-2 mm
Middle spike glume length	Walters (1949)	2.75-3.5 mm	3.5-4.5 mm
Flower number in a spike	Walters (1949)	40-70	20-40

Fig. 1. BSBI records for subsp. *palustris*. *Eleocharis palustris* s.l. is found throughout the UK.

## HYBRIDISATION

Strandhede (1965) considered *E. palustris* subsp. *waltersii* to be a hybridogenous species which had originated from the fusion of an unreduced gamete of subsp. *palustris* and the reduced gamete of *E. uniglumis* subsp. *uniglumis*, giving the chromosome number of  $16+23=39$ .

Fertile experimental hybrids occur between subsps. *palustris* (female) and *waltersii* (male) (resultant  $2n=27$ ), with Strandhede (1966) reporting only backcrossing occurring towards subsp. *waltersii*. Lewis and John (1961) found naturally occurring hybridisation in a mixed population at Port Meadow (v.c. 23).

This presents the possibility that subsp. *palustris* may be hybridised out of existence at a location.

## ECOLOGY

Stomata size matters! Subsp. *palustris* has smaller stomata.

Subsp. *palustris* is slightly more tolerant to soil salinity & drier conditions. Less competitive. (Kaplan et al., 2015; Julve, 2019)

Genome size has also been shown to correlate positively with the size of stomatal guard cells.

Smaller, quicker responding stomata, giving better water conservation (review Raven, 2014).

Strandhede (1966) gave evidence of a certain geographic & ecological isolation between the subsps.

Higher ploidy levels generally give more vigour  $\rightarrow$  greater competitive advantage.

Fig. 2. Stomata from subsp. *palustris* (a) & subsp. *waltersii* (b)(samples from Guernsey).

## METHOD

Herbaria are an important resource for taxonomic & phytogeographic study

- The identification features of herbarium specimens differ from those of fresh specimens. It is desirable to perform a non-destructive examination of herbarium specimens, where even the repositioning of a glume could cause damage.
- Taxonomic revision of Italian material (Lastrucci et al. 2020) confirmed the placement of stomata size as the most definitive characteristic in separating the subsps., with no overlap. On rare occasions, measurements towards the boundary were found and left unassigned.

My trials had shown that *Eleocharis* stomata were easily measurable in dried, unprepared material at x 400 magnification with top illumination.

For herbaria sheets x 200 magnification was used with an objective lens x20 PL L SP95M/200XM 160mm, allowing a long working distance to allow for sufficient top illumination.

This method has the potential to be further enhanced through the focal stacking of images in picture processing, producing publication images (Cobecore 2018).

Isotype vouchers for subsps. *palustris* & *waltersii* CGE.

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## RESULTS

The collections at Cambridge University Herbarium, Fielding-Druce Herbarium Oxford, Kew, Natural History Museum, & University of Reading Herbarium.

Sheets from 40 locations were clearly assigned subsp. *palustris*. The other sheets were subsp. *waltersii*. Assignments could not be made for 3 sheets.

A new distribution map for *E. palustris* subsp. *palustris* showed an association with tidal rivers (figure 3.).

Coastal grazing marsh (fig. 4.) is the stronghold for the subspecies.

There are three main areas:  
1) Thames & Thames Estuary  
2) Wash & Fenlands  
3) Tidal Severn

Other records were associated with fens and floodplain meadows, all habitats associated with upper reaches flooding and grazing.

Only four herbarium records were found from after 1960.

There is substantial variations in size & appearance of different samples.

Fig. 3. UK distribution of subsp. *palustris* from herbaria material. Rivers are shown, with tidal portions in red (OS Open Rivers V3, 2023).

## DISCUSSION

My findings confirm Walter's assertion that subsp. *palustris* is relatively rare in the UK.

- Intertidal rivers demand resilient plants that can cope with raised salinity and long periods of inundation. The fine alluvial soil is subjected to both turbulent flows and wave action from the tidal action, so roots can be easily undermined. The twice-daily inundation, with a range of up to 12 m, produces areas of erosion and accretion where sediment is deposited. Plant rhizomes and roots trap the sediment, with paths and gullies carved by retreating water slowing the drainage. Both seeds and vegetative propagules can also be trapped, but seeds are likely smothered in deposits, hindering their germination and reducing viability.
- The diaspore bank plays a crucial role in establishing pioneer vegetation communities after flooding. Walters (1949) observed that newly dug ponds or ditches were readily colonised by *E. palustris*, suggesting that fruit set and dispersal would present no barrier to spread. It is, however, uncertain whether enough observations could be made to substantiate this for subsp. *palustris*. Seed bank studies carried out by Hölzel, N. & Otte, A. (2004) suggest that *Eleocharis palustris* has moderately good seed bank density and persistence. Again, there is no distinction between the two subspecies, and it is unknown what role different seed sizes have in survivability.
- The lower persistence away from lower catchment tidal areas and coastal grazing marshes suggests that it may be lost to more competitive plants unless consistently managed.
- Additionally, extinction at sites through hybridisation with subsp. *waltersii* is highly likely, with backcrossing only occurring towards subsp. *waltersii*.

Fig. 4  $\rightarrow$  Locations from herbarium specimens found in 2024: red are the confirmed populations, black is absent, and the red circle is a new location in Guernsey.



Fig. 5. Subsp. *palustris* found at Graveney Marshes, Seasalter Levels, Kent, Walters' Holotype location (1949). Found here with Divided Sedge (*Carex divisa*), a red-listed plant favouring coastal grazing marshes.

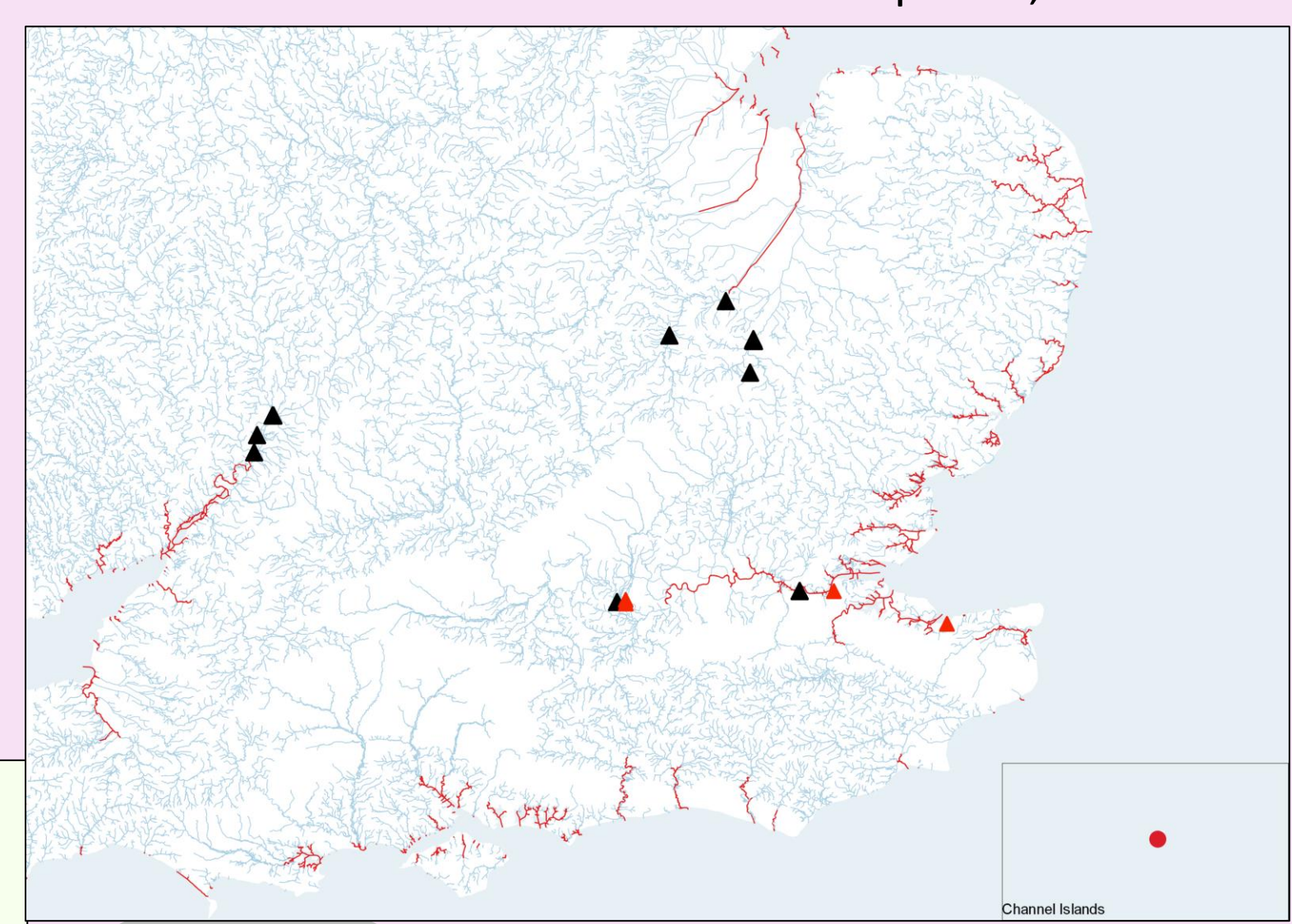


Fig. 6. Subsp. *palustris* found 12/09/2024 at Staines Moor, last found in 1947.

Location	BSBI database	Date	Recorder	Herbarium
Staines, VC 21	yes	12/07/1885	Fraser, J.	K
Staines Moor	no	28/04/1947	Kent, D.H.	BM

## CONCLUSION AND FURTHER WORK

- ✓ Stomata size can be used to determine the subsps. of *Eleocharis palustris* on herbarium sheets.
- ✓ Subsp. *palustris* appears to be rare in the UK.
- ✓ Preliminary findings suggest that it occupies the type of habitat which has declined the most and is lacking the former dynamic processes.
- Continue the process of finding former populations and gathering phytosociological data.
- Use the information to confirm its rarity.
- Use molecular work to establish the species status, and gain insight into the hybridisation dynamics.