

R. Di Pietro, G. Silletti, G. Misano & R. P. Wagensommer

***Juncus valvatus* (Juncaceae) new for the Italian Flora**

Abstract

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A population of *Juncus valvatus* Link was found during a floristic-phytosociological field-work in small-size humid areas of the western Murgian plateau in the municipality of Santeramo in Colle (Apulia region, southern Italy). *Juncus valvatus* is a species of community interest listed in the Habitat Directive 92/43 EEC and in the Strasbourg Convention. This record allows to significantly enlarge eastwards the whole range of the species which at present was known for Portugal, Tunisia and Algeria only.

Key words: biogeography, chorology, *Juncus*, Southern Italy.

Introduction

The rocky limestone plateaus of Apulian Murge are one of the most typical and recognizable landscapes of southern Italy. The south-western Murgian vegetational environment is rather complex; at present it is characterised by extensive secondary dry grasslands rich in chamaephytes dominated by endemic and Southeastern-European species (*Stipa austroitalica* Martinovsky, *Scorzonera villosa* Scop. subsp. *columnae* (Guss.) Nyman, *Thymus spinulosus* Ten., *Thymus striatus* Vahl, *Hippocrepis glauca* Ten., *Thapsia garganica* L., *Cytisus spinescens* C. Presl, *Iris pseudopumila* Tineo, etc.). The potential vegetation is formed by *Quercus trojana* Webb woodlands and to a lesser extent by *Quercus ilex* L., *Quercus virgiliana* Ten. and *Carpinus orientalis* Miller woodlands (Bianco & al. 1998; Biondi & al. 2004; Di Pietro & Misano 2009). At the bottom of the gorges (locally called “gravine”) was found a dominance of *Fraxinus angustifolia* subsp. *oxycarpa* (Willd.) Franco & Rocha Alfonso (Di Pietro & Misano 2009). The few humid areas associated to the drainage lines which characterise the major gullies interposed amongst the adjacent limestone ridges were widely drained in the past to face the spread of the marsh fever and, at the same time, to obtain fertile soils usable for wheat cultivation or to create rich pastures. This operation led to a significant drowdown which restricted the presence of permanent water to the drainage channels only. Precisely along the edge of one of these channels a population of a very peculiar entity belonging to the genus *Juncus* were found during a floristic-phytosociological field-work. On the basis of morphological and anatomical

comparisons, this population was ascribed to *Juncus valvatus* Link. According to Fernández-Carvajal (1983), Serpa Carvalho & Arriegas (1995) this species is known in Europe for western and southern Portugal only, while its entire distribution area (Kirschner & al. 2002) includes also the northern Tunisia and north-western Algeria (Fig. 1).

Material and Methods

The identification and the description of the specimens collected is based on field observations, integrated with a study on exsiccata from the herbaria of FI and RO. Analyses of transverse and longitudinal sections of leaf blades were carried out using a Nikon microscope 50-400x. Voucher specimens are deposited in the Herbaria of the University of Molise at Isernia (IS), and of the University of Rome “La Sapienza” (RO). The nomenclature of the species follows Conti & al. (2005).

Results

Juncus valvatus Link subsp. *valvatus*, in H. A. Schrader *J. Bot.* 1799(2): 316 (1800)

Toponomy: Italy, Apulia, Santeramo in Colle (Bari), Vallone della Silica (Le Rene), 40°72' N 16°69', E 19.V.2009, R. Di Pietro, G. Silletti, G. Misano (Fig. 4).

According to the descriptions made in Snogerup (1980), Fernández-Carvajal (1983) and Kirschner & al. (2002) *Juncus valvatus* is a perennial species living in wet meadows, margins of watercourses and other periodically inundated places. This species is morphologically described as a 11-50 cm tall plant with an horizontal creeping short-noded rhizome. Basal leaves 1-3; cauline leaves 2-4 (5), 5-15 cm long, 1-2 mm wide, terete, unitubular and

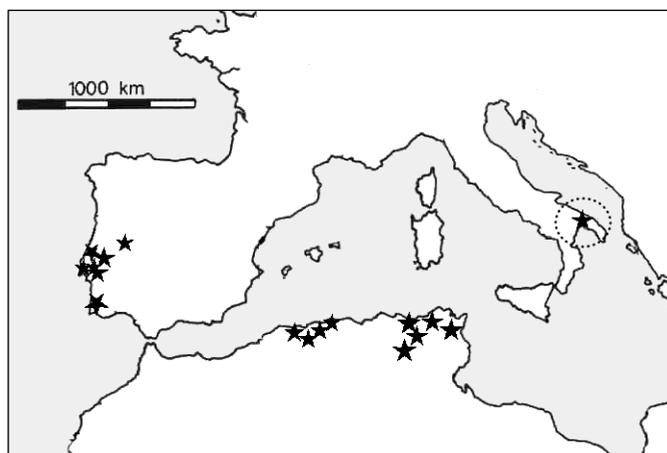


Fig. 1. Distribution area of *Juncus valvatus* Link s.l.

perfectly septate. Lower bract 0,5-3 cm long equally or longer than inflorescence which is composed of 1-5 (7) globose, many flowered congested heads or 1-2 heads on erect to suberect rigid peduncles. Tepals subequal with outer ones subulate at apex. Stamen 3 with anthers 0,5-0,8 mm long, $2/3 - 1/2$ as long as filament. Capsule 4-5 mm exceeding perianth, unilocular, narrowly pyramidal, gradually tapering to a 0,5-1 mm rostrum.

In the Apulian site of collection *J. valvatus* occurs along drainage channels which are interposed between the cultivated fields and the road. It behaves as a companion species in a typical marshes vegetation together with *J. bufonius* L., *Carex flacca* L. subsp. *flacca*, *C. sylvatica* Huds. subsp. *sylvatica*, *Alisma plantago-aquatica* L., and other species which are very rare in Apulia region such as, *Oenanthe silaifolia* M. Bieb., *Poa palustris* L., *Orchis laxiflora* Lam. (etc.). As far as the climate is concerned, the Apulian stations of *J. valvatus* exhibit a typical meso-Mediterranean bioclimate with mean annual rainfalls of 650 mm and two months of summer drought stress.

From the comparisons between the specimens collected in the study area and the exsiccata available in the Herbarium of Roma (RO) and Florence (FI), strong similarities to *J. valvatus* Link emerged. The use of the taxonomical keys occurring in the most important Floras (Durand & Schinz 1895; Coutinho 1939; Snogerup 1980; Pignatti 1982) and taxonomical monographs (Fernández-Carvajal 1981, 1983; Kirschner & al. 2002) seem to support this preliminary hypothesis. According to Buchenau (1906) and Fernández-Carvajal (1983) *J. valvatus* belong to the subgen. *Septati* Buchenau while a most recent classification (Kirschner & al. 1999) report it to the subgen. *Juncus* and to the sectio *Ozophyllum* Dumort.

Several are the diagnostic morphological characters which suggest an attribution to *J. valvatus*; the compressed and perfectly septated leaves, the typical inflorescence composed of globose many-flowered heads, the acute abruptly contracted at apex and long mucroned capsule, the anthers which are $1/2$ as long as filaments and the light-brown fine reticulate seeds (Fig. 2). Fernández-Carvajal (1983) considered this species as divided into two varieties, var. *valvatus* which was characterised by three stamens and which was restricted to central and southern Portugal, and var. *caricinus* which was to be considered endemic of Algeria. All the specimens collected in the study area have three stamens and should consequently be included in the var. *valvatus*. However the more recent revision of Kirschner & al. (2002) do not accept this separation and reports all the varieties to the taxon *J. valvatus* Link.

The few morphological differences which make the individuals of the Apulian population somewhat different from those of Portugal or northern Africa concern the plant size. In fact the taxonomic literature reports for *J. valvatus* stem lengths ranging between 10 and 30 cm (up to 50 cm in Fernández-Carvajal (1983) and Kirschner & al. (2002)). All the specimens found in the study area range between 53 and 60 cm. Furthermore the transverse section of the leaf-blade (Fig. 3a) shows an elliptical outline which is undulated in the inner side due to the presence of an irregular ring of vascular bundles. Each vascular bundle exhibits schlerenchyma in the inner side and parenchyma in the outer side. The number of vascular bundles is higher (32 vs. 22) than reported in Fernández-Carvajal (1983). The longitudinal section (Fig. 3b) shows the presence of long-cells and short-cells, the latter restricted to the stomatic belt. Stomas exhibit a square form and their dimensions are significantly smaller than those reported in Fernández-Carvajal (1983).

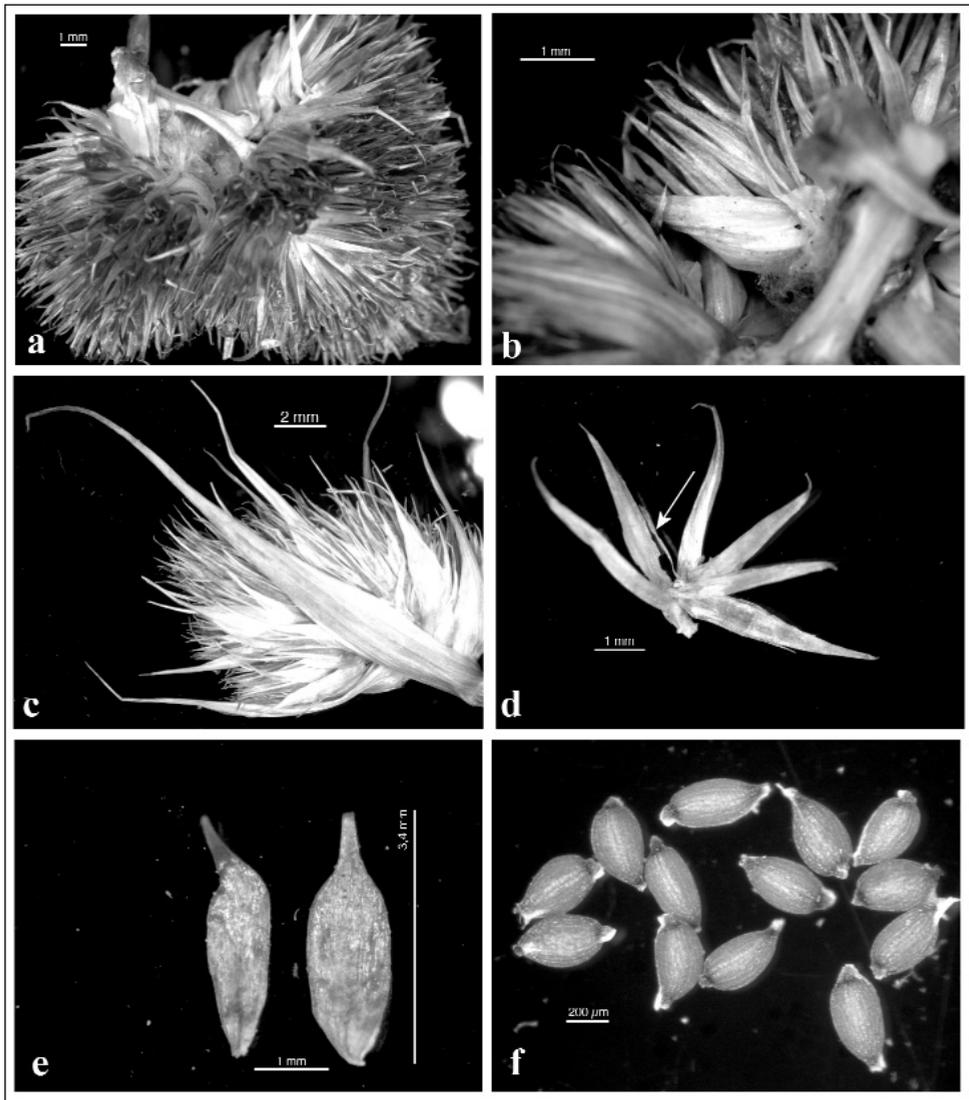


Fig. 2. Some diagnostic morphological characters of the Apulian specimens of *Juncus valvatus*: a) globose heads of the inflorescence; b) particular of the many flowered heads; c) bracteoles of the inflorescence; d) acute perianth segments with the presence of one stamen (arrow) having the anther $\frac{1}{2}$ as long as the filament; e) capsula valves showing a long beak; f) seeds.

SPECIMINA VISA

ITALIA, Apulia, Santeramo in Colle (Bari), Vallone della Silica (Le Rene), 40°72' N 16°69' E, humid channels at the border of both cultivated groves and steppe-like grasslands, 19.V.2009, R. Di Pietro, G. Silletti & G. Misano (IS) (RO). PORTUGAL, Arred. de

Coimbra Eiras, sub *Juncus echinuloides*, VII. 1896, *M. Ferreira*, in Flora Lusitanica exsiccata (Herb. Hort. Bot. Conimbricensis) (RO). **PORTUGAL**, sub *Juncus echinuloides* (*J. valvatus* Link. var. *echinuloides*), 13.VI.1897, *T. Amitrage* (RO). **PORTUGAL**, **Coimbra, Carreira do Tiro**, in pratis inundatis, 7.V.1954, *A. Matos & A. Marques* (FI). **PORTUGAL**, **Entre Leiria e a Marinha Grande**, nas valetas humidas, 7.VI.1960, *A. Fernandes, R. Fernandes & J. Matos* (FI). **PORTUGAL**, **Estrada Nacional Marinha Grande a Leiria**, na berma de estrada, 4.V.1957, *A. Fernandes & J. Matos* (FI). **PORTUGAL**, **parties marçageuses près Bemfica, au N.E. de Lisbonne (Estremadura portugaise)**, VI.1883, *J. Daveau* (FI). **PORTUGAL**, **Arred. de Lisboa, Bellas**, sub *Juncus echinuloides*, VI.1881, *J. Daveau* (FI). **ALGERIA**, **Corso (Alger)** sub *Juncus caricinus* (*Juncus valvatus* Link var. *caricinus* Boiss. et Dur. VI *J.A. Battardier et L. Trabut*, Pl. d'Algerie) (RO). **ALGERIA**, praires humides des environs de Lambise, sub *J. caricinus* Dr., 15.VII.1853, *B. Balansa* 737 (FI). **ALGERIA**, sub *J. valvatus* var. *caricinus*. *A. Crabert* (FI). **ALGERIA**, **Liena humides de la vallés de Dra el Mizan a la base septentrionale des montagna du Zjurdjura prov. d'Alger**, sub *J.valvatus* var. β *caricinus*, 24.VI.1856, *E. Bourgeau* (FI). **ALGERIA**, **Cala tahammant**, sub *J. caricinus*, 21.VI.1887, *A. Crabert* (FI).

Discussion

The western Mediterranean is known as an important centre of distribution for diverse groups of *Juncus* (Kirschner & al. 2004). Among the subgen. *Ozophyllum* there are several species which in addition to *J. valvatus* are endemic or subendemic of this area (*J. emmannuellis* A. Fernandes & García, *J. heterophyllus* Dufour, *J. tingitanus* Maire et Weiller in Maire; etc.).

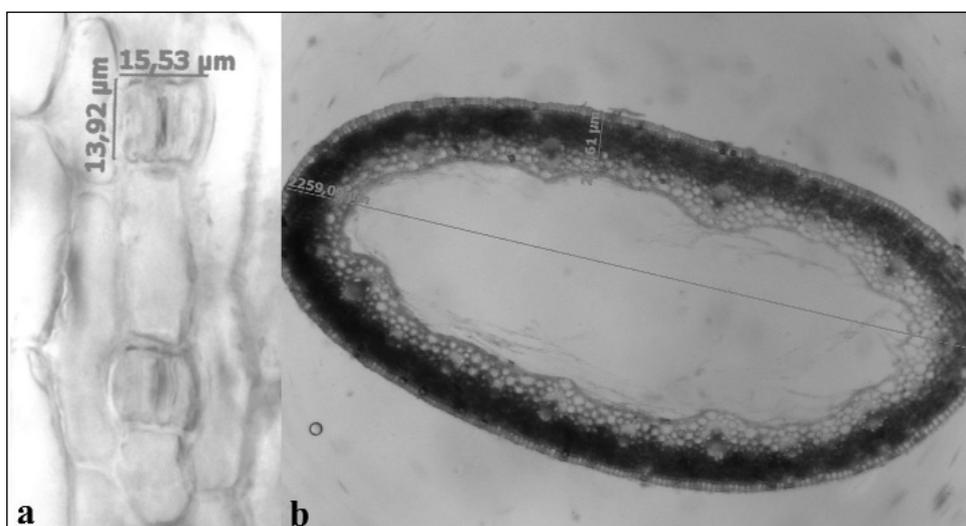


Fig. 3. *Juncus valvatus*: a) leaf longitudinal section with stomate; b) leaf transverse section.



Fig. 4. Herbarium sheath of a specimen of *Juncus valvatus* collected in the Apulian population and housed in the *Herbarium Universitatis Aeserniae* (IS).

At present it is not possible to decide if *J. valvatus* is to be considered an indigenous taxon of the Italian flora or to be treated as an alien species. The fact that in the Italian site *J. valvatus* forms only an isolated population composed of few individuals leads to favour the second hypothesis. Effectively the vicinity of the Apulian site of collection to the ancient roman main road “Via Appia” makes it possible that it represents an old introduction from northern Africa (such possibilities must always be observed for members of *Juncus*, as the small seeds are often reaching new localities with transports of agricultural products).

On the other hand, in addition to not being included in the Italian list of alien species, there are no data in the floristic literature which treat this species as an invasive plant or which associate it to events of alloctonous colonization (Celesti-Grapow & al. 2009a, 2009b).

If we assume the indigenous nature of *J. valvatus* in Italy, it would be reasonable to suppose that this species had been significantly more widespread in the past and that its current scarcity is simply due to the systematic destruction of humid areas performed by man in the last century. There is no doubt that the sporadic presence of the whole hygrophilous vegetation in the study area is related to the significant lowering of the groundwater table due to the reclamation works carried out between 1920 and 1930. In fact, as referred by Tangorra (1983) the site of collection was a well-known depressed area extended for more than 5 km known as “il Pantano di Fontana di Tavola” (“Pantano” is the vernacular name for “marsh”) characterised by an uninterrupted series of pools which were fed by several perennial sources which assured the presence of water even during the dry season in summer.

However, even considering this species as indigenous of Italy, it is still not easy to provide a fully convincing biogeographical theory which could explain an extremely disjunct distributional range which associates Portugal, Algeria, Tunisia and Apulia (the latter being the Italian region which exhibits the highest floristic and coenological amphiadriatic relationships). Such a distributional pattern is in fact very unusual, but certainly not impossible, as emerged from a study of Junikka & Uotila (2003) where Apulia region is proved to have higher floristic similarities to the Iberian Peninsula than those exhibited from some strictly western Tyrrhenian regions of Italy, such as Latium and Campania. There are in fact some other species which show chorological similarities to those of *J. valvatus*. These similarities can be considered “slight” in the case of *Quercus suber*, which has a western Mediterranean range with the easternmost stations located in Apulia, or can be more evident, as in the case of *Cistus clusii*, which exhibits a disjunct distribution range with a centre of distribution in the Iberian Peninsula and few isolated relic stations in Apulia and Sicily.

The scattered distribution of *J. valvatus* restricted to few relictual sites including Apulian region, Portugal and north-western Africa, could lead to consider this species as a sort of “survivor” of the sub-tropical flora and vegetation which existed in the Mediterranean basin during the end of Tertiary. The current, extremely fragmentary distribution and relic occurrence of *J. valvatus* could therefore be the result of the negative impact of the appearance of prolonged periods of summer drought at the end of the Tertiary and of the frequency of the steppic dry periods which alternated with forested periods during the Quaternary (Follieri & al. 1988; Blasi & al. 1995).

However there is a second hypothesis too, which concerns the seed-dispersal mechanism



Fig. 5. Location of *Juncus valvatus* site in the context of the preserved areas (ZPS) of Apulia region.

of the species and which would suggest a more recent “natural” introduction. Considering that at least an half of the stations of the species which are known at present are located in northern Africa, it is possible to hypothesise a sort of “african origin” of *J. valvatus* which could have reached Europe through epizoochory mechanisms. In fact it is well-known that *Juncus* species are perfectly adapted to long-distance seed dispersal thanks to the small-size of their seeds which adhere to birds’ feathers through small mud particles.

In terms of conservation *J. valvatus* is considered a species of community interest by the EU, listed in the Habitat Directive 92/43 EEC under annex II and under annex IV, and in the Strasbourg Convention on the conservation of European wildlife and natural Habitats under annex 1. Following IUCN parameters (Walter & Gillett 1998; Kirschner & Kaplan 2002) this species is to be considered as “rare”. According to the latest IUCN protocol (IUCN 2006) the discovery of this new site of *J. valvatus* in Southern Italy enlarges enormously the extent of occurrence (EOO) of the species whereas the modifications of the area of occupancy (AOO) is practically negligible, since the Italian population is completely included within a single 1x1 km grid cell. On the basis of the data available at present it is not easy to give a definite answer concerning the “global status” of the species as requested by IUCN criteria. When compared to the global population of *J. valvatus*, the Apulian population is in fact very small and can be estimated with certainty at less than 1%. The continuous reduction and fragmentation of the humid areas at disposal of the species as well as

the disturbance due to the intensive agricultural practices in the adjacent fields could progressively lead to a minor capacity of environmental adaptation as well as a minor reproductive fitness. For this reason, although there is at present no definite answer as to whether *J. valvatus* is to be considered an indigenous or an alien species, we suggest that it be preliminarily included in the *Critically endangered* (CR) IUCN category at regional level.

Conclusions

The discovery of a population of *J. valvatus* in Italy is of great interest, since it shifts easternwards the global range of this W-Medit/sub-Atlantic entity which, being very rare, behaves as a relic species within its whole distribution area. The importance of this record however goes beyond the biogeographical aspects or the simple addition of a new species to the Italian flora. *J. valvatus* is a species of community interest, listed in two annexes of the Habitat Directive 92/43 EEC, and this new record for Italy will have implications both at national and at continental level. The hypothesised inclusion of this species in the “highest risk” category at regional level should ensure a higher warrant of protection in expectation of the updating of the national and regional Red lists in the future. Unfortunately at present this species is completely lacking of protection since the site of collection is located in a narrow unprotected area interposed between the two preserved areas of “Alta Murgia National Park” and “Parco delle Gravine” Regional Reserve (Fig. 5).

Acknowledgements

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Address of the authors:

Romeo Di Pietro¹, Robert Philipp Wagensommer¹, Giuseppe Silletti² & Giuseppe Misano³

¹Dipartimento ITACA, sect. TECA, University of Rome “La Sapienza”, Via Flaminia 70, I-00196 Roma, Italy, e-mail. romeo.dipietro@uniroma1.it

²Corpo Forestale dello Stato, Taranto.

³CEA “Parco delle Gravine”, Via San Francesco 53, 74014 Laterza (TA).
www.ceaparcodellegravine.it