



## ***Eleocharis engelmannii* and *E. obtusa* (Cyperaceae), two recent acquisitions from series *Ovatae* in Belgium**

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**Illustrations:** T. Ceulemans (Fig. 1), I. Van der Beeten (BR; 2-4), W. Vercruysse (5), H. Engledow (BR; 6) and F. Verloove (7).

**ABSTRACT.** – A revision of *Eleocharis* series *Ovatae* in Belgium is presented. Three species are distinguished: native *E. ovata* and non-native *E. engelmannii* and *E. obtusa*. An identification key for the separation of these species, as well as SEM photos of their achenes, are presented. Additional information on the distribution and ecology of the two non-native species is also provided.

**SAMENVATTING.** – *Eleocharis engelmannii* en *E. obtusa* (Cyperaceae), twee recente nieuwkomers in België uit series *Ovatae*. Deze bijdrage biedt een revisie van *Eleocharis* series *Ovatae* in België. De groep omvat drie soorten: enerzijds *E. ovata* (inheems), anderzijds *E. engelmannii* en *E. obtusa* (niet-inheems). De bijdrage omvat een determinatiesleutel, SEM-foto's van de vruchtjes en, voor de niet-inheemse soorten, bijkomende informatie over verspreiding en ecologie.

**RÉSUMÉ.** – *Eleocharis engelmannii* et *E. obtusa* (Cyperaceae), deux acquisitions récentes en Belgique de la série *Ovatae*. Cette contribution propose une révision d'*Eleocharis* ser. *Ovatae* en Belgique. Le groupe comprend trois espèces: d'une part *E. ovata* (indigène), d'autre part *E. engelmannii* et *E. obtusa* (non indigène). L'article comprend une clé d'identification, des photographies SEM des fruits et, pour les espèces non indigènes, des informations supplémentaires sur la distribution et l'écologie.

### **Introduction**

*Eleocharis* R. Br. is a nearly cosmopolitan genus with ca. 200-250 species (Govaerts *et al.* 2007, Mabberley 2008). They are generally found in wet places, often where there is strong seasonal variation in water level. The genus is most diverse in the Americas with 67 species occurring in North America (Galen Smith *et al.* 2002) and 145 in the Americas as a whole (González-Elizondo & Tena-Flores 2000). Fifteen species are known from the *Flora Europaea* area, three of which locally naturalized non-natives (Walters 1980). Some additional species were recently reported as locally naturalized (e.g. Gregor *et al.* 2004, Verloove 2010). Eight species have been reported from Belgium and neighboring territories: six native [*E. acicularis* (L.) Roem. & Schult., *E. multicaulis* (Smith) Desv., *E. ovata* (Roth) Roem. & Schult. (Fig. 1), *E. palustris* (L.) Roem. & Schult., *E. quinqueflora* (F.X. Hartm.) O. Schwartz and *E. uniglumis* (Link) Schult.], one certainly [*E. obtusa* (Willd.) Schult.] and one probably introduced (*E. austriaca* Hayek) (Lambinon & Verloove 2012).

*Eleocharis* is a complex genus for which a recent worldwide monographic treatment is lacking. Molecular data are

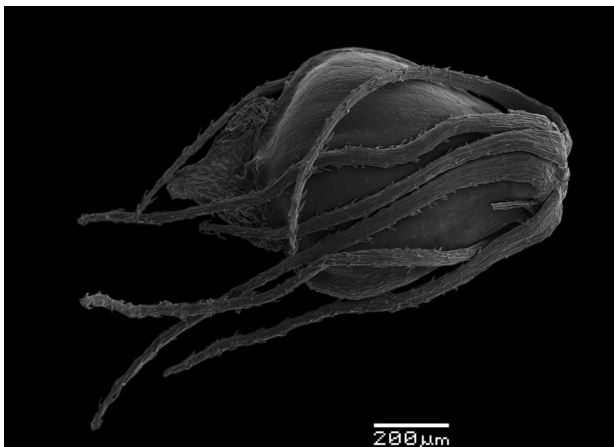
few and mostly limited to selected geographical areas (e.g. North America) or infrageneric taxa [e.g. subgenus *Limnochloa* (P. Beauv. ex T. Lestib.) Torr. or series *Pauciflorae* (Beauverd) Svenson] and limited by the number of species considered (e.g. Roalson & Friar 2000). The supraspecific classification of the genus was recently critically assessed on a worldwide basis (González-Elizondo & Peterson 1997). The new circumscription of several groups proved to be quite different compared with that adopted by earlier authors, including Svenson (1929, 1932, 1934, 1937, 1939), the latest monographer of the genus.

Molecular data showed that many groups are not monophyletic (Roalson *et al.* 2010). The Belgian representatives of *Eleocharis* belong to the subgenera *Zinserlingia* T.V. Egorova (*E. quinqueflora*), *Scirpidium* (Nees) Kukkonen (*E. acicularis*) and *Eleocharis*. The latter is further divided in section *Eleocharis* [with series *Eleocharis* (subseries *Eleocharis*: *E. austriaca*, *E. palustris* and *E. uniglumis*) and series *Multicaules* (Beauverd) Svenson ex J. Kern (*E. multicaulis*)] and section *Eleogenus* (Nees) Benth. & Hook. [with series *Ovatae* Svenson (*E. obtusa* and *E. ovata*)].



**Figure 1.** *Eleocharis ovata*, native to Belgium but rare. Plants of this species typically have slender, thin stems. Genk (Bokrijk), exposed pond margin, September 2011.

Out of these, series *Ovatae* probably is a monophyletic group, as shown by recent molecular studies (Roalson & Friar 2000). As currently understood (i.e., applying a narrow species concept), it comprises six species that are native to temperate North America and Eurasia (Galen Smith *et al.* 2002). Although actual species delimitation corroborates with several previous studies (e.g. Larson & Catling 1996, Haines 2001) this series remains a critical group in terms of taxonomy, most taxa being distinguished on the basis of a limited number of characteristic features (mainly tubercle dimensions and perianth bristle characters). All are distinctive in being caespitose annuals with smooth, brown, lenticular achenes and well-differentiated tubercles. In Belgium series *Ovatae* is represented by the rare and declining native species *Eleocharis ovata* [syn.: *E. soloniensis* (Dubois) Hara] (Lambinon & Verloove 2012) and the recently introduced American *E. obtusa* (Lambinon & Mause 2010; Verloove 2014). In 2014 an additional species, *E. engelmannii* Steudel, also native in North America, was discovered near Ghent (province of East Flanders). All three are much alike and probably confused, not only in Belgium. The present paper aims at improving the knowledge on this series in Europe. SEM



**Figure 2.** SEM photograph of an achene of *Eleocharis ovata*.

photos of achenes are presented for all species, as are distributional records, distinguishing features and ecological notes for the American species. Since all three are much reminiscent, the European species being critically endangered in many areas (incl. Belgium) and the others often considered environmental weeds instead, a correct assessment of their identity is of the utmost importance.

### Identification, distribution and ecology

The three species of *Eleocharis* series *Ovatae* currently found in Belgium are annuals with a caespitose habit combined with smooth, biconvex achenes crowned by dark, compressed tubercles. In the course of time these species either have been accepted as one variable species (*E. ovata*), as infraspecific taxa of the latter or as distinct entities. Since Larson & Catling (1996), however, there is more or less general agreement that all should be given species rank (see also Galen Smith *et al.* 2002). In a morphometric analysis of Canadian plants Larson & Catling l.c. demonstrated that groups established on the basis of stamen number were completely separable by tubercle width, these two features providing the best basis for a reliable identification. Plants from Europe are usually separated without difficulty, *Eleocharis engelmannii* and *E. ovata* being quite different in achene characters, with *E. obtusa* occupying a more or less intermediate position. Some plants of the latter, however, are obviously nearer to *E. ovata*. These observations seem to corroborate with molecular data presented by Roalson *et al.* (2010). A lower taxonomic rank for *E. obtusa*, under *E. ovata*, may turn out to be more appropriate.

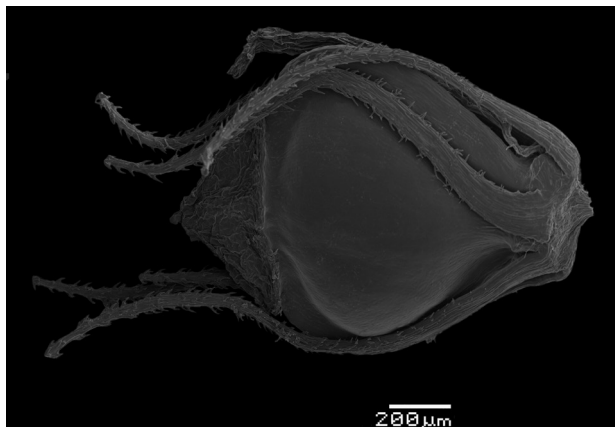
The three species found in Belgium are distinguished in the following identification key. Since their separation is mostly based on achene and tubercle characters, mature achenes are required for an accurate identification. The key is best used in conjunction with Figures 2-4.

1. Tubercle 0.3-0.5 mm wide, less than 2/3 achene width (Fig. 2). Stamens two (rarely three). Style branches two. Stems nearly always decumbent to ascending, usually slender (native) ..... ***Eleocharis ovata***  
Tubercle 0.5-1 mm wide, (nearly) equaling achene width. Stamens three (rarely two). Style branches predominantly three (sometimes in part two). Stems stiffly erect, usually robust (introduced) ..... 2
2. Tubercle less than 3× as wide as high, ca. 1/3-1/2 as high as achene. Perianth bristles greatly exceeding achene (Fig. 3) ..... ***E. obtusa***  
Tubercle more than 3× as wide as high, less than 1/3 as high as achene. Perianth bristles shorter to slightly longer than achene (Fig. 4) ..... ***E. engelmannii***

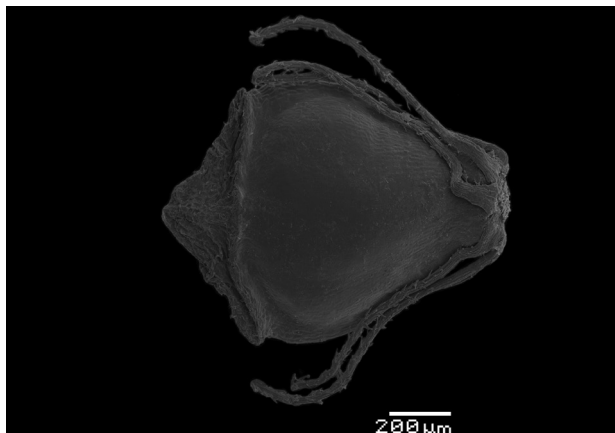
***Eleocharis engelmannii*** Steud., Syn. Pl. Glumac. 2: 79. 1855.

≡ *E. ovata* (Roth) Roem. & Schult. var. *engelmannii* (Steud.) Britton, J. New York Microscop. Soc. 5: 103. 1889.





**Figure 3.** SEM photograph of an achene of *Eleocharis obtusa*.



**Figure 4.** SEM photograph of an achene of *Eleocharis engelmannii*.

≡ *E. obtusa* (Willd.) Schult. var. *engelmannii* (Steud.) Gilly, Iowa State Coll. J. Sci. 21: 92. 1946.

See figure 4 and 5. Caespitose annual (rarely perennial). Culms 2-40 cm × 0.5-1.5(-2) mm. Leaves: apex of distal leaf sheath obtuse to acute, tooth to 0.3 mm. Spikelets lanceoloid to subcylindric or ovoid, 5-10(-20) × 2-3(-4) mm, apex acute (to rounded); proximal scale empty, encircling ca. 2/3 of culm; floral scales 25-100(-200), 8-12 per mm of rachilla, orange brown to stramineous, 2(-2.5) × 1-1.3 mm, midribs mostly keeled, ovate, apex narrowly rounded to subacute. Flowers: perianth bristles present, 5-8, brown, stout, not exceeding tubercle; stamens (2-)3; anthers brown to yellow, 0.3-0.7(-1) mm; styles predominantly 3-fid (some 2-fid). Achenes 0.9-1.1(-1.5) × 0.7-1.1 mm. Tubercles depressed, subdeltoid, 0.1-0.3(-0.4) × 0.6-0.9(-1) mm, 1/10-1/3 as high as wide, 1/4 or less as high as achene, 9/10 as wide as achene (adapted from Galen Smith *et al.* 2002).

**Distribution.** Southern Canada and U.S.A. Outside of its native distribution area perhaps only known from Europe where it has been recorded from Germany (Plieninger 2001) and Belgium (this paper). Possibly overlooked elsewhere. In Germany *Eleocharis engelmannii* is known since 1994 from a former training area of

the U.S. army in Heilbronn in Baden-Württemberg. It is still present but has not spread to other localities (comm. W. Plieninger 2014). In Belgium it was discovered in a single locality in the Ghent port area in 2014. In 2015 its presence there was confirmed; moreover, *E. engelmannii* was also observed on the banks of two adjacent ponds in the same area. A future, local naturalization seems likely but requires confirmation. See the distribution map (Fig. 6), based on 4 × 4 km IFBL squares. Within square C3.53, *E. engelmannii* has been recorded from two 1 × 1 km squares: C3.53.21 and C3.53.22.

**Habitats.** Fresh shores, marshes, disturbed places; 30-2400 m above sea level (Galen Smith *et al.* 2002). In Heilbronn it is found in a wide variety of temporarily wet places (310-362 m a.s.l.; Plieninger 2001) while in Ghent it grows on the exposed, muddy banks of a recently created pond, less than 5 m a.s.l.

**Recognition.** Easily separated from both *Eleocharis ovata* and *E. obtusa* by its very wide but low tubercle (more than three times as wide as high) and perianth bristles shorter than to hardly as long as the achenes (incl. tubercle). Like in *E. obtusa* stems usually are coarse and erect.

Selection of specimens examined from Belgium and Germany, chronologically arranged:

- Harbour of Ghent, Desteldonk-Mendonk, pond margin, recently created, +/- 30 individuals, 19.07.2014, *W. Ver-cruysse* s.n. (BR 14442186);
- SE Heilbronn, "Krampf", nördliche Freifläche, 24.07.2014, *W. Plieninger* 1329 (priv. herb. W. Plieninger, dupl. BR);



**Figure 5.** *Eleocharis engelmannii*. Stems of this species (and of *E. obtusa*) are usually thick, stiff and erect. Ghent (Desteldonk), exposed pond margin, June 2015.

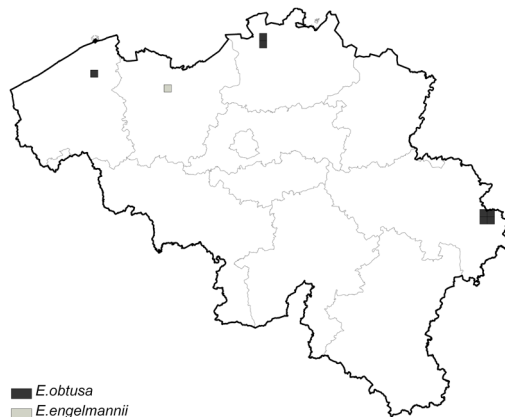


- Gent (Mendonk), E of Kennedylaan (IFBL C3.53.21), recent water reservoir, several tens, scattered, 31.08.2014, *F. Verloove* 11123 (BR 14442193);
- Gent (Mendonk), E of Kennedylaan (IFBL C3.53.21), recent water reservoir, 28.09.2014, *F. Verloove* 11149 (BR 14442209).

***Eleocharis obtusa*** (Willd.) Schult., Mant. 2: 89. 1824.  
 ≡ *Scirpus obtusus* Willd., Enum. Pl. 1: 76. 1809.

See figure 3 and 7. Caespitose annual (rarely perennial). Culms 3-50(-90) cm × 0.2-2 mm. Leaves: apex of distal leaf sheath obtuse to acute, tooth to 0.3 mm. Spikelets broadly ovoid (to ellipsoid or lanceoloid), apex rounded (to acute), (2-)5-13 × (2-)3-4 mm; floral scales 15-150 or more, 8-20 per mm of rachilla, orange-brown (to stramineous), elliptic, 1.5-2.5 × 1-1.5 mm, midribs seldom keeled, apex broadly rounded. Flowers: perianth bristles (5-)6-7, brown, stout, usually greatly exceeding tubercle; stamens usually 3; anthers brown to yellow, 0.3-0.6 mm; styles usually trifid (sometimes some bifid). Achenes 0.9-1.2(-1.3) × 0.7-0.9 mm. Tubercles deltoid 0.35-0.5 × (0.4-)0.5-0.8 mm, 1/3-2/3 as high as wide, 1/3-1/2 as high and 2/3-9/10 as wide as achene (adapted from Galen Smith *et al.* 2002).

**Distribution.** Southern Canada, U.S.A. and Hawaii. Outside of its native distribution area known from Argentina (Pensiero *et al.* 2005), Italy (Koch 1952), Belgium (Lambinon & Mause 2010), Switzerland (Desfayes 2008) and Belarus (Dzhus 2014). Portuguese claims proved to be erroneous and referable to *Eleocharis flavescens* (Poir.) Urb (Jiménez Mejías & Luceño 2007). All records, also those from outside the Iberian Peninsula, being erroneously referred to *E. flavescens*, *E. obtusa* was omitted



**Figure 6.** Actual distribution of *Eleocharis engelmannii* and *E. obtusa* in Belgium based on data from herbarium specimens and records from *waarnemingen.be*. Dots on the map refer to 4 × 4 km IFBL squares.

from the Euro+Med Plantbase (<http://www.emplantbase.org/home.html>). It is possibly overlooked elsewhere in Eurasia, as a result of confusion with *E. ovata*. In Belgium *E. obtusa* is found in three geographical areas, one in Brasschaat (prov. of Antwerp), a second in Bütgenbach (prov. of Liège) and a third in Loppem, near to Bruges (prov. of West-Flanders). Despite being a fairly recent introduction (the first records date back to 2007) it seems firmly established in these areas: see Fig. 6, based on 4 × 4 km squares. Within these squares, *E. obtusa* has been recorded from the following 1 × 1 km squares: B4.38.34, B4.48.13, B4.48.12, C2.31.33, G8.26.33, G8.26.42, G8.27.43, G8.36.21, G8.37.12, G8.37.14 and G8.37.41.

**Figure 7.** *Eleocharis obtusa*.  
 Brasschaat, Klein Schietveld, wet track in heath, July 2013.



**Habitats.** Fresh shores, marshes, disturbed places; 10–1600 m a.s.l. (Galen Smith *et al.* 2002). In Belgium *Eleocharis obtusa* grows in and next to shallow, temporary pools and tracks in heaths, between ca. 4 and 630 m a.s.l. It mostly occurs in areas that are or have been used as military training areas. Elsewhere in Europe it is found in similar habitats but also on exposed river banks and as a weed in rice fields.

**Recognition.** *Eleocharis obtusa* is more or less intermediate between *Eleocharis engelmannii* and *E. ovata*, and usually easily separated from both. It differs from *E. ovata* in normally having three stamens and at least some flowers (often most flowers) with three style branches and tubercles that are at least 2/3 as wide as the achene. Also, plants are usually more vigorous with thicker, erect stems. From *E. engelmannii* it is distinguished by its perianth bristles that greatly exceed the achene (incl. tubercle) and its tubercle that is nearly as high as wide (much less than three times as wide as high).

Selection of specimens examined, all from Belgium, chronologically arranged:

- Camp militaire d’Elsenborn (comm. de Bütgenbach). Hergenvenn (IFBL G8.37.14), dépression-mare dans une piste de chars, 21.08.2007, *J. Lambinon* 07/B/92, *Ph. Frankard* & *J.-L. Gathoye* (LG, dupl. BR 530774);
- Brasschaat, Klein Schietveld (reserve) (IFBL B4.38.34), heathland, in temporarily damp tracks (former military area), two clumps at two different localities, 11.07.2010, *F. Verloove* 8119 (BR 14442247);
- Elsenborn (IFBL G8.37.12), in shallow water, 2011, *R. Barendse* s.n. (BR 14442216);
- Brasschaat, Klein Schietveld (IFBL B4.48.12), damp tracks in heathland (former military area), three plants in newly discovered locality, 30.06.2013, *F. Verloove* 10205 (BR 14442230);
- Brasschaat, Klein Schietveld, former military training area (IFBL B4.38.34), damp track in heathland, 31.08.2014, *F. Verloove* 11120 (BR 14442223);
- Loppem, Zevenkerken (IFBL C2.31.33), shallow depression in grassland, near pond, 25–30 individuals, 19.07.2015, *F. Verloove* 11586 (BR 15200754V).

## Conclusion

*Eleocharis ovata* is a much declining native species in large parts of Europe. In Belgium it is included in the Red List as ‘critically endangered’ (Kestemont 2010). In contrast, two related North American species, *E. engelmannii* and *E. obtusa*, are increasingly found, often in natural habitats that greatly resemble those preferred by *E. ovata*. Both appear to be fairly expansive and easily adapt to new environments. At least *E. obtusa* has become an unwanted environmental weed in the sense of Richardson *et al.* (2000), for instance in Piemonte in northwestern Italy (comm. D. Bouvet & A. Selvaggi, 2015). Since all these species are morphologically very similar, they may have been widely intermingled in Europe, the two North American species potentially being much more widely dis-

persed. Especially new occurrences of ‘*E. ovata*’ in areas where there are no historical records, as well as a sudden increase of records in areas from where it is known, are suspect and may refer to confusion with one of the non-native species. A critical assessment of the genuine identity of species from *Eleocharis* series *Ovatae* is important. This paper therefore aims at improving the knowledge on this species complex in western Europe.

**Acknowledgements.** – Francis Menapace (U.S.A.) is thanked for offering authentic American collections of *Eleocharis engelmannii* and *E. obtusa*. Walter Plieninger (Germany) sent a specimen of *E. engelmannii* from Germany and Ward Vercruysse is acknowledged for drawing the attention to an unknown species of *Eleocharis* in Ghent that turned out to be *E. engelmannii*. Attila Mesterházy (Hungary) is thanked for the interesting discussions about *E. obtusa* and related taxa in Europe and Daniela Bouvet and Alberto Selvaggi (Italy) for providing data about distribution and status of *E. obtusa* in Piemonte.

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### Postscript

Just before publication, on October 13, 2015, the author of the above article discovered yet another population of *Eleocharis engelmannii* in a recently constructed retention basin in Dadizele (province of West Flanders; IFBL E1.27.14 and E1.27.23).

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