

SHORT COMMUNICATION

Bolboschoenus planiculmis (Cyperaceae), a third species of *Bolboschoenus* for the Netherlands

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Key words

Bolboschoenus

'*Bolboschoenus maritimus* group'

cryptic species

wetlands

Abstract – In 2017 *Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova (basionym: *Scirpus planiculmis* F. Schmidt) was discovered in the Grensmaas area in the Province of Limburg in the southeastern part of the Netherlands. The identification of this species, with its bifid styles and biconcave achenes, was straightforward. Later, the first author found a second specimen of this species in the herbarium of the Dutch Plant Protection Organisation, now part of the Netherlands Food and Consumer Product Safety Authority, which was collected in 2002 as a possibly harmful plant in a tree nursery at Sambeek in the Province of Noord-Brabant near the River Meuse. We provide a brief description of this species and a key to the *Bolboschoenus* species in the Netherlands.

Samenvatting – In 2017 werd door de tweede auteur Oostelijke bies (*Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova; basioniem: *Scirpus planiculmis* F. Schmidt) aangetroffen aan de Grensmaas in Zuid-Limburg. De identificatie van de soort was mogelijk op grond van de tweelobbighe stijlen en de biconcave nootjes. Later trof de eerste auteur in het herbarium van de Nederlandse Voedsel- en Warenautoriteit (NVWA) Wageningen (voormalige Plantenziektenkundige Dienst), een tweede exemplaar aan van deze soort, verzameld op een boomkwekerij in Sambeek in 2002 in Noord-Brabant nabij de Maas. In dit artikel geven we een korte beschrijving van deze nieuwe soort en de vindplaatsen, en een sleutel voor de nu drie in Nederland voorkomende *Bolboschoenus*-soorten.

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INTRODUCTION

During the last decades, the so called '*Bolboschoenus maritimus* group' has been studied intensively in Europe. In Flora Europaea, DeFilipps (1980) mentions only one single species of *Scirpus* sect. *Bolboschoenus*: *Scirpus maritimus* L., with two subspecies. However, Egorova et al. (1976) earlier mentioned another species, *B. planiculmis* (F. Schmidt) T.V. Egorova, for the European part of the former USSR. Later, Browning et al. (1996) reported *B. yagara* (Ohwi) Y.C. Yang & M. Zhan, an Asian taxon, for Eastern Europe, and a putative hybrid between *B. yagara* and *B. maritimus* for Europe. In 1998, Browning et al. (1998) reported *B. glaucus* (Lam.) S.G. Sm. for southern Europe.

In a revision of the *Bolboschoenus maritimus* group in Central Europe by Marhold et al. (2004), the putative hybrid between

B. yagara and *B. maritimus* (sensu Browning et al. 1996) was raised to the species level: *B. laticarpus* Marhold, Hroudová, Ducháček & Zák. It is a clear example of speciation by means of hybridisation: a stabilised hybrid that follows a distinct evolutionary and ecological pathway. Pířová et al. (2017) later confirmed that the parent species of *B. laticarpus* are *B. yagara* and *B. planiculmis* (and not *B. maritimus*) as was already hypothesised by Marhold et al. (2004).

Hroudová et al. (2007) presented an overview of the distribution and ecology of the five species of *Bolboschoenus* that are currently accepted in Europe.

In the Netherlands, during the late 19th and early 20th century, several infraspecific taxa on the variety level were recognised within *Scirpus maritimus* L. (Kops et al. 1836; Vuyck 1916). Later, Reichgelt (1956) reduced these taxa to four formae.

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He used the lower rank of forma, because the characters that were used to distinguish the infraspecific taxa proved to have no taxonomic value. [Van der Meijden \(2005\)](#) recognised only one single species with no infraspecific taxa in this group, which he classified in the genus *Bolboschoenus* as *B. maritimus* (L.) Palla. Because [Marhold et al. \(2004\)](#) mentioned a record of a new species, *B. laticarpus* Marhold, Hroudová, Ducháček & Zákr., for the Millingerwaard (Province of Gelderland), [Dirkse et al. \(2007\)](#) included *B. laticarpus* in the Flora of Nijmegen and Kleve. In 2015, [Simons et al. \(2016\)](#) revised collections of *Bolboschoenus* in L, WAG and a few other herbaria in the Netherlands. It turned out that since at least early 19th century *B. laticarpus* is widespread and common alongside present and former rivers. No other species of *Bolboschoenus* besides *B. laticarpus* and *B. maritimus* were found, but the authors 'predicted' *B. yagara* and *B. planiculmis* could appear soon in the southeastern part of the Netherlands.

In 2017, the second author of this paper indeed discovered *Bolboschoenus planiculmis* at three localities in the 'Grensmaas' area, which belong to a series of nature restoration projects alongside the River Meuse just north of Maastricht. Two populations were found very close to each other near Itteren, another near Geulle aan de Maas. Later, the first author found in the herbarium of the Netherlands Food and Consumer Product Safety Authority (Nederlandse Voedsel- en Warenautoriteit) in Wageningen (WAGPD) an herbarium specimen that was collected in 2002, which turned out to be *B. planiculmis* as well. This specimen was collected as a pest plant in a tree nursery at Sambeek in the Province of Noord-Brabant near the River Meuse. It was originally collected as possibly being *Cyperus*

esculentus, which is considered as a harmful invasive species in the Netherlands, but re-identified and preserved as *B. maritimus*. The localities in the Netherlands where *B. planiculmis* has been found are shown in [Fig. 1](#).

MORPHOLOGY AND ECOLOGY OF THE POPULATIONS FOUND IN THE NETHERLANDS

As could be expected, *Bolboschoenus laticarpus* is the most abundant *Bolboschoenus* species in the Grensmaas area alongside the River Meuse ([Simons et al. 2016](#)). The population of *Bolboschoenus* in this area that was found by the second author, however, consists of smaller (30–60 cm) and more slender plants with capitate *B. maritimus*-like inflorescences ([Fig. 2](#)) that are clearly different from the symmetrically umbellate inflorescences of *B. laticarpus*. Examination of the flowers and the unripe fruits showed that the identity of the plants of this population undoubtedly was *B. planiculmis*, because of its bifid (instead of trifid) styles and its biconcave achenes. All other species of *Bolboschoenus* in Europe have trifid styles, making *B. planiculmis* easy to recognise ([Schmidt 1868](#); [Marhold et al 2004](#), [Hroudová et al 2007](#)). Furthermore, the biconcave achenes are a striking feature ([Fig. 3](#)).

In the Grensmaas area near Itteren, *Bolboschoenus planiculmis* grows in small belt-like patches along the bank of a shallow river branch that is connected to the river only when water levels are high. At a second visit, in late September, the populations were submerged in 80 cm deep water. Associated species are shown in a vegetation relevé ([Table 1](#)). These are



Fig. 1. Localities of *Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova in the Netherlands based on herbarium specimens (see [Appendix](#)). [Open Source Geospatial Foundation Project \(2018\)](#).



Fig. 2. Inflorescence of *Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova showing the characteristic bifid styles. Photo: Itteren, 22 August 2017, Sipke Gonggrijp.

mainly glycophile amphibious and helophytic plants as well as some ruderal species that are associated to the Phragmitetea and Bidentetea tripartitae classes. Close to the relevé, *B. laticarpus* is the more frequent or even dominant species at the river branch bank. We think vegetations with *B. planiculmis* here could fit in the Phalarido arundinaceae-Bolboschoenetum laticarpi Passarge 1999 corr. Krumbiegel 2006, like other inland *Bolboschoenus* vegetations alongside rivers in the Netherlands, as suggested by Simons et al. (2016), based on the work by Hroudová et al. (2009).

The second locality at Sambeek has not been visited by us. The plants have been found in full soil (loamy sand) in a tree nursery with planted trees of Italian origin. According to Hroudová et al. (2007), *B. planiculmis* does occur in northern Italy, and is well adapted to temporarily flooded terrestrial habitats as well (e.g., field depressions, ditches); it is known there as an undesirable weed in arable fields.

DISCUSSION

Until recently, *Bolboschoenus laticarpus* has been overlooked, but it is not a recent new species to the Dutch flora, and it should, like *B. maritimus*, be regarded as indigenous (Simons et al. 2016). *Bolboschoenus planiculmus* however, is a recent

addition to the Dutch flora. There are several probable pathways of introduction: The plants from Sambeek are almost certainly introduced and probably transported with potted plants from Italy. 'Noxious' Cyperaceae in arable fields (often *Bolboschoenus maritimus* or *Cyperus esculentus* L.) are often reported to the Dutch Plant Protection Service, but good herbarium collections are scarce. Collecting more herbarium material may reveal some new populations of *Bolboschoenus* species in arable fields.

The area of Itteren is known to be exceptionally rich in introduced plant species, at present (waarneming.nl 2017), but also in the past. Around the mid 20th century the area was already famous for its exotic species (e.g., Van Ooststroom & Reichgelt 1956; Visé 1942, 1958), probably related to wool industry along the River Vesdre, a tributary to the River Meuse. Most wool aliens are of Mediterranean, and in lesser extent Australian, South American or South-African origin. Only a small number of the species associated with the wool industry is of West-Asian or Central European origin, the distribution range of *B. planiculmis*. Hence we incline to think that it is less likely that *B. planiculmis* is a wool alien in the Itteren area and consider it most likely that this species followed a natural pathway of introduction. *Bolboschoenus planiculmus* occurs in France, Germany, and Switzerland, and the Meuse corridor, especially the source area of the River Meuse, is not far from existing populations (Hroudová et al. 2007). Like the two other known species of

Tabel 1. Vegetation relevé of a vegetation with *Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova in the Grensmaas area, Province of Limburg, the Netherlands. The relevé is stored in the Dutch Vegetation Database (Hennekens 2019).

Author	Erik Simons
Relevé number	ES17091501
Cover scale	Braun-Blanquet
Date	15 September 2017
X-coordinate Dutch grid	177035
Y-coordinate Dutch grid	324320
Latitude DD WGS84	50,90822
Longitude DD WGS84	5,70048
Length relevé (m)	1,00
Width relevé (m)	4,00
Surface relevé (m²)	4,00
Total cover (%)	80
Herb layer cover (%)	80
Average height herb layer (cm)	40
Maximum height herb layer (cm)	60

Scientific name

<i>Echinochloa crus-galli</i>	2a
<i>Leersia oryzoides</i>	2a
<i>Lythrum salicaria</i>	2b
<i>Phalaris arundinacea</i>	2a
<i>Salix viminalis</i>	+
<i>Persicaria lapathifolia</i> subsp. <i>lapathifolia</i>	3
<i>Artemisia biennis</i>	+
<i>Bolboschoenus planiculmis</i>	2a
<i>Xanthium strumarium</i>	+



Fig. 3. Biconcave achenes of *Bolboschoenus planiculmis* (F. Schmidt) T.V. Egorova (*S. Gonggrijp 1*, L). Photo: Sipke Gonggrijp.

Bolboschoenus in the Netherlands, achenes of *B. planiculmis* are small and hard and will probably pass easily through the digestive tract of ducks and geese (Kleyheeg 2015, Simons et al 2016), which are present year-round in the Grensmaas area. Probably *B. planiculmis* is one of the many non-native plant species that have been introduced (and will be introduced) into the Netherlands by endozoochorous dispersal by waterfowl. In general, a large fraction of non-native plant species are adapted for dispersal by birds (Morton & Hogg 1989) and this seems also to be true for *B. planiculmis*.

KEY TO THE *BOLBOSCHOENUS* SPECIES OF THE NETHERLANDS

1. Inflorescence always symmetrically umbellate with a central cluster of spikelets and 3–6 rays of peripheral clusters of spikelets; spikelets usually 10–15 mm long, very rarely up to 30 mm. Peduncles of peripheral clusters (rays) (2–)3–4(–5) times as long as the length of spikelets in central cluster 2
1. Inflorescence monostachyous, or multistachyous and capitate or irregularly branched, with peduncles of peripheral clusters (rays) (0,5–)1–2(–4) times as long as the length of spikelets in central cluster. Perianth bristles caducous 3
2. Achene 3,0–4,0 × 2,1–2,7 mm, light brown to dark brown, more or less orbicular, ovate to subtrigonus in cross section (keeled abaxial ridge). Exocarp more than 2 times as thick as the mesocarp, consisting of thick layer of aerenchymous cells that are usually (2–)3–4 as long as wide. Perianth bristles caducous *Bolboschoenus maritimus*
 'typical form', probably not rare in Biesbosch area and in some parts of the Province of Noord-Holland.
2. Achene relatively small, 1,0–3,7 × 2,0–2,4 mm, glossy black, broadly (more or less flattened) triangulate in cross section. Exocarp thin (less than half of the thickness of the mesocarp), consisting of aerenchymous cells being more or less isodiametric to 1,5(–2) times as long as wide. Perianth bristles persistent on ripe fruits *Bolboschoenus laticarpus*
2. Achenes black, narrow; 1,6–1,8 mm wide, equilaterally trigonus in cross section with very thin exocarp consisting of isodiametric cells. Not yet found in the Netherlands *Bolboschoenus yagara*
3. Styles (predominantly) trifid. Achenes more or less orbicular, convex, ovate to subtrigonus in cross section (keeled abaxial ridge). Exocarp more than 2 times as thick as the mesocarp, consisting of thick layer of aerenchymous cells that are usually (2–)3–4 as long as wide *Bolboschoenus maritimus*
3. Styles (predominantly) bifid. Achenes more or less orbicular, biconcave in cross section. Exocarp about as thick as the mesocarp, consisting of thick layer of aerenchymous cells that are usually (2–)3–4 as long as wide, thicker at the rounded angles than at the concave faces *Bolboschoenus planiculmis*

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APPENDIX

Herbarium specimens of *B. planiculmis* in the Netherlands (acronyms according to Thiers (2018)):

- S. *Gonggrijp* 1 (L), Itteren, 05-IX-2017; S. *Gonggrijp* 2 (L), Itteren, 22-VIII-2013; E.L.A.N. *Simons et al. 2095* (WAG), Itteren, 15-IX-2017; s. coll., sub herb. no. E.L.A.N. *Simons 2098* (WAGPD), Sambeek, 09-X-2002.