

## New species of Cyperaceae in Western Australia

K.L. Wilson

Royal Botanic Gardens, Mrs Macquaries Road, Sydney, New South Wales 2000, Australia

### Abstract

K.L. Wilson. New species of Cyperaceae in Western Australia. Nuytsia 11 (2): 269-282 (1997). The following new species of Cyperaceae from Western Australia are described: *Cyathochaeta equitans* K.L. Wilson (*C. clandestina* auct.), *C. stipoides* K.L. Wilson, *Eleocharis keigheryi* K.L. Wilson, *Gahnia sclerioides* K.L. Wilson, *Schoenus calcatus* K.L. Wilson, *S. griffinianus* K.L. Wilson and *S. insolitus* K.L. Wilson.

### Introduction

The family Cyperaceae has numerous genera and species in Western Australia, including many endemics in the south-west of the State. There are numerous undescribed species in that region, not only in the large genera like *Lepidosperma* and *Schoenus* but even in small genera such as *Cyathochaeta*. Several of these species are here described, particularly some of the rarer species that are of conservation concern. Detailed locality information has sometimes been omitted for the apparently rare species; this is available to researchers on application through PERTH. Rarity is indicated by the Conservation Codes used by CALM for its "Declared Rare and Priority Flora List" (these are detailed at the end of each issue of Nuytsia) and also those used by Briggs & Leigh (1996) in the ROTAP classification.

It should be noted that measurements of culm and leaf widths are taken about halfway along the relevant organ. Culm length is measured from the base of the plant to the base of the inflorescence. In some species, the culm is short but the plant as a whole is quite tall because the inflorescence is much longer than the culm.

### *Cyathochaeta* Nees

***Cyathochaeta equitans*** K.L. Wilson, *sp. nov.*

Species basibus plantarum equitantibus, apice obtuse vaginae folii ligula obtusa membranacea brunnea, setis perianthii partim connatis, a congeneribus diversa.

*Typus*: Intersection of Mallee Rd and Ridge Rd, Whicher Range, south-south-east of Busselton, Western Australia, 19 November 1994, *K.L. Wilson* 8959 & *K. Frank* (*holo*: NSW; *iso*: K, PERTH).

Tall tussock-forming *perennial*, equitant, with short woody rootstock. *Culms* erect, 1-2-noded, terete, smooth, yellow-green, 60-120 cm high, *c.* 3 mm diam. *Leaves* basal and cauline; blade thickly canaliculate (margins can be inrolled with age and then can appear terete) to flat near apex, scabrous on margins, shorter than culms, to 80 cm long; ligule brown-membranous, obtuse, to 7 mm long; sheath strongly flattened, striate, pale yellow to grey-brown, split deeply with margins overlapping. *Involucral bracts* leaf-like, with blade to 10 cm long; sheath (5)6-8 cm long, with overlapping margins. *Inflorescence* narrow, interrupted, spike-like, 40-70 cm long, with *c.* 7 more or less distant nodes; internodes to *c.* 12 cm long. *Spikelets* 2 or 3, rarely 5 per node, sessile or on pedicel to 12 cm long, mostly hidden by sheathing base of bract at upper nodes but pedicellate spikelets at lowest 1 (or 2) node(s) much exceeding the sheath (by up to 5 cm). *Glumes* 4 (2 sterile at base, 1 sterile at apex, 1 nut-producing in middle), glabrous, with very long-acute mucronate apex, pale yellow-brown, 2.5-5 cm long, *c.* 4 mm wide when spread out. *Perianth bristles* free above, seta-like and scabrous, densely antrorsely white-ciliate in lower half, fused for 3-5 mm from base of the nut, falling with nut, exceeding to as long as nut, to 2.5 cm long. *Stamens* 2; anthers 2.0-2.7 cm long, excluding linear apical appendage 0.4-1.0 mm long. *Style* 2-fid; style-base awn-like, very elongated, persistent, geniculate or strongly bent about halfway along length, twisted with age in lower half, scabrous, about 3-6 times as long as nut, 5-7 cm long. *Nut* more or less linear in outline, terete in cross-section, with 2 longitudinal pale nerves, scabrous near apex, otherwise glabrous, dark yellow-brown to blackish, *c.* 10 mm long including pungent callus-like base, *c.* 1.5 mm diam.

*Selected specimens examined.* WESTERN AUSTRALIA: Junction of Tootbardie Rd and Coorow-Green Head road, Alexander Morrison National Park, 9 Nov. 1994, *K.L. Wilson* 8828 & *K. Frank* (NSW, PERTH); Gales Road, Ambergate, 22 Oct. 1979, *K.L. Wilson* 3063 (NSW); Albany District Reserve 18739, 18 Oct. 1975, *J.S. Beard* 7713 (NSW); 7 km SE of Wellstead on Cape Riche road, 16 Oct. 1979, *K.L. Wilson* 2950 (NSW); East Mt Barren, Fitzgerald River National Park, 15 Oct. 1979, *K.L. Wilson* 2889 (NSW); western end of Lucky Bay, Cape Le Grand National Park, 30 Nov. 1994, *K.L. Wilson* 9199 & *K. Frank* (NSW, PERTH); 3 km W of Israelite Bay ruins, 7 Jan. 1979, *M.D. Crisp* 4885 (CANB, NSW).

*Distribution.* A widespread species in south-western Western Australia from Israelite Bay in the east to the Albany region, with an apparent gap in distribution west to the Busselton area, with another gap north to the Alexander Morrison National Park south-east of Eneabba. These apparent gaps may reflect unsuitable habitats or (perhaps more likely) inadequate collecting.

*Habitat.* Grows in tall heathlands and low Jarrah/Marri woodland, on sandy soils.

*Phenology.* Flowering January-February; fruiting probably February-March.

*Conservation status.* Apparently a common and widespread species, adequately conserved. In contrast, *C. clandestina*, the species that most specimens of *C. equitans* have been misidentified as, appears to be of much more limited distribution (known only from the southern part of the Donnelly River to the Scott River Plain) and should be surveyed to determine its conservation status.

*Epithet.* From the Latin *equitare*, to ride, referring to the strongly equitant base of the plant, whereby the flattened leaf bases are in two ranks, 'riding' over their neighbours. This condition is best developed in this species; of the other species, only *C. clandestina* shows partial flattening of the bases.

*Relationships.* This species is unique in the genus in having strongly equitant bases and an obtuse apex to the leaf sheath with an obtuse brown membranous ligule up to 7 mm long (it may be partially lost with age).

Formerly, specimens of this have been misnamed as *C. clandestina* (R. Br.) Benth., which is a similarly robust species with long spikelets that are mostly hidden by the long sheaths of the involucre bracts, at least at the upper nodes. However, spikelets at the lowest 1 or occasionally 2 inflorescence nodes in *C. equitans* are more numerous and often on branches to 12 cm long that extend beyond the sheath by up to 5 cm. Plants of *C. clandestina* have only slightly flattened bases, and they are thicker textured, smooth, glossy, and brighter yellow in colour. Leaf blades are thicker in *C. clandestina*, being thickly canaliculate to hemispherical for most of their length (flat at apex). *C. stipoides* (q.v.) also has long spikelets more or less hidden by the sheaths, but differs in being more slender and having perianth bristles reduced to a completely fused, cone-like, white-ciliate base (at least at maturity - it is possible that immature bristles may have a seta-like apex as in other species).

***Cyathochaeta stipoides* K.L. Wilson, *sp. nov.***

Aff. *C. clandestinae* sed omnibus partibus graciliori, laminis teretibus brevioribusque, setis perianthii reductis connatisque, differt.

*Typus*: 5 km north of Windy Harbour on road to Northcliffe, D'Entrecasteaux National Park, Western Australia, 22 November 1994, K.L. Wilson 9020 & K. Frank (*holo*: NSW; *iso*: K, PERTH).

Tall tussock-forming *perennial*, very shortly rhizomatous. *Culms* erect, 1-3-noded, terete, smooth, (25)35-100 cm high, 1.0-1.7 mm diam. *Leaves* basal and cauline; blade terete, sulcate at the base, smooth, shorter than culms, very reduced or to 20 cm long; ligule membranous, delicate and often breaking up into 2 long-narrow-triangular vertical extensions to 5 mm long, hyaline or white or red-tinged; sheath rounded, greenish to yellow-brown with reddish tinges, split deeply with margins overlapping. *Involucre bracts* leaf-like, with 'blade' to 5 mm long; sheath 4-5 cm long, with overlapping margins. *Inflorescence* narrow, interrupted, spike-like, to 30 cm long, with 3-7 more or less distant nodes; internodes 3-4 cm long. *Spikelets* solitary at nodes, sessile, all except apex hidden by sheathing base of bract. *Glumes* 3 (1 sterile at base and apex, 1 nut-producing in middle), glabrous or faintly scabrous, with very long-acute apex, inrolled, red-brown, 3.5-4.7 mm long, c. 3.5 mm wide when spread out. *Perianth bristles* reduced and fused to form a close-fitting cone over the base of the nut, densely antrorsely white-ciliate, adnate to and falling with nut, 7-10 mm long. *Stamens* 2; anthers not seen. *Style* 2-fid; style-base awn-like, very elongated, persistent, geniculate or strongly bent about halfway along length, twisted with age in lower half, scabrous, about 3 times as long as nut, 5-6 cm long. *Nut* more or less linear in outline, terete in cross-section, with 2 longitudinal pale nerves or faint furrows, glabrous, yellow-brown to dark yellow-brown, 10-18 mm long including pungent callus-like base, c. 1.5 mm diam. (Figure 1A, B)

*Other specimens examined*. WESTERN AUSTRALIA: 9 km SW of Bow Bridge on Ficifolia Rd, 20 Oct. 1979, K.L. Wilson 3006 (NSW, PERTH); Maringup Rd, 1.2 km S of Chesapeake Rd junction, 18 Jan. 1992, N. Gibson & M. Lyons 813 (PERTH); Windy Harbour Rd, c. 6.2 km NE of Windy Harbour, 3 May 1991, N. Gibson & M. Lyons 645 (PERTH); Windy Harbour Rd, c. 3 km NE of Windy Harbour, 3 May 1991, N. Gibson & M. Lyons 643 (PERTH); Scott River Rd, 2 km N of Milyeannup Coast Rd junction, 0.6 km W of road, Scott River National Park, 9 Apr. 1990, N. Gibson & M. Lyons 153 and 24 Oct. 1990, 955 (PERTH); Scott River Plains, 24 Oct. 1948, R.D. Royce 2971 (PERTH); Scott River Rd, c. 4 km W of intersection with Milyeannup Coast Rd, Scott National Park, 20 Nov. 1994, K.L. Wilson 8972 & K. Frank (NSW, PERTH).

*Distribution*. Near Bow Bridge, Windy Harbour and on Scott River Plain, so presumably occurring in the intervening coastal heath regions.

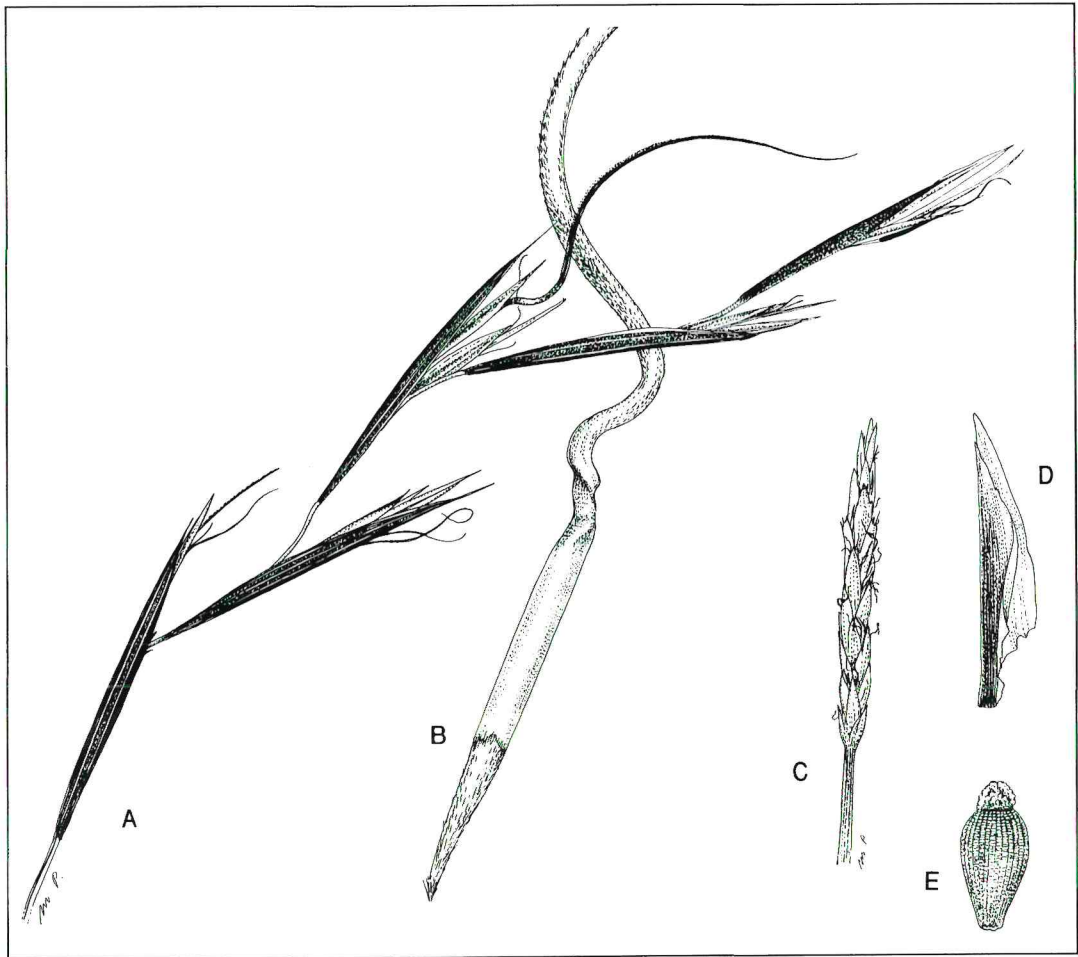


Figure 1. A, B *Cyathochaeta stipoides* A - portion of inflorescence showing spikelets mostly enclosed by sheathing bract, and with one persistent, twisted style-base protruding from a spikelet (x1); B - nut, showing portion of the persistent style-base at the apex and the white, ciliate 'cap' of reduced perianth bristles at base (x3). C-E. *Eleocharis keigheryi* C - inflorescence (x1.8); D - glume (x9); E - nut, showing persistent, fused style-base at apex (x9). Drawn from the type K.L. Wilson 9020 & K. Frank (A, B), G.J. Keighery 5154 (C) and G.J. Keighery 1832 (D, E).

*Habitat.* On winter-wet flats in low heathy sedgeland, on grey sandy soils.

*Phenology.* Flowering October-January and possibly to February; fruiting November-May.

*Conservation status.* Should be considered for listing as a Priority 3 taxon in the CALM Conservation Code and ROTAP Conservation Code 3KC- (Briggs & Leigh 1996) since it is known from a few populations (but their size unknown), at least two in a national park.

*Epithet.* Refers to the resemblance of the diaspore to that of species of the grass genus *Stipa* L. and its relatives in the tribe Stipeae. The resemblance is only superficial but is striking. The 'awn' of *Cyathochaeta* is in fact the very elongated, tough style-base persistent on the nut, whereas the awn of *Stipa sens. lat.* is an apical outgrowth of the lemma (Vickery, Jacobs & Everett 1986).

*Relationships.* A slender species compared with other Western Australian species in this genus. It is most similar in floral characters to *C. clandestina* and *C. equitans*. The long sheathing base to the involucrel bract hides most of the subtended spikelet as in *C. clandestina* but is usually shorter than in that species (4-5 cm long versus 4-8 cm in *C. clandestina*). The spikelets at the upper nodes in *C. equitans* are similarly hidden by the long sheathing bases, which are (5)6-8 cm long. However, spikelets at the lowest inflorescence node in *C. equitans* are more numerous and often on branches to 12 cm long that extend beyond the sheathing base by 5 cm. The awn-like persistent style-base of *C. stipoides* is similar to that of *C. equitans* but is shorter. The perianth bristles are reduced and fused in a cone-like cap about 7-10 mm long over the base of the nut whereas in *C. equitans* the bristles have a scabrous, seta-like apical portion as well as the fused basal portion (which is only 3-5 mm long). The reduced perianth bristles of *C. stipoides* are unique in the genus so far as known (mature nuts are unknown for *C. clandestina*), but a greater range of material needs to be collected to determine whether a deciduous, scabrous upper portion is present at early stages of growth. The nuts of *C. stipoides* and *C. equitans* are very similar, both being terete in cross-section, with the style-base being relatively much longer than the nut. Only immature nuts are known for *C. clandestina*; these are concavo-convex with inrolled margins, and attached perianth bristles are reduced, not fused at the base, and apparently only 3 in number. The leaf blades of *C. stipoides* are terete in cross-section, unlike those of the other species, which are crescentiform to flat in *C. equitans*, thickly canaliculate to hemispherical to flat at the apex in *C. clandestina*, hemispherical to crescentiform in *C. avenacea* (R. Br.) Benth., or oval (sulcate near the base) in *C. teretifolia* W.V. Fitzg. The ligule in *C. stipoides* is delicate and often breaks up into two long-narrow-triangular membranous vertical extensions, and is hyaline or white or red-tinged, whereas that of *C. equitans* is obtuse, brown, and membranous. The tufted bases of the plants are rounded, similar to those of *C. avenacea* and unlike those of *C. equitans*, which are equitant (fan-shaped).

The only non-western species in this genus, *C. diandra* Nees from south-eastern Australia, is similar in size to *C. stipoides* but differs in various characters, notably in having a compound inflorescence with several lateral branches at each node; short sheaths on the involucrel bracts not hiding the spikelets; nuts more or less concavo-convex in cross-section with margins inrolled, and about as long as the (short) awn; leaf sheaths that soon disintegrate to form fibrous remains around the culm bases; and leaf blades triangular to v-shaped in cross-section.

### Eleocharis R. Br.

#### *Eleocharis keigheryi* K.L. Wilson, *sp. nov.*

Ab *E. ochrostachye* et specie inedita aff. *E. ochrostachyis* combinatione characterum sequenti differt: achenium leniter 3-angulare, stylobasis angusta, setae hypogynae nullae, medulla culmi densiori.

*Typus:* Ellen Brook Tortoise Reserve, 21 miles [34 km] north of Perth, Western Australia, 19 October 1978, G.J. Keighery 1832 (*holo:* PERTH02266865).

Slender *perennial*, tufted, very shortly rhizomatous. *Culms* erect, terete, smooth, yellow-green, with multiple septa internally (not visible externally), 20-40 cm high, 1-2 mm diam., often with numerous filiform sterile leaf-like culms at base of tuft. *Leaves* reduced to basal sheaths, straw-coloured or red-tinged, more or less dull, with oblique apex. *Inflorescence* a single terminal spikelet, narrow-cylindrical, erect, slightly broader than culm, 1.3-4 cm long, 2-3 mm diam. *Glumes* spirally arranged, oblong to narrow-obovate, with obtuse apex, more or less chartaceous with hyaline margin 0.2-0.3 mm wide (or sides occasionally

more or less hyaline for most of width), with the midvein occasionally obvious but otherwise very similar to the rest of the veins, 4.5-5.5 mm long, 1.5-2 mm wide. *Perianth bristles* absent or 1 short vestigial bristle present at least in younger flowers. *Stamens* 3; anthers 2.0-2.7 mm long, plus apical appendage c. 0.1 mm long. *Style* 3-fid; style-base enlarged and persistent on nut, glabrous, c. 0.3 mm long, 1/3-1/2 width of nut. *Nut* obovate in outline, planoconvex with a weak third rib on the convex surface, trabeculate with 14-20 columns of transversely elongated cells per face, pale straw-coloured, 1.8-2.2 mm long (not including style-base), c. 1.0 mm diam. (Figure 1C-E)

*Other specimens examined.* WESTERN AUSTRALIA: Proposed Lesueur National Park c. 5.5 km E of Mount Peron trig, NE of Jurien, 5 Sep. 1985, *E.A. Griffin* 4209 (CANB, PERTH); Cataby Creek, 3 km S of Cataby, c. 160 km N of Perth, 28 Aug. 1982, *G.J. Keighery* 5154 (NSW, PERTH); 3.3 km N along Wannamal road from Gingin road intersection of Wells Glover Rd, South Bindoon, 18 Sep. 1983, *R.J. Cranfield* 4153 (PERTH); 2 km N of Waroona (Reserve C53) on road to Pinjarra (South Western Highway), 14 Nov. 1994, *K.L. Wilson* 8893 *et al.* (NSW, PERTH); 9 km along Railway Rd, Boyanup to Capel, 29 Aug. 1984, *G.J. Keighery* 6981 (PERTH).

*Distribution.* Known from the Mt Lesueur area near Jurien and south along the Swan Coastal Plain to near Capel.

*Habitat.* In seasonally water-filled clay pans and drainage lines, in water to about 15 cm deep, in clayey soils.

*Phenology.* Flowering August-November; fruiting September-November.

*Conservation status.* CALM Conservation Code: listed as Priority 3. Briggs & Leigh (1996) list it as 3KC- (geographic range > 100 km; poorly known; occurring in reserves but population size(s) not accurately known).

*Epithet.* Named after Gregory J. Keighery, who collected the first specimens of this species and who has extensively collected the sedges of the south-west when many have ignored them.

*Relationships.* The species is probably best placed in *Eleocharis* series *Mutatae* Svenson (terminology as in Blake 1939) despite the variable venation of the glumes in *E. keigheryi* (the central vein is often more prominent than the lateral veins, which may be few in number, unlike most species of series *Mutatae*, which usually have numerous equal-sized veins). It is unusual in that series in being a temperate species; most of the other species are tropical. The only other species of that section in the south-west is *E. sphacelata* R. Br., readily distinguished by its obviously transversely septate, mostly dark green culms, its stout and rather woody rhizome, its broad nut with more or less isodiametric epidermal cell outlines, and its well-developed perianth bristles.

In series *Mutatae*, the species morphologically most similar to *E. keigheryi* are *E. ochrostachys* Steud. and a related undescribed species from northern Australia that produces many filiform sterile leaf-like culms. However, there are numerous differences between *E. keigheryi* and these species, most notably in the absence of perianth bristles in *E. keigheryi* and in the form of the nut and style-base.

Nuts with a trabeculate surface are also found in series *Aciculares* (C.B. Clarke) Svenson. However, there are many differences between *E. keigheryi* and species in series *Aciculares*, which are generally

much more slender plants than *E. keigheryi*, with a distinct midvein on the glumes, and mostly with the lowest glume fertile (*E. atricha* R. Br. is a notable exception to that). The nut in that series is generally more or less terete and there is a distinct division, often a small neck, between the top of the nut and the persistent style-base, unlike that of *E. keigheryi*, which is less clearly delineated from the nut in the few fruiting examples known.

*Notes.* Specimens of this taxon have been given the phrase name *Eleocharis* sp. Kenwick (*G.J. Keighery* 5179) in PERTH.

### **Gahnia** Forst. & Forst. f.

***Gahnia sclerioides*** K.L. Wilson, *sp. nov.*

Species habitu graminoido glumis subsimilibus cum *G. insignis* optime congruens, sed differt in glumis pluribus, culmis cavis, foliis latioribus sed in partes ceteri minores.

*Typus:* c. 33 km south-west of Busselton by road, north end of Yelverton State Forest, Western Australia, 18 November 1994, K.L. Wilson 8936 & K. Frank (*holo:* NSW; *iso:* CHR, K, P, PERTH).

Lax, slender, rhizomatous *perennial*. Culms slender, terete, hollow, with 4-6 nodes, branching at the base, 30-90 cm high, 1-1.5 mm diam. Leaves with blades more or less flat, relatively soft-textured, erect to spreading, twisted 180° about halfway along their length, with scabrous margins, shorter than culms, to 35 cm long, 2.5-4 mm wide; ligule white-ciliate, 0.1-0.2 mm long, occasionally with hairs to 1.5 mm long near the margins; sheath greenish. Inflorescence slender, lax with branches rather drooping, 20-50 cm long. Spikelets not clustered, with 1 nut-producing flower above 0-2 male flowers; subtending bract usually similar to glumes; glumes 4 or 5, ovate, with long-acute apex c. 0.5 mm long, lower 2 glumes sterile and occasionally slightly shorter and narrower than upper glumes, all glabrous or with a few fine hairs near apex, greenish to pale straw-coloured with dark purple-red patches towards apex, (2.7)3.5-4.5 mm long. Stamens 3; anthers 1.3-1.6 mm long, plus apical appendage c. 0.2 mm long; filaments not strongly elongated or persistent. Style 3-fid. Nut obovate to oblong-obovate, trigonous, glabrous, very finely reticulate-colliculate, glistening, pale straw-coloured to dark yellow-brown at maturity, 2.0-2.2 mm long, 1.0-1.2 mm diam. (Figure 2A-C)

*Other specimens examined.* WESTERN AUSTRALIA: West Cape Howe, 6 Mar. 1956, R.D. Royce 5405 (PERTH); William Bay National Park, 23 Nov. 1994, K.L. Wilson 9050 & K. Frank (NSW, PERTH); Parryville [Denmark Shire], 5 Sep. 1947, J. Willis, Grimwade Expedition (PERTH); 7 km ENE of Walpole, 28 Jan. 1992, G. Wardell-Johnson GWJ43 (PERTH); Yelverton State Forest, 8 Nov. 1989, G. Keighery 10820 (PERTH).

*Distribution.* Known from only six collections, from Yelverton State Forest, and further south-east from the areas of William Bay, Denmark, Walpole and West Cape Howe.

*Habitat.* In moist, shaded situations in Jarrah forest, on sandy soil. The only other south-west species of *Gahnia* in a similar situation is *G. decomposita* (R. Br.) Benth., but that is a very different-looking plant, being taller and stouter, and scabrous-papillose on most surfaces except the black uppermost fertile glumes in each spikelet.

*Phenology.* Flowering time unknown; fruiting time includes November.

*Conservation status.* CALM Conservation Code: should be considered a Priority 3 taxon since its distribution is poorly known although it has been collected from at least one site in a national park. In the Briggs & Leigh (1996) ROTAP classification, it would be 3KC- (geographic range > 100 km; poorly known; occurring in reserves but population size(s) not accurately known).

*Epithet.* Named from the superficial resemblance of its spikelets to those of some slender species of the genus *Scleria* Berg.

*Relationships.* Not closely related to any of the Western Australian species. It is curious that this species is morphologically most similar to *G. insignis* S.T. Blake, another slender species from similarly shaded, rather moist habitats in south-eastern Queensland and north-eastern New South Wales. These two species differ from most other species of *Gahnia* in having the sterile glumes of a similar size and shape to the fertile glumes in a spikelet (Blake 1957). Both species have numerous cauline leaves, one nut-producing flower in each spikelet, and staminal filaments that are not greatly elongated or persistent as in many other species in the genus (Benl 1937). However, *G. insignis* differs from *G. sclerioides* in having spikelets with only 2 or 3 glumes (4-6 mm long); anthers 3-3.5 mm long, with an apical appendage 0.3-0.4 mm long; and nuts 2.2-2.8 mm long, 1.0-1.3 mm diam. The culms of *G. insignis* are often longer (50-200 cm) and coarser (1-2.5 mm diam.), and are usually solid or rarely with the narrow pith-filled core breaking down, unlike those of *G. sclerioides*, which have a large hollow cylindrical core. *G. insignis* usually has narrower leaves (1.5-2.7 mm wide) that inroll strongly when dried; the leaves of *G. sclerioides* tend to remain flattish when dried.

*Notes.* This taxon has been known by the phrase name *Gahnia* sp. Yelverton (*G.J. Keighery* 10820) in PERTH.

There is variation between the Yelverton specimens and those from farther east. Yelverton specimens have shorter leaf blades and clusters of longer hairs on the margins of the ligule; their spikelets have two basal sterile glumes, which are slightly shorter than the fertile glumes but all are in the range 3.5-4.5 mm long. In contrast, the more easterly specimens lack longer hairs on the ligule margins; there are two or three sterile glumes at the base of the spikelet, which are not shorter than the fertile glumes (they may even be slightly longer than them) all being in the range 2.7-4 mm long.

### Schoenus L.

***Schoenus calcatus*** K.L. Wilson, *sp. nov.*

Species ab aliis congeneribus combinatione characterum sequenti distinguitur: pulvinos humiles tenaces formans; lamina folii rigida reductaque, vagina folii fulva orificio lanato; inflorescentia 1-spiculata.

*Typus:* 28 miles [45 km] east of Newdegate, Western Australia, 25 April 1969, *A.S. George* 9284 (*holo:* NSW; *iso:* PERTH).

Small *perennial*, forming cushions to 30 cm diam. *Culms* densely tufted and intertwining, noded with leaves hiding the culms, erect, to 2.5 cm long. *Leaves* arranged spirally; blades reduced, oval in cross-section, smooth, with broad-acute apex, adaxially usually with a pale central longitudinal band without

stomates, abaxially with 3 such bands on the margins and centrally, 2.5-4 mm long; sheaths yellow-brown, with hyaline margins, smooth; apex of sheath split deeply (margins not overlapping), very woolly (hairs lost with age). *Inflorescence* of a single small, erect, terminal spikelet; involucre bract leaf-like, with woolly apex to sheath. *Spikelet* sessile, not falcate, c. 4 mm long, with 1 nut-producing flower, often with a male flower below it; glumes 2 or 3, straw-coloured, shining, stiffly membranous, without prominent midrib, with broad-acute to retuse apex, with leaf-like mucro on lowest glume, with margins woolly on lower 1 or 2 glumes and glabrous on upper glume(s), 3-4 mm long. *Perianth bristles* absent. *Stamens* 3 or 4; anthers yellow, 1.7-2.2 mm long, plus apical appendage 0.1-0.2 mm long. *Style* 3-4-fid. *Nut* (so far as seen) elliptic in outline, symmetrical, obscurely 3-angled, golden-pubescent over at least upper half, mid-brown, minutely granular, c. 2.3 mm long, c. 1.2 mm diam. (Figure 2D,E)

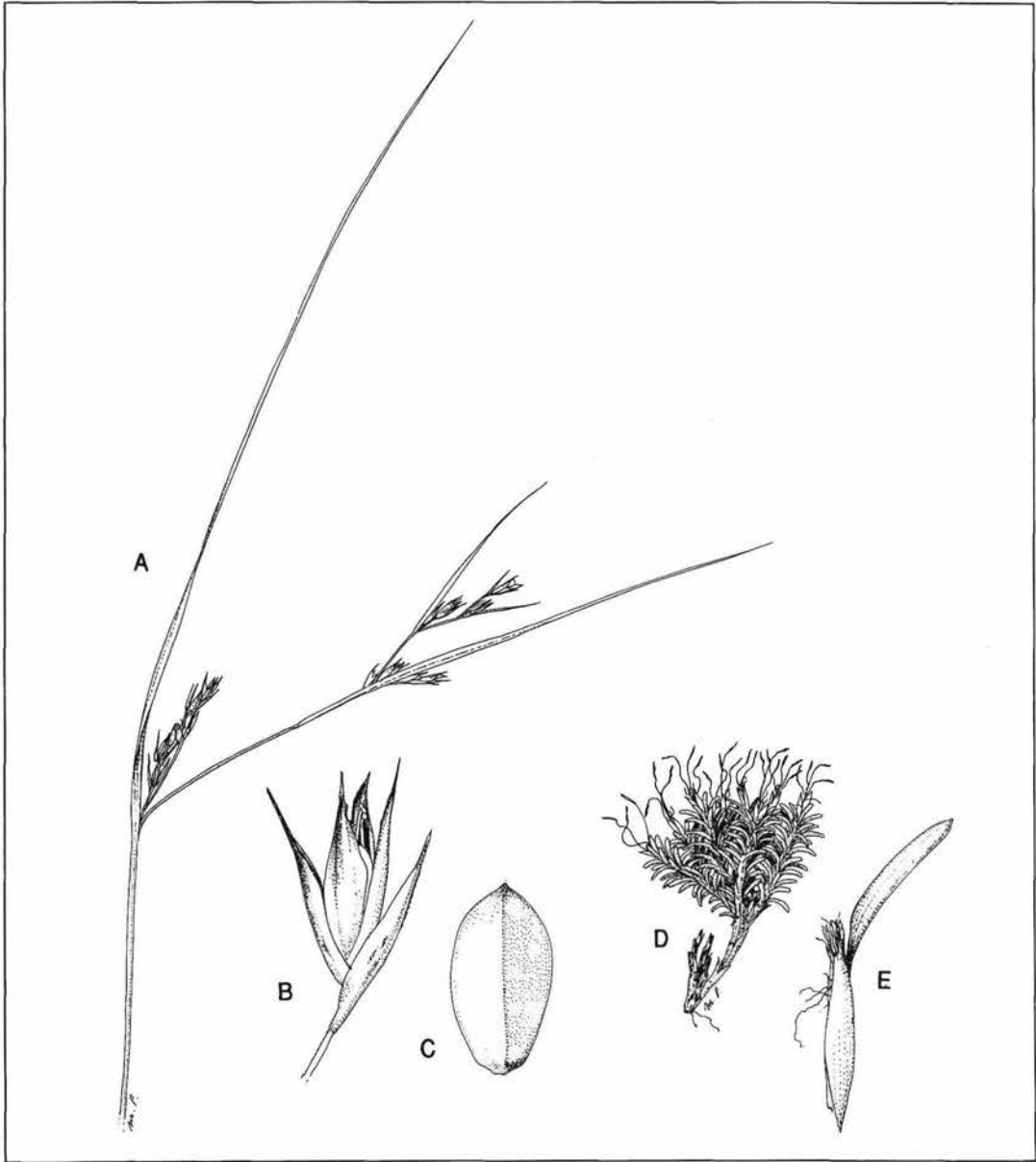


Figure 2. A-C *Gahnia sclerioides* A - portion of inflorescence (x1); B - spikelet (x7); C - nut (x12). D, E. *Schoenus calceatus* D - tuft of whole plant, showing several culms, with anthers protruding from spikelets (x1); E - leaf, showing short blade and sheath, with ciliate apex to sheath (x10). Drawn from the type K.L. Wilson 8936 & K. Frank (A-C) and A.S. George 7382 (D, E).

*Selected specimens examined.* WESTERN AUSTRALIA: Durokoppin Reserve, 4 June 1987, *L. Atkins* HLA 36 (PERTH); 14 km E of Newdegate on Lake King road, 12 Oct. 1979, *K.L. Wilson* 2785 (NSW, PERTH); Lake King-Ravensthorpe road, Jan.-Feb. 1966, *A.S. George s.n.* (NSW, PERTH), 16 Jan. 1966, *A.S. George* 7382 (PERTH), 27 Oct. 1985, *J. McCarthy* 6 *et al.* (NSW); One Mile Rocks Reserve, SE of Lake King, 2 June 1979, *A.S. George* 15731 (PERTH); Dunn Rock Nature Reserve, 30 km SW of Lake King, 15 Apr. 1984, *D.J. Backshall* 228 (PERTH); 2 km S of Mt Gibbs, 10 Aug. 1979, *K.R. Newbey* 5480 (PERTH).

*Distribution.* Apparently most common in the Newdegate-Lake King region, with two apparent outlying occurrences farther north near Kellerberrin and Ballidu. Probably occurs (or did occur) in suitable habitats in the intervening areas.

*Habitat.* Forming low cushions or mats in open shrubland on clayey soils (over laterite).

*Phenology.* Flowering March-April; fruiting April (rarely collected in fruit).

*Conservation status.* CALM Conservation Code: this species should be treated as a Priority 3 taxon to encourage further surveys. In the terminology of Briggs & Leigh (1996), this species would be classified as 3KC- (geographic range > 100 km; poorly known; occurring in reserves but population size(s) not accurately known).

*Epithet.* From the Latin *calcare*, to tread upon, walk over, referring to one of the potential threats to this species with its low, mat- or cushion-like form.

*Relationships.* Not closely related to any other member of the genus described so far, but further study is needed of other (un-named) cushion-forming species before its relationships can be understood. For this purpose, more fruiting material of *S. calcatus* is needed.

*Notes.* Specimens of this taxon in PERTH have been housed under the phrase name *Schoenus* sp. Newdegate Cushion (*A.S. George* 9284).

This is unusual in the genus in often having one of the three style-branches secondarily divided (e.g. in *George* 9284 and *Atkins* HLA 36). It is also unusual in apparently being a 'resurrection plant' - its foliage is reported to become orange in summer (*A. George* pers. comm.; note on *Atkins* HLA 36).

***Schoenus griffinianus* K.L. Wilson, *sp. nov.***

Inter species sectionis *Stricti* combinatione sequenti characterum distinguitur: nux papillosa, erugosa; culmi quam inflorescentiarum breviores, valde costati, valde hispidulae; apex vaginae foliis longe ciliatus; spiculae 4-7 mm longae.

*Typus:* c. 4 km east-north-east of Eneabba on Three Springs road, Western Australia, 9 November 1994, *K.L. Wilson* 8835 & *K. Frank* (*holo:* NSW 363902; *iso:* K, P, PERTH).

Small tufted *perennial*. *Culms* erect, more or less terete, strongly ribbed, strongly hispidulous to more or less long-papillose, usually with 1 node, not swollen at the base, much shorter than the inflorescence, 0.5-5 cm long. *Leaf blades* exceeding the culms but shorter than the inflorescence, to 3 cm long, 0.5-0.7 mm wide, somewhat curly, rigid, thick, more or less flat in cross-section, with hispid margins,

adaxially smooth, abaxially strongly and thickly 3-ribbed and hispid between the ribs, with acute to obtuse apex; sheaths split to base, yellow-brown to dark red-brown towards the base, white on the margins and towards the apex, glabrous, more or less dull, membranous to chartaceous; apex of sheath truncate, long-ciliate, produced beyond the attachment point of the blade. *Involucral bracts* leaf-like but with the sheath occasionally only split for about half its length and occasionally scabrous; the blade portion exceeding the subtended spikelet, to 2.5 cm long. *Inflorescence* raceme-like, erect, with spikelets solitary at 2 or 3 widely separated nodes, occasionally reduced to a single small cluster of spikelets or with uppermost nodes reduced to give an apparent cluster of spikelets, longer than the culms, to 4 cm long. *Spikelets* sessile, 4-7 mm long, *c.* 2.5 mm wide in side view; mature rachilla zigzag; glumes 3, lowest or uppermost sterile, other 2 nut-producing, 3.5-5 mm long (uppermost slightly smaller than others), hyaline or whitish with red-brown tinge or patches with prominent green keel, more or less shining, margins ciliate, midrib hispidulous, lowest glume shortly mucronate, upper 2 glumes acute. *Perianth* absent. *Stamens* 3; anthers 1.1-1.3 mm long, plus apical appendage 0.1-0.2 mm long. *Style* 3-fid. *Nut* ellipsoid narrowing to a short stipe-like base, trigonous, faintly 3-ribbed, yellow-brown overlaid with red-brown patches, more or less dull, glabrous but with scattered large papillae on upper half and tiny papillae all over surface, *c.* 1.5 mm long (including stipe-like base 0.2-0.3 mm long), *c.* 1 mm diam. (Figure 3A-C)

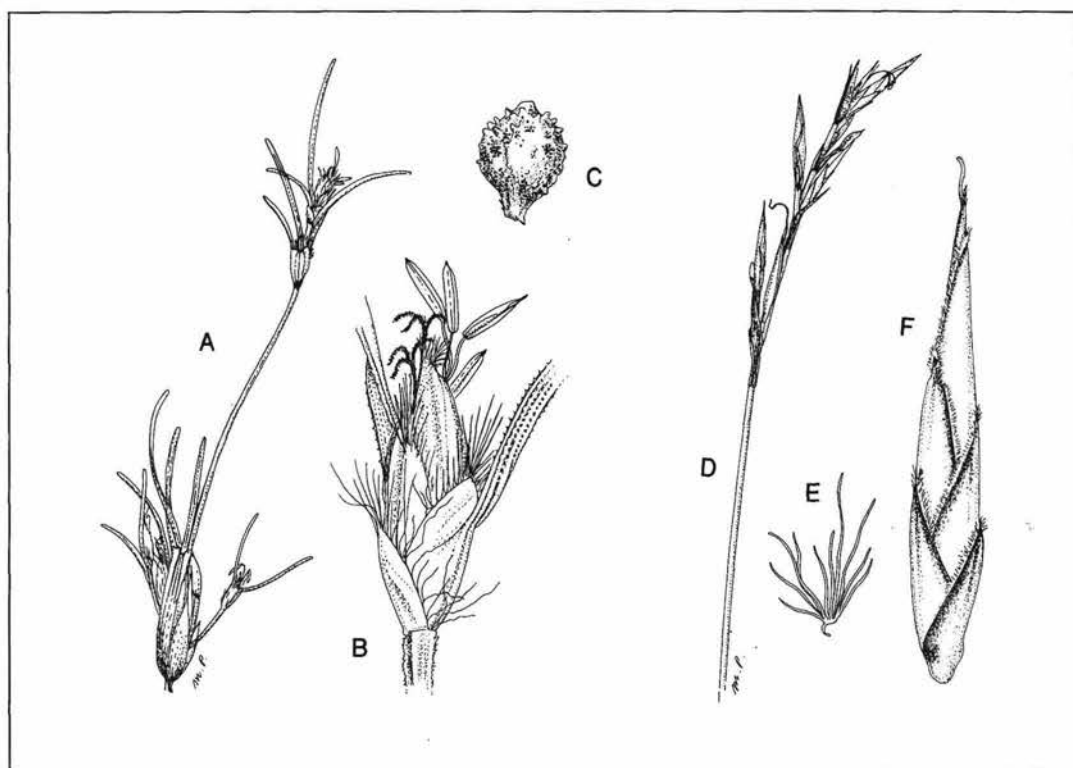


Figure 3. A-C *Schoenus griffinianus* A - inflorescence (x1); B - spikelet (x7.5); C - nut (x10). D-F. *Schoenus insolitus* D - inflorescence (x1); E - a substellate hair from leaf sheath (x20); F - spikelet (x6). Drawn from C.M. Parker 276 (A-C), E.A. Griffin 4712 (D, F) and the type K.L. Wilson 8823 & K. Frank (E).

*Other specimens examined.* WESTERN AUSTRALIA: Victoria location 10240, 8 km SSE of Eneabba, 7 Nov. 1984, *E.A. Griffin* 3841 (NSW, PERTH); c. 8 km S of Eneabba, 28 Sep. 1977, *R.J. Hnatiuk* 771442 (PERTH); Wongan Hills Experimental Farm, Reserve 18672, 24 Oct. 1984, *C.M. Parker* 276 (NSW, PERTH), 11 Oct. 1985, *C.M. Parker* 354 & *P.J. Poli* (CANB, CHR, K, NSW, PERTH).

*Distribution and habitat.* Only known from a few collections from near Eneabba and Wongan Hills, growing in disturbed areas such as firebreaks in low heath, on sand.

*Phenology.* Flowering September-October; fruiting November.

*Conservation status.* CALM Conservation Code: listed as Priority 2 - a poorly known taxon that is only known from a few populations, one of which is in a reserve near Wongan Hills. Briggs & Leigh (1996) list this species as 3K (geographic range > 100 km; poorly known); I suggest modification to 3KC - since one population is in a reserve.

*Epithet.* The species is named after E.A. (Ted) Griffin, an ecologist who has collected one of the specimens of this species, amongst many others collected during his survey work.

*Relationships.* This species fits in *Schoenus* section *Stricti* (Benth.) Benth. in Kuekenthal's classification of the genus (Kuekenthal 1938), which is still a convenient framework to use pending further study of other species in the genus. This species differs from others in that section in not having a rugose nut but is otherwise similar in being a smallish perennial species, with an erect raceme-like inflorescence with distant nodes and sessile spikelets, and lacking perianth bristles. Its most distinctive features are the deeply ribbed, strongly hispidulous culms, long-ciliate apex to the leaf-sheath, and the papillose nut. It does not closely resemble any known species, but has some similarities to *S. grammaatophyllus* F. Muell., *S. asperocarpus* F. Muell., *S. obtusifolius* (Nees) Boeck. and *S. unispiculatus* F. Muell. ex Benth. The latter species was placed in section *Oligostachyi* (Benth.) Benth. by Kuekenthal, presumably because of its small inflorescence, but its affinities seem to lie with the small perennial species in section *Stricti*.

*Notes.* Specimens of this species in PERTH have been given the phrase name *Schoenus* sp. Wongan (*E.A. Griffin* 3841).

***Schoenus insolitus*** K.L. Wilson, *sp. nov.*

Inter species sectionis *Nudicaules* indumento foliorum conferto albo substellatoque singulari distinguitur.

*Typus:* 30 km east of Brand Highway on the Green Head to Coorow road, Alexander Morrison National Park, Western Australia, 8 November 1994, *K.L. Wilson* 8823 & *K. Frank* (*holo:* NSW 363883; *iso:* PERTH).

Tufted *perennial*. Culms slender, wiry, erect, terete, smooth, not or rarely 1-noded, yellow-green, (15)35-45 cm high, c. 1.2 mm diam. Leafblades reduced, erect, more or less triangular in cross-section, smooth (including margins) or occasionally with white hairs, abaxially 1-ribbed, with acute apex, much shorter than culm, to 8 mm long, 0.7-0.8 mm diam.; sheaths very shortly split at the apex in a v-shaped opening, margins not overlapping, pale to dark yellow-brown, densely hairy at least when young, can be lost with age; hairs white, more or less stellate but arms of unequal length so that the overall impression

is of antrorse hairs, 0.5-1 mm long. *Inflorescence* panicle-like, erect, (4)9-25 cm long, with 4-6 nodes, the lower nodes more distant (internodes to 16 cm long), each node with 2-4 spikelets. *Involucral bract* leaf-like, smooth or scabrous or minutely white-hairy, much shorter than the inflorescence, to 1 cm long; sheath often scabrous, with apex glabrous or sparsely white-hairy, shortly split in a v-shaped opening. *Spikelets* on pedicel to 4 cm long, narrow-elliptical to ovate in outline, not falcate, 11-17 mm long, c. 1.5 mm wide in side view; glumes 5 or 6, lowest 4 sterile, gradually increasing in length from base to apex of spikelet, lowest glume c. 7 mm long, upper (nut-producing) glumes 11-12 mm long, yellowish with red-brown to dark red-brown patches, often paler towards margins and apex, more or less shining, stiff, with more or less prominent midrib, sides glabrous or occasionally white-hairy, with margins white-ciliate at least near apex, with apex long-acute and mucronate. *Perianth bristles* absent or 1 vestigial bristle, white, deciduous, c. 1 mm long. *Stamens* 3; anthers c. 4.5 mm long, plus apical appendage to 1.5 mm long. *Style* 3-fid. *Nut* (slightly immature) narrow-elliptical to oblong in outline, glabrous, shining, dark red-brown, 4-6 mm long, c. 1 mm diam. (Figure 3D-F)

*Selected specimens examined.* WESTERN AUSTRALIA: 50 km W of Winchester on Eneabba road, 24 Aug. 1965, A.C. Beauglehole 12159 (PERTH); Alexander Morrison National Park, N of Coorow-Green Head road, 21 Oct. 1987, E.A. Griffin 4712 (NSW, PERTH); Victoria location 10240, 8 km SSE of Eneabba, 7 Nov. 1984, E.A. Griffin 3842 (PERTH); c. 11 km S of Leeman turn-off on Brand Highway, Eneabba South Nature Reserve, 9 Nov. 1994, K.L. Wilson 8841 & K. Frank (NSW, PERTH); 1 km W of Brand Highway along Green Head road, 2 Oct. 1979, K.L. Wilson 2690 (NSW, PERTH); between Scenic Rd and Capitella Rd, S of Dandaragan, 10 Sep. 1988, E.A. Griffin 4988 (PERTH); W of Watheroo near Magnetic Observatory, 19 Sep. 1958, H. & E. Walter 744 (PERTH).

*Distribution.* From near Carnamah and Eneabba south to the Dandaragan area.

*Habitat.* In low heath and shrubland, on sand (often over laterite).

*Phenology.* Flowering April-October; fruiting October-November.

*Conservation status.* CALM Conservation Code: was previously listed as a Priority 2 taxon but was removed following further collections being identified. Briggs & Leigh (1996) list this species as 2KC- (geographic range < 100 km; poorly known; population(s) in reserve(s) but population size(s) unknown).

*Epithet.* From the Latin *insolitus*, unusual, uncommon, strange, referring to the white, more or less stellate hairs that cover the leaves at least when young but are easily rubbed off. They are unique in the genus.

*Relationships.* This species is unique in the genus in its dense white substellate indumentum on leaves and occasionally also on involucral bracts and glumes; the indumentum is apparently often lost with age except near the base of the leaf sheaths. Other features such as its reduced leaf blades and slender but rigid panicle-like inflorescence with pedicellate spikelets clearly place it in *Schoenus* section *Nudicaules* Kuek. as defined by Kuekenthal (1938). *S. laevigatus* often has similarly coloured leaf sheaths with a shortly split apex but differs in having the split sheath margins overlapping.

*Notes.* Specimens of this taxon have been given the phrase name *Schoenus* sp. Warradarge (E.A. Griffin 3842) in PERTH.

No specimens have been seen with fully mature fruits. The species seems to drop its spikelets whole, rather than the individual glumes falling and leaving the rachilla behind as is usual in this genus.

### Acknowledgements

Fieldwork in Western Australia was facilitated by a grant from the Australian Biological Resources Study, and Kristina Frank, Greg Keighery, Neil Gibson and Alastair Wilson are thanked for their help in the field. The Western Australian Herbarium financed two periods of study by me in the PERTH Herbarium in 1994 and 1995, during which I examined the species described here as well as many more still to be dealt with. My thanks to the staff there, especially Bruce Maslin, Barbara Rye and Neville Marchant, for their kind assistance. Barbara Briggs is thanked for her comments on the manuscript. Margaret Pieroni drew the illustrations.

### References

- Benl, G. (1937). Eigenartige Verbreitungseinrichtungen bei der Cyperaceengattung *Gahnia*. Forst. Flora 131: 369-386.
- Blake, S.T. (1939). A monograph of the genus *Eleocharis* in Australia and New Zealand. Proc. Roy. Soc. Queensland 50: 88-132, pl. 7-10.
- Blake, S.T. (1957). A new species of *Gahnia* from eastern Australia. Proc. Roy. Soc. Queensland 68: 37-41, pl. 3.
- Briggs, J.D. & Leigh, J.H. (1996). "Rare or Threatened Australian Plants." 1995 revised edition. (CSIRO: Melbourne.)
- Kueckenthal, G. (1938). Vorarbeiten zu einer Monographie der Rhynchosporoideae. Feddes Repert. 44: 1-32, 65-101, 161-195.
- Vickery, J.W., Jacobs, S.W.L. & Everett, J. (1986). Taxonomic studies in *Stipa* (Poaceae) in Australia. Telopea 3: 1-132.