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FILIP VERLOOVE¹

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Abstract

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The identity of the North American xenophyte *Scirpus atrovirens* in France was critically reassessed. Nearly all known populations (notably those from the departments Aisne, Jura, Pas-de-Calais and Saône-et-Loire) turned out to be referable to a closely related species, *S. hattorianus*. Distinguishing features for three species from the *S. atrovirens* complex (i.e. *S. atrovirens* s.str., *S. georgianus* and *S. hattorianus*) are compared and discussed. An identification key and SEM photographs of their achenes are provided. The ecology and degree of invasiveness of *S. hattorianus* in France are also briefly discussed.

Additional key words: ecology, invasive, North America, *Scirpus atrovirens*, *Scirpus georgianus*, taxonomy, xenophyte

Introduction

As currently circumscribed, *Scirpus* L. is a genus of c. 35 subcosmopolitan species (Mabberley 2008). It apparently is most diverse in North America, where 18 species occur (Schuyler 1967; Whittemore & Schuyler 2002). Only two species are originally native in Europe (DeFilipps 1980, as *S. sect. Scirpus*): *S. radicans* Schkuhr and *S. sylvaticus* L. A few others, all originating in North America, are locally naturalized: *S. cyperinus* (L.) Kunth in Germany (Lanski 1985; Kiffe 1998) and *S. pendulus* Muhl. in Switzerland (Bornand & Clerc 2011) and the former republic of Czechoslovakia (DeFilipps l.c.). However, a third American species is by far the most widespread in Europe: *S. atrovirens* Willd. It has been known from parts of C Europe and France for quite some time (DeFilipps l.c.) and over the past several decades it has been discovered in other European countries as well, for instance Belgium (Giot 2004; Lannoy 2004) and Italy (Pignotti 2003).

Scirpus atrovirens belongs to a group of closely related species that includes *S. flaccidifolius* (Fernald) Schuyler, *S. georgianus* R. M. Harper, *S. hattorianus* Makino and *S. pallidus* (Britton) Fernald (Tucker 1987). These four species are largely allopatric, but hybridize in areas where they occur sympatrically (Schuyler 1961; Schuyler 1967; Whittemore & Schuyler 2002). The identity of some of the European populations of *S. atrovirens* has been questioned. Some German plants were re-identified as *S. georgianus* (Schnittler & Niedbala 1993, as *S. atrovirens* var. *georgianus* (R. M. Harper) Fernald) and Kiffe (1998) even suggested that genuine *S. atrovirens* might not have been documented in Germany. Recent reports from Slovenia (Zelnik 2004) and Belgium (Verloove 2006; Verloove & Lambinon 2011) were also ascribed to *S. georgianus*. Similarly, plants from E France have been assigned to *S. pallidus* (Litzler 2000; Prost 2000; Bizot & Parent 2005, as *S. atrovirens* var. *pallidus* Britton, apparently following Riomet & Bournérias 1952–1961).

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The present study, mainly based on a critical reassessment of herbarium specimens of *Scirpus* from Europe (herbaria BR, GENT, LG and P; herbarium codes following Thiers 2014+), found that nearly all collections from France were identified incorrectly and in fact belong to another species, *S. hattorianus*. In the present paper its distinguishing features are discussed and compared with related species; also some additional information on its distribution, ecology and degree of naturalization in France is provided.

The *Scirpus atrovirens* complex in France

Scirpus atrovirens s.l. has been known in France for more than a century. It was probably first collected in Nanteuil-Notre-Dame in the department Aisne where, by 1903, it was already known to occur (Riomet & Bournérias 1952–1961) and lately confirmed by Bizot & Parent (2005). From the 1970s onwards it was reported from various locations in the department Jura (Prost 1983; Litzler 2000; Prost 2000, 2001) and since the 1980s also from the department Marne (Lambinon & Duvigneaud 1988; Worms 1989). Bizot & Parent (2005) confirmed its presence in the aforementioned regions and added a first record from the department Saône-et-Loire. It was recently detected for the first time in the department Pas-de-Calais (B. Toussaint pers. comm. Dec 2011) and Tela Botanica (2012+) added a record from the department Ain.

Although usually referred to as “*Scirpus atrovirens*” in French floras or catalogues (e.g. Kerguelen 1999), populations from the department Aisne were ascribed to *S. atrovirens* var. *pallidus* (\equiv *S. pallidus*) by Riomet & Bournérias (1952–1961). This point of view was followed subsequently by Litzler (2000) and Bizot & Parent (2005). These authors drew attention to the (initially) pale brownish, small spikelet scales (c. 2 mm or slightly longer), characteristic features of *S. pallidus*. However, all specimens seen from France (including those referred to by Litzler l.c. and Bizot & Parent l.c.) clearly differ from this species: the scales are much darker and ultimately turn blackish brown, are much smaller (always less than 1.5 mm long) and have a mucro of 0.1–0.2 mm long, whereas *S. pallidus* has scales 1.6–2.8 mm long with a pale midrib and a distinct mucro 0.4–0.6(–1.2) mm long (Whittemore & Schuyler 2002). Thus, *S. pallidus* obviously does not compare well. A single population from a military camp site in Belgium (Marche-en-Famenne) belongs to *S. georgianus* (\equiv *S. atrovirens* var. *georgianus* \equiv *S. atrovirens* subsp. *georgianus* (R. M. Harper) Verloove & Lambinon). This species is readily told apart by the perianth bristles, which are either absent or at most 3, always much shorter than the achene (often rudimentary) and nearly smooth throughout (or with a few teeth near the apex only). Most collections examined from France have the following characteristics: leaf sheaths not or

only inconspicuously nodulose-septate; spikelet scales blackish brown in distal half, less than 1.5 mm long, with a mucro less than 0.2 mm long; perianth bristles always present, usually 4–6, all straight (never contorted), distinctly shorter than achene; and achenes at most 1 mm long. These features are typical of *S. hattorianus* and clearly exclude *S. atrovirens* s.str. A few collections from the French departments Bas-Rhin and Marne correspond with *S. georgianus* (see below for an overview).

The two species of *Scirpus* hitherto reliably recorded in W Europe and *S. atrovirens* s.str. can be separated using the following key:

1. Perianth bristles (not to be confused with filaments, which often persist!) absent or rudimentary, at most 3 if present, up to $\frac{3}{4}$ of achene length, smooth or with a few teeth near apex *Scirpus georgianus*
- Perianth bristles always present, (4 or)5 or 6, shorter than to slightly longer than achene, with retrorse teeth in distal $\frac{1}{2}$ 2
2. Perianth bristles (4 or)5 or 6, all distinctly shorter than achene; spikelet scales blackish brown in distal $\frac{1}{2}$, less than 1.5 mm long and with mucro less than 0.2 mm long; achenes mostly less than 1 mm long; leaf sheaths smooth to somewhat nodulose-septate *Scirpus hattorianus*
- Perianth bristles nearly always 6 (rarely 5), longer ones frequently exceeding achene; spikelet scales brownish, to 2.1 mm long and with mucro often more than 0.2 mm long; achenes mostly 1–1.3 mm long; lowermost leaf blades and sheaths distinctly nodulose-septate *Scirpus atrovirens*

SEM photos of achenes of the three species are compared in Fig. 1. Other useful SEM photos of achenes are provided by Strong (1994). Line drawings are found in Whittemore & Schuyler (2002).

The identity of other European populations of *Scirpus atrovirens* should be critically assessed. Achenes illustrated by Schnittler & Niedbala (1993), with at least five perianth bristles, possibly also represent *S. hattorianus* and certainly not *S. georgianus* as claimed. *Scirpus hattorianus* appears to be by far the most widespread species, at least in France. Despite being a North American species, it was originally described from Japan (Makino 1933), which clearly demonstrates its potential as an environmental weed.

Specimens examined

Scirpus hattorianus

FRANCE: DEPARTMENT AISNE: Nanteuil-Notre-Dame, dans un fossé voisin de la voie ferrée, adventice, Jul 1919, *Riomet s.n.* (P); Nanteuil (ex cultu), trouvé à l'état adventif dans les fossés avoisinant la voie ferrée, 12 Aug 1923, *G. Desplantes s.n.* (P). — DEPARTMENT

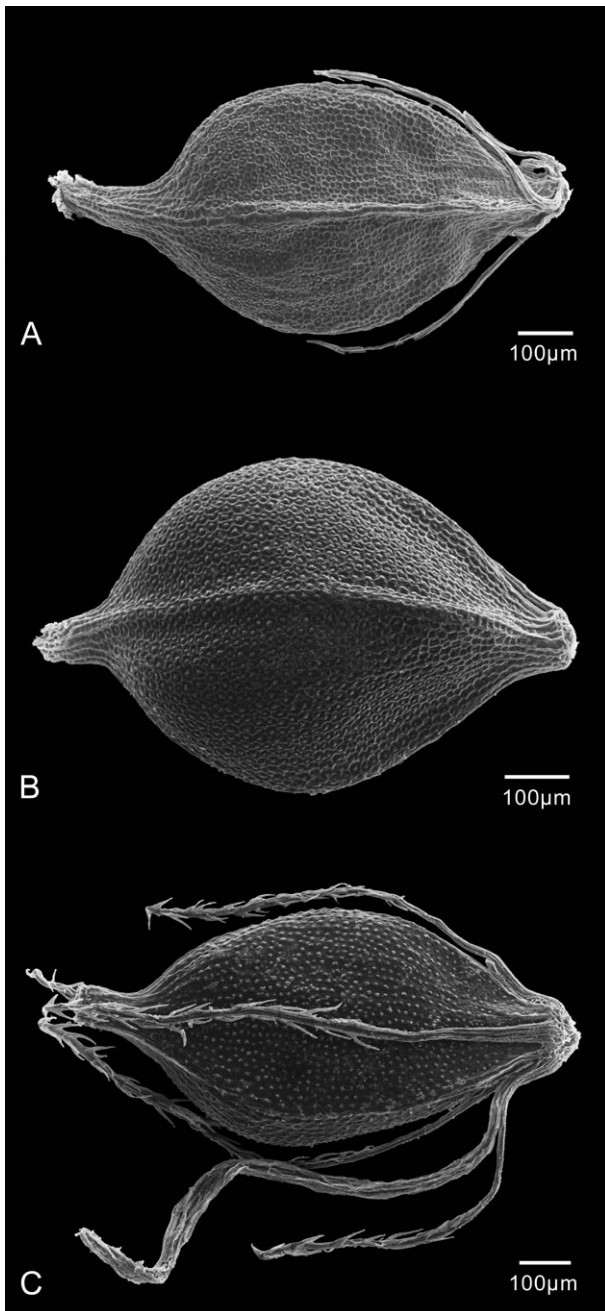


Fig. 1. SEM photographs of achenes of *Scirpus* – A: *S. hattorianus* from France (*F. Verloove* 9564, see specimens examined); B: *S. georgianus* from Belgium; C: *S. atrovirens* from North America.

JURA: Dole, Forêt Domaniale de Chaux, laies forestières fraîches, mi-ombragées, 4 Aug 1998, *P. Litzler* 98/659 (P); *ibid.*, 18 Jun 1999, *P. Litzler* 99/425 (P); Rye, Forêt de Rye, sentier forestier sur sol argilo-siliceux détrempe en hiver, partant de la D 214, abondant, 1 Jul 2001, *J.-M. Tison s.n.* (BR, LG); Bois de Champrougier, en Forêt d'Amont-Aval, layon forestier entre les routes Les Deux Fays-Foulénay et Les Deux Fays-Champrougier, 15 Jul 2004, *G. H. Parent* 04/120 (BR); Bois de Rye (Forêt d'Amont-Aval), 16 Jul 2004, *G. H. Parent* 04/121G (BR); Bois de Rye, vers Le Ferment (Forêt d'Amont-

Aval), 16 Jul 2004, *G. H. Parent* 04/121 (BR); Sergenon, Forêt d'Amont-Aval, bois à l'W du village, 16 Jul 2004, *G. H. Parent* 04/121 (BR); Sergenon, Bois en Bief Vallon, 16 Jul 2004, *G. H. Parent* 04/121 (BR); Tassenières, Bois d'Amont-Aval, bord des chemins dans le bois au NW de la N475, parcelle 30, 16 Jul 2004, *G. H. Parent* 04/121 (BR); Le Villey (Forêt d'Amont), bordure d'un chemin forestier, 16 Jul 2004, *G. H. Parent* 04/121 (BR). — DEPARTMENT PAS-DE-CALAIS: Bournonville, Forêt Domaniale de Desvres, close to RD 253, damp track in open woodland, locally frequent, 18 Jul 2012, *F. Verloove* 9564 (BR, LG, GENT). — DEPARTMENT SAÔNE-ET-LOIRE: À l'E de Verdun-sur-le-Doubs, forêt, *Caricetum pendulae*, argileux-humide, Jul 1974, *M. Bournérias* 577bis (P); Dissey [Mouthier-en-Bresse], Forêt de Dissey, station inédite nouveau pour ce département, 16 Jul 2004, *G. H. Parent* 04/122 (BR).

Scirpus georgianus

FRANCE: DEPARTMENT BAS-RHIN: Plobsheim, près Strasbourg, plan d'eau installé entre 1965 et 1970, Sep 1975, *Kapp s.n.* (P); Plobsheim, près de Strasbourg, bord du plan d'eau installé 1965 et 1970 (ouvriers méridionaux et nord-africains), Sep 1975, *Institut Botanique de Strasbourg s.n.* (P). — DEPARTMENT MARNE: Ecueil, Jul 1987, *C. Worms s.n.* (BR); [Saint-Martin-d'Ablois], Forêt de Bruguy, chemin forestier humide, Jul 1989, *L. Delvosalle s.n.* (BR) (see Worms 1985). – A claim from Saint-Imoges (also in the department Marne) possibly also belongs here (Lambinon & Duvigneaud 1988; Worms 1989).

Ecology and invasive status in France

Scirpus hattorianus appears to be confined in France to rather damp, shady spots in (open) woodland, nearly always by tracks. This is exactly the sort of habitat where it is typically found in the NE United States. More rarely it has also been observed in forest margins and by ponds. All locations are on sandy or clayish substratum.

Most species of the *Scirpus atrovirens* complex are weedy and their small achenes are well adapted for accidental transport by humans and animals. Once established, plants are readily dispersed to adjoining suitable habitats. Bizot & Parent (2005) suggested that “*S. atrovirens*” was spread by hunters. All French authors have remarked on the abundance of the species in most of its locations: “très nombreuses touffes”, “abondante”, “constante progression”, etc. (see Litzler 2000; Prost 2000; Bizot & Parent 2005). Bizot & Parent (*l.c.*) described its presence in the departments Jura and Saône-et-Loire in an area that by now covers approximately 100 km². In the sense of Richardson & al. (2000), *S. hattorianus* is in France doubtless an invasive species (*i.e.* naturalized plants that produce reproductive offspring at considerable distances from parent plants and thus

have the potential to spread over a considerable area). However, it is unknown whether or not native, vulnerable species are outcompeted by its presence. Additional research on its ecology is therefore required.

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Fig. 2. Distribution by department of *Scirpus hattorianus* (dark grey) and *S. georgianus* (pale grey) in France.

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