

## *Vulpia fasciculata*: a new species for the Bulgarian flora

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**Abstract.** A new species for the Bulgarian flora, *Vulpia fasciculata* (*Poaceae*), is reported. The species was found in seven locations on the Southern Black Sea Coast. All locations are on coastal sands, which are a typical habitat for this species. The status of six populations is described and the origin of the species in the Bulgarian flora is discussed.

**Key words:** Bulgarian flora, distribution, population status, *Vulpia fasciculata*

### Introduction

In 1991, during an investigation of the flora and vegetation of the sand dunes in the Sunny Beach Resort Complex, a new for the country species was identified: *Vulpia fasciculata* (Forssk.) Samp. Subsequently, this species was discovered in five more locations and a check in the Herbarium of the Institute of Botany (SOM) confirmed its distribution in one more location.

Stace & Cotton (1976) specified the nomenclature of *V. fasciculata* and compared it to another close species, *V. membranaceae* (L.) Dumort. They also analysed the natural distribution of the species, which extended to the Mediterranean coastline, part of the Atlantic coast of Europe, and the coastline of South England. It belongs to the psamophytic species, whose biology was subjected to detailed study in England (Watkinson 1990).

The vouchers are deposited in the Herbarium of the Institute of Botany (SOM).

**Fig. 1.** *V. fasciculata*: general view and inflorescence. Scale bars = 1 cm.



## Results

*Vulpia fasciculata* (Forssk.) Samp., Lista Esp. Herb. Port. 24 (1913) (Fig. 1, 2)

An annual caespitose plant. Stems 8–50 cm, unbranched, erect or geniculate. Leaves non-auriculate, with a 0.2–0.9 mm long, entire ligule. Inflorescence in the form of raceme or panicle, 3–11 cm, partially exerted from to partly included in the uppermost leaf-sheath. Pedicels 3–7 mm long, erect, distally dilated, minutely scabrous. Spikelets 10–20 mm long (excluding awns), 4–6 mm wide, laterally compressed, disarticulating as separate units below the glumes, as well as below each floret, lower 2–5 florets fertile, distal 3–4 florets sterile, incomplete and much smaller. Lower glume 0.1–2.6 mm, less than 1/6 as long as upper, upper glume 10–30 mm (including awn 3–12 mm). Lemma similar to the glumes, 8–20 mm long, carnose, glabrous or minutely scabrous, callus present, 0.5–0.8 mm, pointed, shortly scabrous. Pallea  $\frac{1}{2}$  the length of the lemma to slightly shorter. Anthers 1–3 (in all Bulgarian specimens examined there were 3 stamens), 0.8–2 mm, slightly exerted at anthesis. Ovary pubescent at apex.

The species differs from the remaining representatives of genus *Vulpia* in Bulgaria (*V. myuros* (L.) C. C. Gmel., *V. muralis* (Kunth) Nees, *V. bromoides* (L.) S. F. Gray, *V. ciliata* Dumort., *V. unilateralis* (L.) Stace, and *V. ambigua* (Le Gall) More) by the acuminate callus of the lower glume (Stace & Cotton 1980). The most conspicuous diagnostic differences from the neighbouring *V. membranaceae* (with which it has partially overlapping areas in the Western Mediterranean), described by Stace & Cotton (1980), are the pilose ovary, which is apically pubescent in *V. fasciculata* and glabrous in *V. membranaceae*, and the length of anthers: 0.8–2 mm in *V. fasciculata* and 0.6–0.9 mm in *V. membranaceae*.

As far as currently known, the species is distributed in the southern part of the Bulgarian Black Sea Coast and five of its known locations lie in a 25 km stretch of the coastline, while the other two are situated 50 km northwards of them (Fig. 3).

Black Sea Coast (*Southern*): in the northern part of the Sunny Beach Resort, in the stage of budding,



Fig. 2. *V. fasciculata* on the Primorsko beach.

27.05.1991, coll. A. Petrova & T. Meshinev, det. A. Petrova & I. Apostolova, SOM 155567; at the dunes in the central part of the Sunny Beach Resort, plants in the stage of dissemination, 15.08.1991, coll. & det. A. Petrova, I. Apostolova, T. Meshinev, SOM 161254; at the dunes near the motel in Arkoutino locality, 42° 19' 40" N, 27° 44' 55" E, 27.05.1995, coll. & det. A. Petrova, SOM 155227, 27.05.1995 (Fig. 1) & 155568, 21.05.2003, SOM 158470, 04.06.1998, coll. & det. T. Meshinev, SOM 161255; in the sands of the Golden Fish camping site near Sozopol town, 42° 24' 21" N, 27° 40' 13" E, 25.05.1999, by the 1999 OPTIMA expedition, № 18-1-3-1 & 18-1-11-1, sub *Vulpia* sp., coll. T. Raus & F. Pina, det. A. Petrova, SOM 160886 & 160887; at the town beach of Primorsko town 10.06.2004, coll. B. Assyov & Ch. Pedashenko, det. A. Petrova, SOM 160888 (Fig. 2); at the dunes north of Primorsko town, 15.06.2005, coll. B. Assyov, SOM 162032 at the beach of the International Youth Centre, south of Primorsko town, 26.05.2005, coll. B. Assyov, SOM 162031.

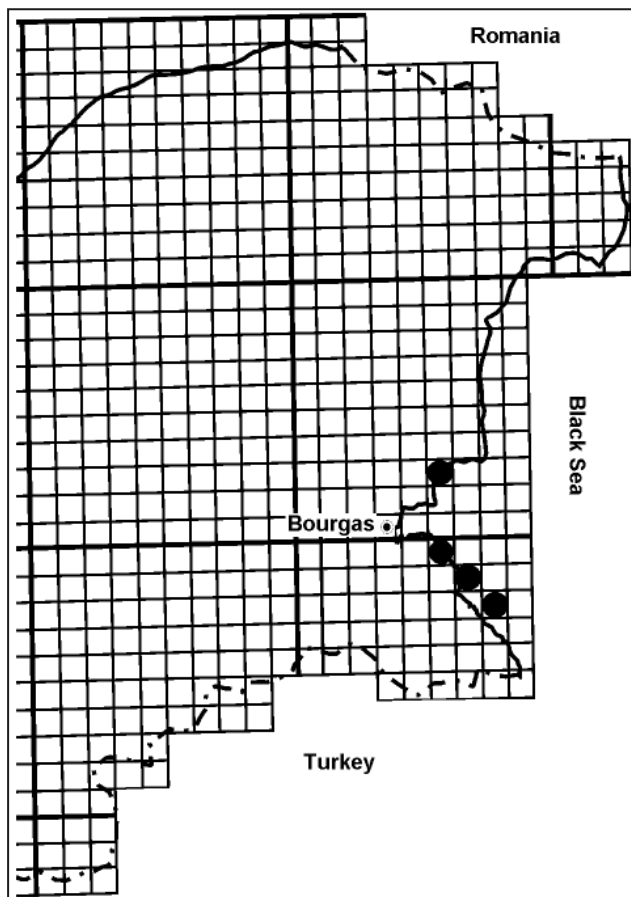


Fig. 3. Map of the distribution of *V. fasciculata* in Bulgaria.

The two locations in the area of the Sunny Beach Resort are at 2.5 km from each other. The abundance of the species is insignificant: less than 20 individuals in an area of 2 m<sup>2</sup> in the northern part and about 5 m<sup>2</sup> in the central part of the dunes. The plants were found on relatively barren patches, in the innermost part of the beach strip in the northern end of the resort, as well as in the zone of shifting dunes in the central part. The accompanying species were annuals (*Bromus tectorum* L., *Secale sylvestre* Host, *Corispermum nitidum* Kit.). The flora and vegetation in the region have been subject to a detailed study (Meshinev & al. 1994) and it could be maintained that at the moment of the observation the species occurrence there was strictly local.

In the Arkoutino locality the species population covers an area of 600 m<sup>2</sup>. It is situated close to the hotel building, along the trails leading to the beach and to the dunes in southward direction. The population was observed by us also in 1997, 1998 and 2003. The abundance was high during all four years of observation. Its density was also high, occasionally exceeding 70 plants per m<sup>2</sup>. The species dominated the commu-

nity, which also included some annual species: *B. tectorum*, *B. sterilis* L., *S. sylvestre*, *Kochia laniflora* (S.G. Gmel.) Borbás, *Aegilops geniculata* Roth, *Orlaya kochii* Heywood, *Hypocoum ponticum* Velen., *Allysum minutum* Schlecht. ex DC., as well as *Festuca vaginata* Waldst. & Kit. ex Willd. and single individuals of *Artemisia campestris* L.

The population at the beach of Primorsko town was in the innermost parts of the beach strip, scattered in patches. In two of these patches the species was dominant in groups with participation chiefly of annual species: *S. sylvestre*, *B. tectorum*, *K. laniflora*, *Maresia nana* (DC.) Batt., and *Silene euxina* (Rupr.) Hand.-Mazz. In one of the patches situated close to a draining canal there were some ruderal species, such as *Conyza canadensis* (L.) Cronq., *Medicago lupulina* L., etc. One of the groups was dominated by *Galilea mucronata* (L.) Parl. In places where the density of *G. mucronata* was high, *V. fasciculata* occurred with single plants, while in places with lower density of the former it occurred more amply, forming an inhomogeneous, mosaic spatial population structure.

The population northern of Primorsko town (Perla dune complex) forms two small patches (less than 10 m<sup>2</sup>). The vegetation is dominated by *Cynodon dactylon* (L.) Pers. and *B. tectorum*.

The largest observed population was found recently at the International Youth Centre locality, south of Primorsko town. Here *V. fasciculata* forms a stripe approximately 1 km long in the innermost part of the beach. Spatial structure is uneven. Accompanying species are mostly annuals (*S. sylvestre*, *B. tectorum*, *B. sterilis*, *S. euxina*, etc.).

## Discussion

The species is a typical coastal psamphyte, occasionally occurring inland of the coast (Stace & Cotton 1976; Watkinson 1978b). It is naturally distributed along the entire coastline of the Mediterranean, along the Atlantic coast of Europe, where it reaches the Somme Department of Northwestern France in the north, along the coastline of England (mainly in the southern parts of the island) and on the coastline of Southeast Ireland. It also occurs along the Black Sea Coast of Turkey (both in the European and in the Asiatic part) (Stace 1985). According to Stace & Cotton (1976), the species is naturally distributed inland of the coast on-

ly in Cairo and Jerusalem. Locations inside England, Italy and Spain are adventive and casual. The species was introduced in Australia, where it was distributed on suitable sandy soils and in sunny and dry places, often in disturbed habitats, and presently occurs as an adventive species in the Australian states of Tasmania, New South Wales, Victoria, Western and South Australia (Weiller & al. 1995).

The question whether the distribution of this species in Bulgaria is natural or adventive might be a subject to discussion. The identified locations neighbour on the so far known natural area of the species, including the southern coast of the Black Sea (Stace 1985). The conditions in the locations correspond to the climatic and topographic limits outlined by Watkinson (1978b). On these grounds, we consider the species as naturally distributed in the Bulgarian part of the Black Sea Coast. Although floristic studies of the coastline are dated to the end of the 19th century, they are few in number and only single beach strips have been studied thoroughly (Meshinev & al. 1994). So it is quite possible for a species of local distribution to remain un-found. Some examples of species identified for the first time in the dune habitats in Bulgaria in recent years are: *Medicago constricta* Dur. (Velchev & Vassilev 2002; Petrova 2004), *Clematis recta* L., *Pyracantha coccinea* M.J. Roem., and *Buglossoides incrassata* (Guss.) I. M. Johnson (Petrova 2004). Local distribution of *V. fasciculata* is related to the character of its dissemination. The investigations carried out by Watkinson (1978a) in two dune systems in England had shown that almost all dispersal units fall within centimetres of the mother plant, and only in areas of shifting sands, barren of vegetation they travel to a greater distance. This way of dissemination relates to the fact that the population observed in the Arkoutino location in the period 1995–2003 practically remains local, within the same limits. The opinion for the natural distribution of the species along the Bulgarian part of the Black Sea coast is supported also by the recently found locality in the northernmost part of the Turkish Black Sea coast (Turkey in Europe, dunes north of the Igneada village, 09.07.2005, coll. A. Petrova, SOM 161992).

On the other hand, mention deserves that the adventive distribution of *V. fasciculata* outside the boundaries of its natural area is a fact (Stace & Cotton 1976; Weiller & al. 1995). Dissemination by biological agents, including humans with their many-sided activities, is the way to distribute this species at me-

dium and long distances. The increasing use of the coastline for recreation and, above all, of the beach strips, has vastly increased the probability of its transport by man. All established locations have been in areas of active resort activities in the last 25–30 years. Thus transport of the dispersal units is quite possible, comprising parts of the ears (Pemadasa & Lovell 1974; Watkinson 1978a, b), which with their sharp ends or awns could get easily attached to the beach gear and thus be transported to new locations.

Further investigations into the distribution of the species in Bulgaria, as well as monitoring of the populations in the established locations at regular intervals could trace out possible invasive behaviour in some locations, or disappearance in others for natural reasons (Watkinson 1990), or under anthropogenic activity.

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