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**New distribution and morphological data of *Vulpia membranacea*****Abstract**

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*Vulpia membranacea* is more widespread than supposed before. Specimens from W Germany, N Greece, S Macedonia, Israel, the Balearic and Canary Islands, considerably extending the total range of the species, are listed and dot-mapped here for the first time. Stomata measurements in the newly investigated material partly disaccord with the previously reported correlation of stomata size and chromosome numbers of  $2n = 14$  and  $2n = 28$ , questioning the ploidy level as a differentiating character of the closely related species *V. membranacea* and *V. fasciculata*. Unusual lemma scabrosity in specimens from the Canary Islands is documented by REM photographs.

The application of the name *Vulpia membranacea* (L.) Dumort. to two closely related species, *V. pyramidata* (Link) Rothm. (= *V. longiseta* Brot.) and *V. fasciculata* (Forssk.) Fritsch (= *V. uniglumis* [Aiton] Dumort.), has caused much taxonomic confusion. Some authors even favoured the concept of conspecificity of both taxa (see, e.g., Täckholm 1974, Bor in Meikle 1985). Only after the Spanish holotype of *Stipa membranacea* L. (basionym of *V. membranacea*) was thoroughly studied by Stace & Cotton (1976) and, moreover, extensive chromosome counting as well as morphological analyses were accomplished (Cotton & Stace 1976, 1977) it became evident that indeed two separate species can be distinguished. One of them, *V. membranacea* (= *V. pyramidata*), is diploid ( $2n = 14$ ) and distributed in the W Mediterranean region, covering most of France, the Iberian Peninsula and NW Africa eastward to W Libya, the other, *V. fasciculata*, is tetraploid ( $2n = 28$ ) and distributed chiefly as a coastal plant all around the Mediterranean Sea and along the Atlantic coasts from Morocco to Scotland and Ireland (distribution maps in Stace & Cotton 1976 and Cotton & Stace 1976). These authors characterise the two species by the strong correlation of chromosome number, glabrous or hairy ovaries or caryopses (apically glabrous in *V. membranacea* contrary to hairy in *V. fasciculata*) and a different chorology. Some additional specific features of both taxa exist but should be considered with some caution (Stace & Cotton 1976), perhaps except for the anther lengths of 0.6-0.9 mm and 0.8-2.0 mm in *V. membranacea* and *V. fasciculata*, respectively (Stace & Cotton 1980), and a different cross-sectional lemma configuration, more or less U-shaped in *V. membranacea* and of V-shaped in *V. fasciculata* (Scholz 1990).

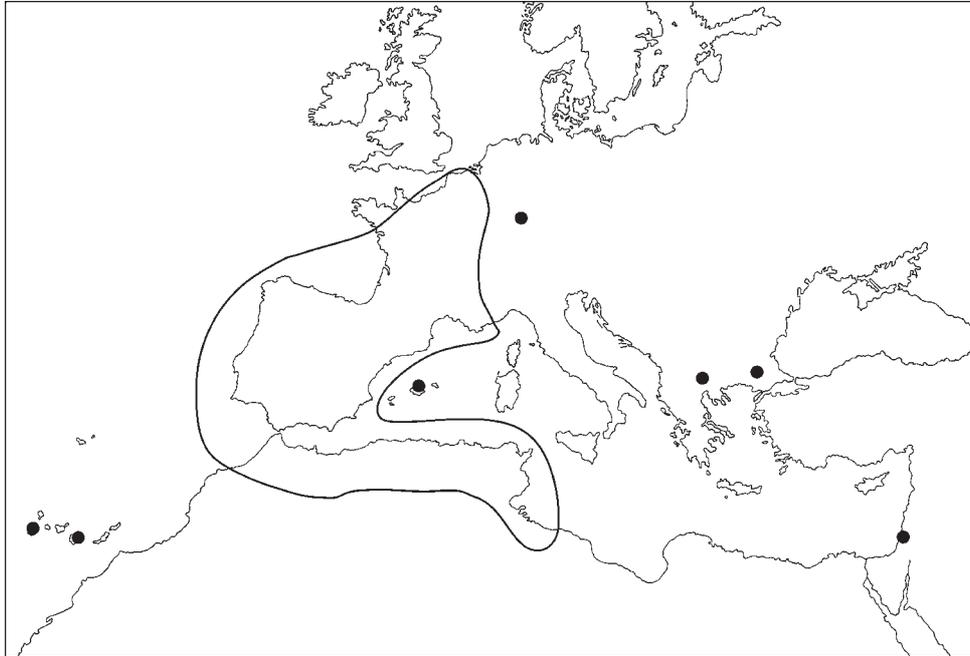


Fig. 1. Distribution of *Vulpia membranacea*, redrawn from Stace & Cotton 1976 (line), and completed (dots). – Orig. M. Rodewald & Th. Raus.

Judged from morphological criteria, the general distribution range of *Vulpia membranacea* needs revision. In the following all localities presently known to us outside the hitherto assumed W Mediterranean distribution centre of this species are listed and dot-mapped (Fig. 1, 3).

Only for Germany there is evidence for recent introduction of the annual *V. membranacea*, mainly inferred from its man-made habitats and absence of historical records, whereas for the other countries mentioned, we have assumed the plant to be native.

ISRAEL: Magdiel, near Tel-Aviv, sandy fields, 27.4.1928, A. Eig, *Fl. Palaest. Exsicc.* 16, “*V. uniglumis*” (B, BM, E, HUI, K). – Eig writes on the label: “An uncommon plant, strictly limited to the sandy fields and sandstone hills of the Mediterranean plain.” In 1979 and 1980 P. Auquier annotated two duplicate specimens of this collection in B and HUI as “*Vulpia pyramidata* (Link) Rothm.” [i.e. *V. membranacea*] but N. Feinbrun-Dothan re-determined “*Vulpia fasciculata* (Forssk.) Samp.” thus failing to include *V. membranacea* in *Flora Palaestina* 4 (Feinbrun-Dothan 1986). One of us (H.S.) and P. L. Thomas, Wirral (UK), independently confirmed in letters of 1989 and 1998 to the Hebrew University of Jerusalem the correctness of Auquier’s determination. A short note on this topic (Danin 2000) is somewhat misleading.

MACEDONIA: Stari Dojran, sandy coast of Dojran lake about 1 km N of the Greek border, 5.5.1998, N. Jogan (LJM; specimens not seen). – Jogan (in a letter of 12.2.2001) remarks: “Its occurrence there must be a secondary one, as the sandy coast appeared there just few years ago because the water level of the lake decreased for several meters due to water-pumping for plantation watering.”

GREECE: Thrace, Nomos Evrou, Eparchia Orestiadou, Dikea (41°42'30"N/26°18'E), sandige Böschungen am Südufer des Evros, 55 m, 9.5.1991, Th. Raus & Ch. Schiers 17231 (B). – Many vouchers taken from a large population.

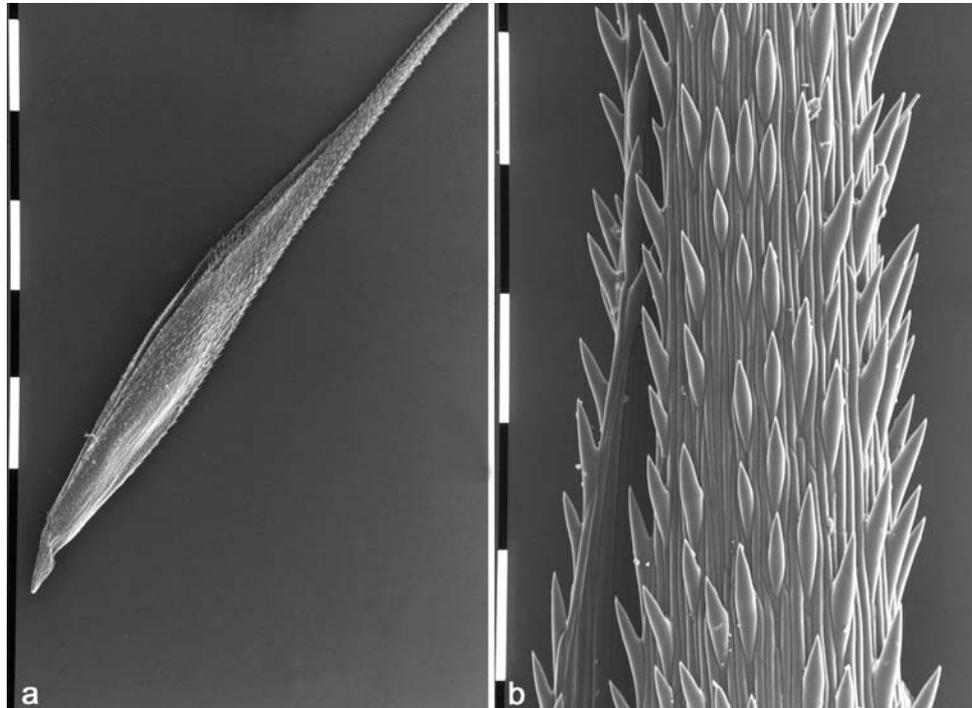


Fig. 2. Lemma indumentum of *Vulpia membranacea* – a: overview; b: detail. – Specimen: El Hierro, 13.5.1998, *Stierstorfer*, B; scale: a = 1 mm, b = 0.1 mm. – Photograph by M. Lüchow.

GERMANY: Rheinland-Pfalz, Waldsee, am Baggersee (6566,4), “seit einigen Jahren eingebürgert”, 8.6.1985, *W. Lang* (B; zusammen mit *V. fasciculata*); ibid. (6514,4), 17.6.1989, *W. Lang* (B; zusammen mit *V. fasciculata*); Rülzheim, S-Ufer eines Baggersees (6815,4), 9.7.1989, *P. Wolff* (B). – These Central European occurrences of *V. membranacea* were first recorded by *Lang* (1990).

BALEARIC ISLANDS (SPAIN): Mallorca, Port de Pollença, Can Cullerassa, Platja de Can Cap de Bou, km 63.3 (39°52'20"N/3°05'20"W), 16.7.1993, *L. Mucina 4138* (B, det. *H. Scholz*). – Anthers extraordinarily long, c. 1.2 mm, see also Table 1.

CANARY ISLANDS (SPAIN): EL HIERRO: SW El Tomillar (28AR9569), Sabinar with *Juniperus turbinata* subsp. *canariensis* and *Echium aculeatum*, 915 m, 13.5.1998, *Ch. Stierstorfer* (B); Roque Grande (3070/194), Übergang Sabinar-Sukkulentenbusch, 880 m, 18.5.1998, *Ch. Stierstorfer* (B); E Fuente de Bintó, lapilli and volcanic ash with *Echium aculeatum*, 1430 m, 16.5.1998, *Ch. Stierstorfer* (B); W Hoya de Fileba, near street Valverde-Frontera between km 23 and km 24, lapilli and volcanic ash, 1325 m, 20.5.1999, *Ch. Stierstorfer* (B). – For Gran Canaria see *Hansen & Sunding* (1985), specimens not seen.

Some of the El Hierro specimens (13.5.1998 & 20.5.1999) exhibit lemmas with a high dorsal scabrosity in the distal 1/3-2/3 (Fig. 2). This feature is very unusual for *Vulpia membranacea* and not mentioned in the literature (see *Cotton & Stace* 1977: 179).

The aforementioned strong correlation of chromosome number, morphology and distribution appears questionable to us. Leaf blade stomata lengths of 26-41 vs. 33-59  $\mu\text{m}$  indicating different ploidy levels of *Vulpia membranacea* and *V. fasciculata* (*Stace & Cotton* 1976) do in part

Table 1. Stomata dimension in *Vulpia membranacea*, taken from central to distal parts of basal leaves (i.e., basal parts and sheath tissue excluded). Orig. Th. Raus.

Collection	Stomata length and width [ $\mu\text{m}$ ]
	36 × 11
<i>Raus &amp; Schiers 17231</i> (NE Greece)	36 × 11 36 × 11
	55 × 15
<i>Mucina 4138</i> (Mallorca)	53 × 14 50 × 14
	40 × 24
<i>Stierstorfer [1]</i> (El Hierro 13.5.98)	40 × 23 41 × 21
	20 × 8
<i>Stierstorfer [2]</i> (El Hierro 18.5.98)	18 × 8 22 × 8
	40 × 22
<i>Stierstorfer [3]</i> (El Hierro 20.5.98)	45 × 22 40 × 15
	40 × 19
<i>Stierstorfer [4]</i> (El Hierro 13.5.98)	40 × 18 43 × 20
	36 × 13
<i>Stierstorfer [5]</i> (El Hierro 16.5.98)	38 × 13 40 × 13

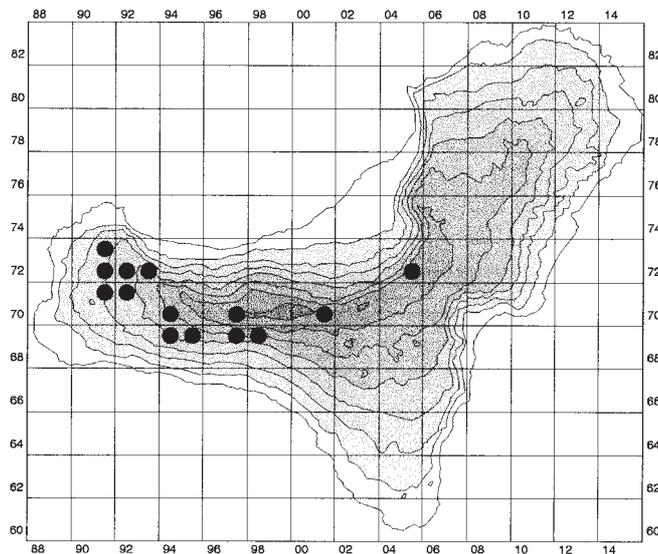


Fig. 3. Distribution of *Vulpia membranacea* on El Hierro (Canary Islands). – 2 × 2 km grid squares, contours at 200 m interval; orig. Ch. Stierstorfer.

disaccord evidently with the data (Table 1) from *V. membranacea* specimens listed above. Hence at least some of the plants may be rather tetraploid instead of diploid. Further studies whether there is a relationship between phenotype and ploidy level or not are certainly urgently needed.

It appears rather probably that diploid and tetraploid cytotypes ( $2n = 14, 28$ ) of *V. membranacea* occur sympatrically and have escaped notice so far. By re-examination of Egyptian *Vulpia* specimens, especially in the Cairo Herbarium, misnamed true *V. membranacea* possibly could be found, thus extending its distribution range in the Near East beyond Israel. One herbarium specimen (K), collected by C. C. Townsend in 1967 near Alanya in coastal S Turkey and believed to belong to *V. membranacea* (Thomas 1999) points in this direction, too.

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