XYRIDACEAE

J. Leong-Škorničková

C.Agardh, Aphor. Bot., pt 11 (1823) 158, as 'Xyrideae', nom. cons.; Kral in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 4 (1998) 461; Seberg in Heywood et al., Fl. Pl. Fam. World (2007) 407. **Type:** *Xyris* Gronov. ex L.

Abolbodaceae Nakai, Chosakuronbun Mokuroku [Ord. Fam. Trib. Nov.] (1943) 221. Type: Abolboda Bonpl.

Perennial (rarely annual) rosulate to caulescent herbs, usually in marshes or wet places. Leaves alternate, distichously or spirally arranged, congested at base, with open, frequently keeled, leaf sheaths, occasionally ligulate, lamina narrow, mostly flat, rarely angulate, terete or cannaliculate. Inflorescences lateral or terminal, scapose (rarely subsessile), often with a pair of bracts on the scape, terminated by a spike or panicle of spikes or a head, the spikes or heads bearing one to many flowers. Flowers ephemeral, solitary and subsessile in axils of chaffy, leathery or scarious bracts (rarely pedicellate in spathe axils), trimerous, bisexual, slightly bilateral or zygomorphic. Perianth in two differentiated whorls; sepals (2–)3 subequal, anterior (inner) sepal membranous, wrapped around the corolla and detaching as the flower opens or reduced to scale, the lateral (outer) two subopposite, connivent to connate, chaffy, often keeled, persistent around the ripe fruit; petals 3, equal to unequal, free or united with a narrow basal claw or tube, salver-shaped or bilabiate, often yellow, white or blue. Stamens rarely 6, usually 3, opposite the petals, attached to corolla tube or hypogynous, and (1-)3staminodes, filamentous, bibrachiate, often ending in moniliform hairs; filaments thin; anthers tetrasporangiate, basifixed, usually bilocular at anthesis, dehiscing introrsely or laterally, longitudinally. Ovary superior, 3-carpellate, unilocular to completely or incompletely 3-locular, placentation axile (but also marginal, parietal, basal and free-central in *Xyris*); ovules numerous, anatropus or atropous; style slender, sometimes with appendages, apically trifid with horseshoe-shaped stigmas, or variously expanded with funnel-shaped, laminar or subcapitate zones with papillate or fringed stigmatic zones. Fruit a loculicidal capsule, often prominently ridged, with many (rarely 1) seeds. Seeds with mealy or oily endosperm, embryo small.

Distribution. Xyridaceae has 5 genera and slightly over 300 species. Four genera, accounting for about 25 species, are confined to South America. Only the largest genus, *Xyris*, extends into the northern hemisphere (especially North America) and to Africa, Asia and Australia.

Ecology. Almost all species are heliophytic, occurring in acidic moist to wet habitats.

Uses. Records of uses of Xyridaceae are sparse. These include ornamental potential for gardens or as aquarium plants. There is also some traditional medicinal use of the roots and leaves

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of several *Xyris* species in South America for treating skin diseases and colds. According to Burkill (Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2317), *Xyris melanocephala* Miq. (= *X. capensis* Thunb.) is used in Java as material for matting. Medicinal uses reported in Asia include using *Xyris indica* L. for treating ringworm and *X. anceps* Lam. (actually misidentified *X. complanata* R.Br.) to treat skin complaints (Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2317). Mabberley (Mabberley's Pl. Book, ed. 3 (2008) 917) reports that culms of *Xyris capensis* are used to make figures for Hindu temples in Java.

Taxonomy. Although the family has traditionally been placed in the order Commelinales, it is now included in the Poales, based on molecular data, and is most closely related to Eriocaulaceae. Two genera, *Abolboda* and *Orectanthe* Maguire, were previously thought to form a separate family, Abolbodaceae (Takhtajan, Bot. Rev. (Lancaster) 46 (1980) 225–239), although this family has since been synonymised into Xyridaceae. Recent molecular studies have suggested that Xyridaceae might not be monophyletic (Michelangeli et al., Amer. J. Bot. 90 (2003) 93–106; Davis et al., Syst. Bot. 29 (2004) 467–510) but there is still insufficient data to propose changes to the current circumscription of Xyridaceae.

XYRIS Gronov. ex L.

(Latin, *Xyris* = iris, or Greek, *xuron* = razor; referring either to the shape of the flowers which resemble small irises, or to the flat leaves which occur in some species and resemble cut-throat razors) *Yellow-eyed grass* (English), *chelagi, berudang* (Malay)

Sp. Pl. 1 (1753) 42; Engler in Engler & Prantl, Nat. Pflanzenfam. 2(4) (1887) 18; Ridley, Mat. Fl. Malay. Penins. 2 (1907) 111; Ridley, Fl. Malay Penins. 4 (1924) 348; Malme in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 15a (1930) 35; Van Royen, Fl. Males., ser. 1, 4(4) (1953) 367; Hutchinson, Fam. Fl. Pl., Monocot., ed. 2 (1959) 570; Hansen, Fl. Cambodge, Laos, Viêtnam 20 (1983) 151; Hansen, Fl. Males., ser. 1, 9(3) (1982) 573; Hansen, Fl. Thailand 5(1) (1987) 130; Doust & Conn, Austral. Syst. Bot. 7 (1994) 456; Kral in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 4 (1998) 468; Phonsena et al., Thai For. Bull., Bot. 41 (2013) 103. **Type:** *Xyris indica* L.

Perennial (rarely annual) mostly rosulate (rarely caulescent) herbs, solitary or caespitose, sometimes rhizomatous or bulbous herbs, usually in marshes or wet places. **Leaves** alternate, mostly equitant and distichously arranged, congested at base, with open, frequently keeled, leaf sheaths, occasionally ligulate, lamina narrow, mostly flat, or subterete to terete, linear, narrowly oblong or ensiform, surface smooth, rough or papillate (papillae may form transverse ridges), margin smooth, papillate or denticulate. **Inflorescences** scapose, scape mostly long, terete or complanate, straight or twisted, often sulcate or ribbed, terminated by a dense few to manyflowered spike, spike ovoid to obovoid or almost cylindric, composed of spirally arranged bracts; bracts persistent, chaffy, leathery or scarious, imbricate, ovoid to obovoid or orbicular, rarely keeled, mostly brown, rarely with red or yellow tinge, usually with a triangular, oblong or elliptic stomatal field below apex, margin mostly paler and more or less semitranslucent, entire or distally fimbriate or lacerate, or just split near the apex; apex rounded, entire or emarginate; basal bracts sterile, each fertile bract subtending one sessile flower. **Flowers** ephemeral, trimerous, bisexual, with perianth in two differentiated whorls; sepals 3, subequal,

anterior (inner) sepal hood-like, ovate, thin, membranous, wrapped around the corolla in bud and detaching at anthesis, the lateral (outer) two sub-opposite, yellow to pale brown, somewhat translucent, spathulate or oblong to obovate, basally oblique or equal, keeled, keel sometimes inconspicuous but mostly well-developed and often crested, crest entire, papillate, or irregularly serrate to fimbriate, margins basally entire, distally entire or erose, lacerate to fimbriate, persistent around the ripe fruit; petals 3, yellow, more or less equal, with basal claw, petal limb obovate, obtriangular, ovate or elliptic, margin distally erose to lacerate, adjacent petal limbs occasionally fused to base of staminodial lobes. Stamens 3, attached to base of petal limb; filaments linear or distally narrowed, flattened; anthers basifixed, tetrasporangiate, bilocular at anthesis, shortly lobed basally and apically, dehiscing longitudinally; staminodes 3 (or absent), filament linear basally, as long as petal claw and more or less adhering to it, distally bilobed, ending with elongate moniliform hairs. Ovary (in Asian species) superior, 3-carpellate, sessile, 1-locular with 3 parietal placentas; ovules numerous; style slender, more or less terete or somewhat flattened, trifid, branching at or just above the base of petal limbs, branches distally funnel-shaped or tubular; stigma horseshoe-shaped. Fruit a loculicidal capsule, obovoid and somewhat dorsiventrally flattened, mostly with many seeds. Seeds ovoid to ellipsoid, or sub-globose, yellow- to red-brown, longitudinally and transversely ridged, area between ridges smooth or ornamented, endosperm mealy or oily, embryo small.

Distribution. About 280 species with most occurring in North and South America. A few species occur in Africa, Asia and Australia. In Southeast Asia there are 18 species, of which 2 are native in Singapore.

Ecology. Same as for the family.

Taxonomy. The above generic description is predominantly based on Asian species. Six generic synonyms are listed in various online databases but none of these have appeared in the regional literature and are, therefore, not listed above.

Key to Xyris species

1. Xyris complanata R.Br.

(Latin, *complanatus* = flattened, usually in one plane; referring to the leaves)

Prodr. Fl. Nov. Holland. (1810) 256; Ridley, Mat. Fl. Malay. Penins. 2 (1907) 112; Ridley, Fl. Malay Penins. 4 (1924) 348; Van Royen, Fl. Males., ser. 1, 4(4) (1953) 369; Henderson, Malay. Wild Fls., Monocot. (1954) 193; Koyama, Philipp. J. Sci. 84 (1956) 366; Hansen, Fl. Males., ser. 1, 9(3) (1982) 571; Keng, Gard. Bull. Singapore 40 (1987) 126; Turner, Gard. Bull. Singapore 45 (1993) 228; Doust &

Conn, Austral. Syst. Bot. 7 (1994) 461; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 26; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 91, 185, 273; Phonsena et al., Thai For. Bull., Bot. 41 (2013) 115. **Type:** *Brown s.n.* [Iter Austral. 5732], Australia, Northern Territory, Islands of the Gulf of Carpentaria, December 1802–February 1803 (lectotype BM [BM000529001], designated by Doust & Conn, Austral. Syst. Bot. 7 (1994) 461; probable isolectotypes E [E00502163], K [K000912584]). Fig. 1, 2.

Xyris laevis R.Br., Prodr. Fl. Nov. Holland. (1810) 256. **Type:** *Brown s.n.* [Iter Austral. 5729], Australia, Northern Territory, Islands of the Gulf of Carpentaria, December 1802–February 1803 (lectotype BM [BM000529002], first step designated by Doust & Conn, Austral. Syst. Bot. 7 (1994) 461, second step designated here; probable isolectotype BM [BM000528999]).

Xyris scabra R.Br., Prodr. Fl. Nov. Holland. (1810) 256. **Type:** *Brown s.n.* [Iter Austral. 5730], Australia, Queensland, Port Curtis, 5–8 August 1802 (lectotype BM [BM000529003], designated by Doust & Conn, Austral. Syst. Bot. 7 (1994) 461; probable isolectotype K [K00912580]).

Xyris elongata Rudge, Trans. Linn. Soc. London 10 (1811) 289, t. 15: fig. 1. **Type:** *Fleming s.n.*, New Holland [Australia], 'prope Port Jackson' (lectotype BM [BM000990759], designated here).

Xyris walkeri Wight ex Kunth, Enum. Pl. 4 (1843) 19; Thwaites, Enum. Pl. Zeyl., fasc. 5 (1864) 340. **Type:** *Collector unknown s.n.* [Herb. Wight 2373], Ceylon [Sri Lanka] (lectotype K [K00912549], designated here).

? *Xyris malaccensis* Steud., Syn. Pl. Glumac. 2, fasc. 10 (1855) 287; Miq., Fl. Ned. Ind. 3, fasc. 4 (1859) 529. **Type:** *Griffith s.n.*, [Malaysia], Malacca (not traced).

Xyris anceps auct. non Lam.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 169; Ridley, Mat. Fl. Malay. Penins. 2 (1907) 111; Ridley, Fl. Malay Penins. 4 (1924) 348.

Caespitose perennial herb, (40-)55-82 cm tall. Leaves linear, 8-25(-30) cm long, 2-3 mm wide, slightly twisted, basally with bright reddish tinge and sheathing, ligule minute; lamina smooth; margin papillate; apex acute, slightly oblique. Inflorescence terminal, dense spike on a long scape; scape compressed, lenticular (distally) to broadly lenticular (basally) in crosssection, slightly twisted, (40-)55-82 cm long, 1.5-2.3 mm in diam., surface smooth; spike ovoid to ellipsoid to cylindrical, 7-25(-30) mm long, 5-8 mm in diam., composed of (16-)20-60(-70) imbricate greenish-brown to brown bracts, darkening with age, basal 4-8 bracts sterile, broadly ovate, $2.5-4 \times 3-4$ mm, fertile bracts broadly elliptic, to orbicular, $3-5.5 \times 3.5-$ 5.5 mm; margin entire basally, entire to lacerate distally (laceration increases with age); apex slightly emarginate; stomatal field ovate to elliptic, $2-2.5 \times c$. 2 mm. Flowers yellow, dorsal sepal not seen; lateral sepals light brown, $4-5 \times 1-1.5$ mm, irregularly boat-shaped, keeled, keel crested, crest with irregularly serrate to laciniate margin; petals 3, yellow, spathulate, basal claw c. 5 mm long, distal part broadly obovate, $5-6 \times 5-7$ mm, margin distally irregularly shallowly serrate. Stamens c. 4 mm long; filaments c. 2 mm long; anthers c. 2 mm long, thecae opening along the entire length, apex of each theca bidentate when fully opened. Staminodes 3, Y-shaped, basal part c. 1 mm long, branches c. 2–3 mm long, with fine fimbriae. Style c. 2.5 mm long, distally 3-branched, branches 1-1.5 mm long, each branch with flattened undulate apex with pectinate margin. Fruit a dark brown capsule, obovoid, c. 2 mm long, c. 1.2 mm at widest point. Seeds prolate, reddish-brown, ribbed, $0.4-0.5 \times 0.3-0.4$ mm, 14-15 dark brown longitudinal ridges and 2-4 transverse ridges.

Distribution. India, Sri Lanka, Thailand, Cambodia, Laos, Vietnam, China (Hainan), Malesia and Australia. In Singapore the most recent collections are known from Tampines-Punggol area (*Leong et al. SING2008-89*, 11 Apr 2008, SING [SING0106407]) and Woodlands (*Lai LJ150*, 1997, SING [SING0008239]). The oldest historical collections are recorded from Balestier Plain (*Ridley 5878*, 1894, SING [SING0034058]) and Geylang (*Ridley 5757*, 1893, SING [SING0034061]) as well as from Pulau Tekong (*Ridley s.n.*, Oct 1890, SING [SING0034060]).

Ecology. In Singapore Xyris complanata occurs in open wet sandy places.

Provisional conservation assessment. Globally Least Concern (LC) (Phonsena et al., Thai For. Bull., Bot. 41 (2013) 117) as this species is widespread in the region. This species was listed as Rare in the first edition of The Singapore Red Data Book (Tan et al. in Ng & Wee (ed.), Singapore Red Data Book (1994) 312) but not mentioned in the second edition (Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 244) suggesting it is of Least Concern in Singapore. Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 91, 185, 273) treated this species as a 'weed of uncertain origin' (hence without a conservation assessment), although no previous Singapore-related literature has suggested it is not native. This species is here considered to be native in Singapore due to the presence of early specimens and also due to the presence of this species in a specialised habitat which is rich in other native species. All but one collection from the last 25 years is from the Tampines-Punggol area which has been largely developed into housing estates. The species has not been found in repeated recent surveys of the only undeveloped area with a suitable habitat between Tampines Avenue 8 and Avenue 10, and even this area is currently being developed. The species is, therefore, assessed here as Critically Endangered (CR/D) in Singapore and it is quite possible that it might already be Nationally Extinct.

Vernacular names. Stiff-leaved xyris (English), chelagi, berudang (Malay).

Taxonomy. In early accounts by Ridley (Mat. Fl. Malay. Penins. 2 (1907) 112; Ridley, Fl. Malay Penins. 4 (1924) 348), this species was listed under the name *Xyris anceps* Lam., a species originally described from Madagascar. More recent accounts for Singapore (Keng, Gard. Bull. Singapore 40 (1987) 126; Turner, Gard. Bull. Singapore 45 (1993) 228; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 91, 185, 273) follow the *Flora Malesiana* treatment by Van Royen (Fl. Males., ser. 1, 4(4) (1953) 369) listing this species under *Xyris complanata*, as currently defined, is widespread but possibly a complex of cryptic species. Doust & Conn (Austral. Syst. Bot. 7 (1994) 464–465) already highlighted the need for a detailed analysis of the morphological variability throughout its range before the significance of the variation within Australia can be understood. In particular, the type material of *Xyris complanata* has flatter leaves and scapes than the material from Singapore which does, however, match type material of a number of synonyms. The description of the species above is based exclusively on Singapore material.

For *Xyris elongata*, Doust & Conn (Austral. Syst. Bot. 7 (1994) 461) listed the type with the locality information given in the protologue coupled with information on collectors as '*Anon. (?Banks & Solander s.n.)*, anno 1770'. No such sheet could be located at the BM. However a sheet from Rudge's herbarium, collected by Fleming from the type locality which



Figure 1. *Xyris complanata* R.Br. A. Habit. B. Spike. C. Bract. D. Ovary with style and stigma. E. Petal with anther and staminode. F. Lateral sepal. G. Seed. (From Singapore, Tampines, A, C, F, G from *Vermeulen & Ang 2203*; B, D, E from *Leong et al. SING2008-89*. Drawn by D. Teo).



Figure 2. *Xyris complanata* R.Br. **A.** Habit (inset: flower). **B.** Two spikes. **C.** Leaves. **D.** Basal part of leaves. (From Singapore, A–D from Tampines; A (inset) from Tampines, *Leong et al. SING2008-89*. Photos: A–D, S.L. Koh; A (inset) P.K.F. Leong).

contains a flattened flower corresponding to the figure in the original description, is present at the BM and most likely represents original material; it is designated here as the lectotype of *Xyris elongata* Rudge.

2. Xyris pauciflora Willd.

(Latin, *pauci*- = few, *-flora* = flowers; referring to the few-flowered inflorescence)

Phytographia (1794) 2, t. 1: fig. 1; Hooker, Fl. Brit. India 6, fasc. 18 (1892) 365; Ridley, Mat. Fl. Malay. Penins. 2 (1907) 112; Ridley, Fl. Malay Penins. 4 (1924) 348; Van Royen, Fl. Males., ser. 1, 4(4) (1953) 371; Henderson, Malay. Wild Fls., Monocot. (1954) 193; Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 3 (1968) 24; Hansen, Fl. Males., ser. 1, 9(3) (1982) 573; Keng, Gard. Bull. Singapore 40 (1987) 126; Turner, Gard. Bull. Singapore 45 (1993) 228; Doust & Conn, Austral. Syst. Bot. 7 (1994) 472; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 26; Tan et al. in Davison et al. (ed.) Singapore Red Data Book, ed. 2 (2008) 244; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 91, 185, 199; Phonsena et al., Thai For. Bull., Bot. 41 (2013) 129, fig. 13. **Type:** *Koenig s.n.*, India, Malabar, 1794 (lectotype B-W n.v., designated by Doust & Conn, Austral. Syst. Bot. 7 (1994) 472; isolectotype C n.v.).

Xyris denticulata R.Br., Prodr. Fl. Nov. Holland. (1810) 256. **Type:** *Banks & Solander s.n.*, [Australia, Queensland], Endeavour River, 1770 (in Brown's hand) (holotype BM [BM 000528997]).

Xyris oryzetorum Miq. ex Steud., Syn. Pl. Glumac. 2, fasc. 10 (1855) 288. **Type:** *Hohenacker 369*, India, Mangalor (lectotype C n.v., designated by Phonsena et al., Thai For. Bull., Bot. 41 (2013) 129; isolectotypes L [L0367241], P n.v., U [U.1779852]).

Xyris dajacensis P.Royen, Blumea 7 (1953) 308. **Type:** *Ramos 1405*, [Malaysia], British North Borneo [Sabah], Sandakan, September–December 1920 (holotype L [L0041774]; isotypes BM [BM000958439], GH [GH00068709], P n.v.).

Xyris maritima T.Koyama, Philipp. J. Sci. 84 (1956) 367, pl. 1: fig. 2, pl. 6: fig. A7–A10. **Type:** *Hayata 510*, Vietnam, Annam, Nhatrang, 12 May 1921 (holotype TI n.v.; isotype P n.v.).

Xyris schoenoides auct. non Mart.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 169.

Xyris oreophila auct. non Ridl.: Hansen, Dansk Bot. Ark. 27 (1969) 38.

Caespitose perennial herb, 20–35 cm tall. **Leaves** linear, 8–20(–30) cm long, 1–2 mm wide, twisted, green, basally with red, reddish-green or red-brown tinge, ligule minute 0.5–1 mm; lamina papillate-scabrid, papillae arranged into short transverse ridges; margin papillate; apex narrowly acute, slightly oblique. **Inflorescence** terminal, dense spike on a long scape; scape terete or subterete with 6–8 low ridges below the spike, slightly twisted, 15–33 cm long, 0.7–1.1 mm in diam., green, surface smooth; spike broadly ovoid to almost globose, $4-8 \times 3-9$ mm, composed of (8–)12–20 imbricate brown bracts with greenish margins, fully brown when older, basal 4 bracts sterile, orbicular, $3.5-4 \times 3.5-4$ mm, fertile bracts broadly ovate to orbicular c. 5 mm long, c. 5 mm wide; margin entire basally, entire with occasional laceration distally; apex widely acute, blunt; stomatal field ovate to tear-shaped, 1–1.5 × c. 0.5–0.8 mm. **Flowers** yellow, dorsal sepal not seen; lateral sepals light brown, $4-4.5 \times 1-1.5$

mm, irregularly boat-shaped, keeled, keel crested, crest narrow with entire margin; petals 3, yellow, spathulate, basal claw 4–5 mm long, distal part obovate, margin distally irregularly shallowly serrate. **Stamens** 3, not seen. **Staminodes** 3, Y-shaped, branches with fine fimbriae. **Style** distally 3-branched. **Fruit** a dark brown capsule, obovoid, c. 2.5–3 mm long, c. 1.5 mm at widest point. **Seeds** slightly unequally prolate, reddish-brown, ribbed, 0.4–0.5 mm long, 0.2–0.25 mm diam., 14–15 dark brown longitudinal ridges, 1–3 transverse ridges, sometimes none.

Distribution. Widespread from India, Sri Lanka, Myanmar, Thailand, Cambodia, Laos, Vietnam and China through Malesia and extending to Australia. In Singapore it is known from only two localities, MacRitchie (*Ridley [Hullett] 5740, 1893, SING [SING0034056]; Abu Kassim 195, 14 Dec 1955, SINU; Maxwell 76-795, 16 Dec 1976, SINU; Keng et al. s.n., 26 May 1979, SINU) and Balestier Plain (<i>Ridley 5877, 1894, SING [SING0034055]*).

Ecology. In Singapore *Xyris pauciflora* has been reported from the open sandy shores of MacRitchie Reservoir. Elsewhere in the region it grows in open wet places among grass, from sea level to 1300 m (Phonsena et al., Thai For. Bull., Bot. 41 (2013) 130).

Provisional conservation assessment. Globally Least Concern (LC) (Phonsena et al., Thai For. Bull., Bot. 41 (2013) 130) as the species is widespread in the region. In Singapore it was last seen in 1979 and is presumed Nationally Extinct.

Uses. Phonsena et al. (Thai For. Bull., Bot. 41 (2013) 130) reported that in Thailand a tonic made from this species is believed to relieve back and waist pains.

Vernacular name. Few-flowered xyris (English).

Taxonomy. Phonsena et al. (Thai For. Bull., Bot. 41 (2013) 111), in their revision of the genus for Thailand, reported *Xyris borneensis* Rendle occuring in the wider region including Singapore. Although no particular specimens were cited, it is likely that they misapplied this name to the taxon treated here as *Xyris pauciflora*.

As *Xyris pauciflora* is extinct in Singapore and there are no flowers on any of the herbarium specimens, the description above is largely based on information from herbarium labels and the Singapore related literature. The description has not been augmented from literature records outside of Singapore due to significant differences in sizes reported by other authors.