Studies in Cyperaceae in southern Africa. 24: Three species of Scirpoides

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The Cape endemic generally known as Scirpus thunbergianus (Nees) Levyns is upheld as Scirpoides thunbergii (Schrad.) Sojak. It is recognized as distinct from the northern hemisphere Scirpoides holoschoenus (L.) Sojak, under which it was previously reduced to infraspecific ranking. Another southern African endemic, Scirpus dioecus (Kunth) Boeck., is compared with the two Scirpoides species and transferred to that genus. Scirpoides was included within the tribe Cyperaeae by Goethgeheuer mainly for reasons of embryo conformation. This placement is confirmed. Because of embryography, it is no longer acceptable that any of the three species considered in this paper be maintained in Scirpeae.

Die endemiese Kaapse plant, algemeen bekend as Scirpus thunbergianus (Nees) Levyns, word as Scirpoides thunbergii (Schrad.) Sojak gehandhaaf. Daar word erkan dat dit afsonderlik is van Scirpoides holoschoenus (L.) Sojak van die noordelike halfrond, waaronder dit tot infraspecifieke status verlaag was. Nog 'n spesie endemies aan suidelike Afrika, Scirpus dioecus (Kunth) Boeck., word vergelyk met die twee Scirpoides spesies en word na laasgenoemde genus oorgelaat. Scirpoides is deur Goethgeheuer in die Subfam Cyperaeae ingesluit, hoofsaaklik as gevolg van embriografie. Hierdie plaaslike word goedgekeur. As gevolg van embryography is dit nie meer aanvaarbaar dat enige van die betrokke drie spesies in die Scirpeae behou word nie.

Keywords: Scirpus dioecus, Scirpoides holoschoenus, Scirpoides thunbergii.

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Introduction

Browning (1989: 426) circumscribed Scirpus dioecus (Kunth) Boeck., as a southern African endemic requiring transfer from the heterogeneous Scirpus L. sensu lato to a more appropriate generic affiliation. At that time, apart from tenuous relationship with Schoenoplectus (Rehb.) Palla, this entity was anomalous. At specific level, its closest relatives had not been unequivocally determined. Kunth (1837: 199) originally placed the species under Isolepis R. Br., but it does not clearly relate to other southern African taxa of that genus.

Scirpus thunbergianus is another southern African endemic, at present poorly collected and inadequately known. Schrader (1832: 22) described it as Isolepis thunbergii. Clarke (1894: 623; 1898: 227) referred it to the European, N. African and E. Asian Scirpus holoschoenus L. as var. thunbergii. However, Levyns (1944: 28) regarded the differences between the typical expression of that species and Clarke’s variety as ‘... far too great for more varietal status,’ and raised the latter to specific rank as Scirpus thunbergianus. A change in epithet was required because of the preoccupation of Scirpus thunbergii (Sprengel 1828).

Typical Scirpus holoschoenus (= Holoschoenus vulgaris Link) has never been recorded for southern Africa. It is predominantly a northern hemisphere species reported as morphologically variable, especially in inflorescence form, length of individual bract, and length and width of culm (DeFilipps 1980: 279). This author maintained the species under Scirpus, placing it in Section Holoschoenus (Link) Koch and ignoring or being unaware of Sojak’s (1972a: 127) transfer of it to Scirpoides Gérouer (1754) = Holoschoenus Link (1827). In the same publication, Sojak (1972a: 127) transferred Schrader’s Isolepis thunbergii to Scirpoides as a species, but in the same year modified this opinion by reducing the entity to a subspecies under Scirpoides holoschoenus (Sojak 1972b: 61). These new affiliations and rankings were made without explanation.

Wilson (1981: 162), in treating Scirpus s.l. in Australia, discussed the genus Scirpoides, stating that further study of its limits were required, particularly in southern Africa, where its probable relatives, Isolepis and Ficinia Schrad., are well represented.

This account will provide evidence in support of close morphological affinity among the species Scirpoides holoschoenus, Scirpoides thunbergii (Schrad.) Sojak and Scirpus dioecus and will discuss their formal systematic classification in relation to this affinity.

Materials and Methods

About 45 specimens, including some duplicate material, of Scirpoides thunbergii from South African herbaria were examined. Comparisons were made against representative examples of Scirpus dioecus, which species had been studied in detail previously (Browning 1989). A literature survey was carried out for Scirpoides holoschoenus to supplement the limited number of specimens available for study (four from southern England, France and Spain). This species was also compared with Scirpus thunbergii and Scirpus dioecus. Light and electron microscopy were employed in order to investigate micromorphological features.

Embryo examination was carried out. Mature achenes of Scirpus thunbergii were sparsely represented and difficult to find. Few specimens of Scirpoides holoschoenus were available. For all three species preparative procedure for embryo study was as follows.

Achenes were soaked for 24 h in water. The pericarp was then broken with fine forceps and the embryo separated from the endosperm and removed. After clearing in lactophenol for 5–10 h, the embryos were mounted in hollow slides in Gurr’s water-soluble mountant. The hollow slides gave freedom of movement, so that microscopic examination could be carried out for a number of positions of an embryo. Photographs were taken, but this procedure yielded poor results because of the density of tissue.

Results

The more important morphological similarities and differences between the three species under study are summarized in Table 1. Figure 1 illustrates Scirpus thunbergii. Browning (1989: 427, Figure 3) showed comparable features for Scirpus dioecus.
Table 1  Morphological similarities and differences between *Scirpoides thunbergii*, *Scirpus dioecus* and *Scirpoides holo­schoenus*

<table>
<thead>
<tr>
<th></th>
<th><em>Scirpoides thunbergii (S.t.)</em></th>
<th><em>Scirpus dioecus (S.d.)</em></th>
<th><em>Scirpoides holo­schoenus (S.h.)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant height</strong></td>
<td>(250-)300–500(-900) mm</td>
<td>600–1500 mm</td>
<td>300–1500 mm</td>
</tr>
<tr>
<td><strong>Rhizome (diameter, dry)</strong></td>
<td>± 8 mm</td>
<td>4–8 mm</td>
<td>8–10 mm</td>
</tr>
<tr>
<td><strong>Culm shape</strong></td>
<td>flattened, occasionally more or less terete</td>
<td>More or less terete</td>
<td><strong>Terete</strong></td>
</tr>
<tr>
<td><strong>Leaves</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>sheaths</strong></td>
<td>± 5 : 2 lowest, ovate, uniform brown, veined; 3 upper, tubular, backs firm, fronts membranous; brown, mouth sloping, not cancellate (breaking to form fibrous reticulum)</td>
<td>As for S.t. but softer, mouths markedly sloping and lacking colour differentiation, never cancellate</td>
<td>Sheaths larger than for S.t.; lacking colour differentiation, except occasionally, becoming markedly cancellate</td>
</tr>
<tr>
<td><strong>blades</strong></td>
<td>usually lacking, when present reduced, 2–5 mm long</td>
<td>Usually not developed</td>
<td><strong>'Upper sheaths often with short, semi-terete lamina'</strong> (Defillips 1980: 279)</td>
</tr>
<tr>
<td><strong>Inflorescence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>bracts</strong></td>
<td>2: lower erect, in line of culm, 3–7(−20) mm, generally not surpassing inflorescence</td>
<td>1–2: lower erect, ± 30 mm long, surpassing inflorescence</td>
<td>1–2: lower erect, semi-terete; long in comparison with S.t. (220 mm in Turrill 2001)</td>
</tr>
<tr>
<td><strong>arrangement of spikelets</strong></td>
<td>1–6 globose heads, ± 10 mm in diameter; central head sessile, remainder more or less rayed, no rays compound; solitary heads and young rayed inflorescences pseudolateral; later occasionally appearing terminal</td>
<td>Solitary, pseudolateral head, (5–)10–25 mm in diameter, of 10–60 sessile spikelets</td>
<td>In 1–10 globose heads, ± 12 mm in diameter, central head sessile, remainder more or less rayed, rays sometimes compound, inflorescence clearly pseudolateral</td>
</tr>
<tr>
<td><strong>Spikelets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>length</strong></td>
<td>2.0–5.0 mm</td>
<td>5.0–13.0 mm, occasionally up to 32.0 mm</td>
<td>2.5–4.0 mm</td>
</tr>
<tr>
<td><strong>outline shape of apex</strong></td>
<td>Acute</td>
<td>Acute</td>
<td>Obtuse</td>
</tr>
<tr>
<td><strong>Glumes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>size</strong></td>
<td>1.8–2.5 × 1.3–1.5 mm</td>
<td>2.0–2.3 × 1.2–1.5 mm</td>
<td>1.3–3.0 × 0.6–2.0 mm</td>
</tr>
<tr>
<td><strong>shape</strong></td>
<td>obovate, keeled, strongly concave</td>
<td>obovate, keeled, not strongly concave</td>
<td>obovate, keeled, strongly concave</td>
</tr>
<tr>
<td><strong>margin</strong></td>
<td>widely membranous</td>
<td>not widely membranous</td>
<td>not widely membranous</td>
</tr>
<tr>
<td><strong>apex</strong></td>
<td>more or less truncate, mucronate, not notched, glabrous</td>
<td>broadly acute, usually mucronate, not notched, glabrous</td>
<td>truncate, mucronate, clearly notched, ciliate on margins and keel</td>
</tr>
<tr>
<td><strong>colour</strong></td>
<td>planks with dark brown inverted V, margins membranous, pale</td>
<td>glossy white with ruddy brown discrete patches</td>
<td>brown to whitish with faint darker markings, paling basally</td>
</tr>
<tr>
<td><strong>Stamens</strong></td>
<td>3; anthers 1.0–1.4 mm, crest irregular, dark marked; base minutely ciliate; filaments occasionally persistent</td>
<td>3; anthers ±1.3 mm, minutely crested; (abortive in female plants)</td>
<td>3; similar to S.t., but crest smaller; base minutely auricled (Bruhl 1992)</td>
</tr>
<tr>
<td><strong>Style branches</strong></td>
<td>3</td>
<td>3 (rudimentary in male plants)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Achenes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>size</strong></td>
<td>0.8–0.9 × 0.3–0.4 mm</td>
<td>0.7–1.2 × 0.6–0.9 mm</td>
<td>0.6–1.3 × 0.6–0.7 mm</td>
</tr>
<tr>
<td><strong>shape</strong></td>
<td>narrowly elliptic, slightly trigonous, minutely beaked</td>
<td>elliptic to obovate, slightly trigonous, shortly beaked</td>
<td>obovate-elliptic, slightly trigonous, long beaked.</td>
</tr>
<tr>
<td><strong>surface</strong></td>
<td>cellular (reticulate)</td>
<td>cellular (reticulate)</td>
<td>irregular cellular (not uniformly reticulate)</td>
</tr>
<tr>
<td><strong>exocarp cells in surface view</strong></td>
<td>5–6-sided, more or less isodiametric</td>
<td>5–6-sided, more or less isodiametric</td>
<td>Some 5–6-sided, isodiametric to oblong; others less clearly defined</td>
</tr>
<tr>
<td><strong>Embryo</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>size</strong></td>
<td>± 0.25 mm long</td>
<td>± 0.25 mm long</td>
<td>?</td>
</tr>
<tr>
<td><strong>shape</strong></td>
<td>ellipsoid, cotyledon not widened, 1st &amp; 2nd leaf primordia detectable, coleoptile basal, coleorhiza lateral, embryo constriction absent</td>
<td>as for S.t.</td>
<td>as for S.t. (Van der Veken 1965, Figure 35N; Goetghebeur (1986: 498, Figure 8.8.2D)</td>
</tr>
</tbody>
</table>

**Notes:**
- "Upper sheaths often with short, semi-terete lamina" (Defillips 1980: 279)
- "Irregular cellular (not uniformly reticulate)"
Butcher (1961: 788, No. 1587) depicted *Scirpoides holoschoenus* (as *Scirpus holoschoenus* L.), in which two style branches (termed 'stigmas') are illustrated. We have dissected spikelets from two sheets of a collection of this species from Braunton, N. Devon (the locality given by Butcher). In these we found the style branches were uniformly three per gynoecium.

Consideration of Table 1 and the illustrations reveals the close morphological relationship that exists among the three species. Differences are limited to details of structure and to small ranges of variability in measurable parameters. There are few strongly marked disjunctive characteristics.

*Scirpoides holoschoenus* is most clearly distinguished from the other two species by markedly truncate glumes that are notched and mucronate, and ciliate on the distal margin and the distal portion of the keel abaxially. There may be a very long over-topping inflorescence bract, but the length of this organ is variable. Spikelets tend to be obtuse apically.

*Scirpus dioecus*, unlike the other two taxa, has a reduced inflorescence that always lacks rays. In this species, Browning (1989: 426) noted a tendency towards segregation of the sexes not recorded for the other two taxa.

*Scirpoides thunbergii* is smaller in all its parts than the other two, except occasionally in plant height. Its colouration also sets it apart, the brown markings to the leaf sheaths and glumes being
The three species are tufted, rhizomatous perennials favouring sandy substrates near the sea, or inland, near small water bodies such as pans and waterholes where there is brackishness. *Scirpoides thunbergii* has a limited distributional range in southern Africa, being known only south of 32°S latitude and between 18° and 27°E longitude (Figure 2). *Scirpus dioecus* is widespread by comparison (Browning 1989: 430, Figure 7).

**Discussion and Conclusions**

Soják's (1972a: 127) transfer of *Scirpus holoschoenus* and *Scirpus thunbergianus* to *Scirpoides* has not received full acceptance. Nevertheless, Goetghebeur (1986) and Bruhl (1990), both of whom reviewed generic limits within Cyperaceae, recognized *Scirpoides*, but with the reservation that further study of its limits and constituent species is needed. Both used the combination *Scirpoides holoschoenus* and employed this species to help exemplify characteristics of the genus. Goetghebeur accepted it as lectotype of the genus but was unable to provide an authority for its selection. Neither author investigated *Scirpus thunbergii*, nor *Scirpus dioecus*, although the latter was referred to by Goetghebeur (1986: 499) under *Isolepis dioici (dioica)* Kunth as a possible relative of *Scirpoides holoschoenus*, thus clearly intimating that the species should be considered for inclusion in *Scirpoides*.

If the generic limits of *Scirpoides* are to be accurately defined and firmly established, it is important that species appearing to fulfill the required criteria, should be placed within the genus. *Scirpus dioecus* requires such transfer. The new combination is made and the lectotype established under Formal Taxonomy which follows the discussion and conclusions.

Discussion of reasons for the placement of these three species in *Scirpoides* rather than in any of the other several genera with which they have been variously associated (*Isolepis*, *Ficinia*, *Scirpus* L. and *Schoenoplectus*), is necessary, as is consideration of the tribal placing of *Scirpoides*.

Both *Scirpoides thunbergii* and *Scirpus dioecus* were originally described in *Isolepis*, but the rhizome covered in scale leaves and the coarse, coriaceous texture and size of the plants fit better in *Scirpoides*. The embryo type (Figure 3) is that of *Cyperus*, but slightly modified, so that by this criterion also, relationship is not directly with *Isolepis*, in which there is constriction of the embryo at the laterally placed coleoptile. *Scirpoides* possesses the general appearance of some species of *Ficinia*, but in most representatives of that genus the achene is associated with a definite gynophore, a feature not known in *Scirpoides*.

*Schoenoplectus* has not yet been entirely satisfactorily delimited from *Scirpus* on a worldwide basis, but from embryo structure alone, the three species under study cannot be directly related to *Scirpus* or *Schoenoplectus*. There are other differentiating characteristics from these two genera. For example, the presence/absence of a perianth and the sculpturing of the achene surface may, or may not, prove distinctive (Figure 4). At present, the exocarp cells of species of *Scirpoides* observed in surface view appear distinctive, but perhaps doubtfully so from *Schoenoplectus lacustris* (L.) Pall. sensu lato, and its relatives.

Goetghebeur (1986: 445) placed the genera *Isolepis* and *Ficinia* in the tribe *Ficiniaceae* Nees. *Scirpoides* itself (*Scirpoides holoschoenus*) he placed in *Cyperaceae*. Bruhl (1990: Table 5.6) maintained *Scirpoides*, *Isolepis* and *Ficinia* in the tribe *Cyperaeae* Kunth ex Dumort., perhaps only temporarily, although this proviso was unstated. Bruhl (1992) also reported *Scirpoides* as lacking proliferation from the inflorescence, as he was apparently unfamiliar with *Scirpoides thunbergii*. We conclude, from our findings, that *Scirpoides* does not belong with *Scirpeae*. We place it in *Cyperaceae*, following Goetghebeur (1986: 477) and include therein *Scirpoides dioecus*.

**Formal taxonomy**


*Scirpus dioecus* (Kunth) Boeck. (Type as above). For further citations and description see Browning (1989: 426).

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**References**


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**Figure 2** Recorded known distribution of *Scirpoides thunbergii*.

**Figure 3** Embryos. A. *Scirpoides thunbergii*, Wolley-Dod 256 (BOL). B. *Scirpus dioecus*, Ward 11936 (NU). Scale bar: 100 μm.

*Scirpoides holoschoenus* (L.) Sojak subsp. *thunbergii* (Schrad.) Sojak 141: 61 (1972b).

Isolépis thunbergiana Schult.: 67 (1824); Nees: 85 (1833); Nees: 160 (1835); Kunth: 200 (1837). Type: *Cape Province* In fossis prope urbem Cap albique, Hesse, not located.

Scirpus thunbergii Steud.: 83 (1855); Böeck.: 720 (1870) name invalid non A. Sprengel (1828).

Holoschoenus thunbergii Dietrich: 164 (1839). Type unknown.


Isolepis thunbergiana Schult.: 67 (1824); Nees: 308 (1832).

Scirpus thunbergianus Leyv.: 28 (1944); Leyv.: 106 (1950). Type: *Cape Province* 'An einem Graben bei Lauenbach an der Reidvallei', Ecklon s.n. Not located.

Scirpus holoschoenus sensu Thunb.: 17 (1794);: 368 (1811); 97 (1823) excl. syn.; non L.

Perennial. Rhizome about 8 mm in diameter when dry, woody, of contiguous stem bases tufted or uniserial, younger parts clothed with golden brown, coriaceous, scale leaves. Roots numerous, 2–4 mm wide. Culms erect, variable in height (250–350–500–900) mm, flattened to suberecte, firm, glabrous, clothed basally by up to 5 tubular sheaths, firm dorsally, membranous and brown ventrally forming a distinctive colour pattern (Figure 1A,B).

Ligule a short, brown, membranous flap. Leaves reduced to sheaths, except uppermost which may bear a channelled blade 2–5 mm long. Inflorescence variable, of 1–6 compact, rounded heads, about 10 mm in diameter, central sessile, remainder on flattened rays up to 20 mm long, forming an open, pseudolateral anthela that may appear terminal with age, occasionally reduced to a solitary, pseudolateral head. Bracte 2, lower, channelled or spiciform, 3–7(–)20 mm long, following line of culm, seldom surpassing inflorescence rays, upper small, inconspicuous. Spikelets sessile, closely packed, 2.0–5.0 mm long, more or less ovate, apex acute. Glumes spiral, closely packed, 1.8–2.5 x 1.3–1.5 mm, obovate, folded about strongly marked keel, flanks with dark brown inversed V from apex and wide membranous, glabrous, pale margin, apex truncate, mucronate, not notched. Stamens 3, filaments broad, sometimes persistent; anthers 1.0–1.4 mm long including brown marked, linear, spike-like crest 0.1–0.5 mm long. Style about half the length of its 3 branches, these papillate, brown-marked. Achene 0.8–0.9 x 0.3–0.4 mm, ovate in outline, trigonous, shortly beaked; surface appearing smooth (<20 magnification), cellular (reticulate) (<40); exocarp cells 5–6-sided, more or less isodiametric (<600).

**Selected citations**

—3218 (Clanwilliam): Aurora to Redlinghuis Rd; near Aurora (~AD), K.D. Gordon-Gray s.n. (NU); 10 miles from Clanwillian on banks of Olifants River (-BB), K.D. Gordon-Gray 206/59; Klavarwlei ca. 18 mL S of Clanwillian (-BD), Acocks 23425 (PRE); 3.2 km NW of Sauer P.O. (-DC), Acocks 24463 (PRE).

—3318 (Cape Town): Buck Bay farm, Bakkerivier at eye (-CB), Boucher 4179 (PRE, STE); Sandown Road, Rondebosch (-CD), Woller-Dod 2563 (BOL); Margin of Riet Vlei, Tygerberg (-DC), Mass 9064 (-J). In arenosis humidis ad Kuilsrivier (-DD), Zeyher 4393 (BOL, PRE).

—3319 (Worcester): In arenosis prope Brandvlei (-CB), Schlechter 9927 (GRA, PRE).

—3322 (Oudtshoorn): Wilderness (-DC), Taylor, H.C. 4475 (STE).

—3325 (Port Elizabeth): Moost places on the banks of the Zwartkop River, in the first altitude. District of Uitenhage (-CD), Zeyher 464 (BOL, PRE, SAM); Old Drift, Perseverance (-DC), Olivier, D.C. 491 (GRA).

—3336 (Grahamstown): Boesmansriviermond (-DA), Killick 1760 (NU, PRE); Kowie West, Salt Vlei (-DB), Britten 2846 (GRA).

—3418 (Simonstown): Princess Vlei, Dispiritv (-AB), Forbes 602 (J).

—3419 Caledon: Zoutendals Vlei, on road from Gansbaai to Stilbaai (-DB), Van Wyk, C.M. 917 (PRE, STE).

—3423 (Knysna): In turf between Belvidere church and edge of lagoon (-AA), Duthie 955 (GRA, STE).

—3424 (Humansdorp): Dune veld at Slang River (-BA), Phillips, E.P. 3432 (PRE).

**References**


