

POACEAE (GRAMINEAE)

J.F. Veldkamp¹, H. Duistermaat¹, K.M. Wong² & D.J. Middleton²

Barnhart, Bull. Torrey Bot. Club 22 (1895) 22; Monod de Froideville in Backer & Bakhuizen van den Brink, Fl. Java (Spermatoph.) 3 (1968) 495; Watson & Dallwitz, Grass Gen. World (1992) 1; Chen et al., Fl. China 22 (2006) 1; Chen et al., Fl. China Illus. 22 (2007) 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 3. **Type:** *Poa* L.

Gramineae Juss., Gen. Pl. (1789) 28, nom. alt.; Ridley, Fl. Malay Penins. 5 (1925) 186; Schmid, Agron. Trop. (Nogent-sur-Marne) 13 (1958) 7; Bor, Grasses Burma, Ceylon, India & Pakistan (1960) 1; Gilliland, Rev. Fl. Malaya 3 (1971) 1; Clayton & Renvoize, Gen. Gram. [Kew Bull., Addit. Ser. 13] (1986) 1. **Type:** *Poa* L.

Annual or perennial plants. **Stems** herbaceous or (in most bamboos and rarely in other grasses) heavily lignified and hard-tissued ('woody'), prostrate (stoloniferous: creeping and rooting at nodes), or with distinct subterranean portions (**rhizomes**: mostly sympodial, in some bamboos monopodial) and above-ground portions (**culms**: that may be somewhat erect or, in some bamboos, scrambling, clambering or even twining); terete, hollow or solid, with transverse septa; branching at culm base intra- or extravaginal, producing equivalent culms, that at more distal nodes of the culm irregular and simple (especially in stoloniferous taxa) or (in most bamboos) more consistently present at most nodes and typically with few to many orders of branching ('complex branching'); nodes when branch-bearing with the axillary bud initially enclosed within a prophyll (its bract-like first leaf whose back is addorsed to the main axis), bearing verticils of short roots (in stoloniferous grasses and the culm bases of some bamboos) or not, such roots rarely indurated ('root-thorns') in some bamboos. **Foliar elements** distichously arranged on all axes: **culm leaves** at the very base of culms in many grasses small sheath-like organs without distinctive blades ('cataphylls'), or all along the culm in bamboos differentiated into a more proximal enlarged rigid portion that tightly encircles the internode (British 'culm sheath' or American 'culm leaf sheath') and which is not or ephemerally green, and a distally developed, typically smaller portion ('culm-sheath blade' or 'culm leaf blade') that is green or otherwise, lanceolate, linear or triangular, and erect, spreading or reflexed; **foliage leaves** in grasses occurring on the culm distal to the basal cataphylls and on branches if present, in nearly all bamboos only on branches, each with a basal sheath ('leaf sheath' or 'foliage leaf sheath') tightly rolled around the culm or branch internode and its more distal green blade ('leaf blade' or 'foliage leaf blade') separated from the sheath by a transverse line or joint, sheath

Addresses: ¹Naturalis Biodiversity Center, Leiden, Netherlands; ²Singapore Botanic Gardens, National Parks Board, Singapore.

Treatment and author contributions: The bamboos and herbaceous grasses have often been treated separately. In this account the genera of subfamily Bambusoideae are treated first (genera 1–3) in alphabetical order, followed by the rest of the grasses in alphabetical order even though they belong to several different subfamilies. Jan-Frits Veldkamp passed away before the completion of the account. His provisional accounts, based on earlier work by Helena Duistermaat, were assembled and greatly edited by David Middleton and then checked through and further edited by Helena Duistermaat. David Middleton provided almost all conservation assessments. The bamboo genera and notes on the bamboos were researched and written by Khoon Meng Wong.

Doi: 10.26492/fof7.2019-07; 19 October 2019 (online & press).

margins overlapping, free or very rarely connate, near the apex sometimes auriculate, ligule (upward extension of the uppermost portion of the sheath on its inner side) usually present and membranous, hairy, or reduced to a row of bristles or segments, blades most usually linear, parallel-nerved, seldom (except in bamboos) with transverse veinlets, blade base often at least slightly narrowed but in nearly all bamboos conspicuously constricted into a 'pseudopetiole'. **Synflorescence** simple or a spicate, racemose or paniculate aggregation of branches subtended by bracts (spathes, spatheoles), the basic inflorescence units (in herbaceous grasses and some bamboos, the latter not native to Singapore) determinate or semelactant, composed of true spikelets, each spikelet comprising 2 or more sterile bracteoles (glumes), one or more fertile bracts (lemmas), each typically with a prophyll (palea) enclosing a floret, all arranged in two ranks; otherwise (in many bamboos, including native Singapore taxa) the inflorescence units indeterminate or iteractant, composed of pseudospikelets, these being highly condensed units comprising a terminal true spikelet with 1 or more prophyllated buds below it that can proliferate into a cluster or tight bunch of equivalent pseudospikelets of increasing branching order. **Floret** hypogynous, bisexual, composed of 2 microscopic tepals (lodicules) in most herbaceous grasses (0–3 in bamboos); stamens (1–)3 (or rarely 6) in herbaceous grasses (3–6, rarely more, in bamboos), filaments filiform (in some bamboos fused into a filament tube), anthers dorsifixed, oblong to linear; ovary usually solid, the pericarp fused with the single ovule; stigmas 2 (1–3 in some bamboos), feathery. **Fruit** a grain-like caryopsis or (in some bamboos, excluding native Singapore taxa) a fleshy caryopsis with thickened pericarp. **Embryo** abaxial, basal, lateral. **Hilum** adaxial, subbasal to dorsal, dot-like to linear.

Distribution. Grasses are found throughout the world. There are over 800 genera and over 11,500 species worldwide. Of these, nearly 120 genera and 1500 species are bamboos. In Singapore there are 61 genera, of which the native status or otherwise of 2 genera is uncertain, and 14 are only known from naturalised species. There are 86 native species (including presumed native), two of which have 2 varieties in Singapore, 4 species for which their status in Singapore is uncertain, and 39 naturalised and casual species. Of these, 3 genera and 4 species are native bamboos. Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 17, 168, 262) listed *Bambusa heterostachya* (Munro) Holttum and *B. vulgaris* Schrad. ex J.C.Wendl. as casual, but both were at best cultivated and the former has ceased to be common; the genus is thus omitted here. Cultivated bamboos are included in Chua et al. (Bamboos Singapore, 1996). Of the native species of Poaceae, 19 are believed to be Nationally Extinct.

Ecology. Grasses grow nearly everywhere, although fewer of the herbaceous species grow in forest and none grow in the sea or as epiphytes. The so-called seagrasses in Singapore belong to the Cymodoceaceae and Hydrocharitaceae, not the Poaceae. For the bamboos, most taxa are adapted to more exposed environments at forest fringes, along waterways and in gaps or secondary vegetation. A number may also be found in more shaded forest understorey. Most bamboos prefer well-drained soils, with a small number found in predominantly waterlogged conditions in swampy habitats. Various fauna depend on bamboos (Wong, Malayan Forest Rec. 41 (1995) 1–199), including bats which gain access into internodes via narrow vertical slits (Ridley, J. Straits Branch Roy. Asiat. Soc. 50 (1908) 103). Otherwise, bamboo shoots (including the young shoot-tips of branches) and leaves are consumed by wildlife, especially primates.

Uses. The Poaceae are the world's most economically important plant family. Between 33–40% of the land area of the Earth is covered by grasslands: savannahs, prairies, meadows, fields, etc. Staple foods like cereals (rice, barley, wheat, maize, sorghum, etc.) are grass 'seeds' and the vegetative parts are the prime fodder for cattle and many other herbivores. Without grasses there would not have been a human civilisation as we know it.

Across much of the tropics, bamboos are important in rural economies and are used in construction (including as scaffolding in older and even modern-day construction of tall buildings), ad hoc domestic implements and handicrafts, horticulture, as well as in supplying leaves as food-wrappers and bamboo-shoots for the table. Incorporating bamboo fibre into paper- and fabric-making through modern processes has become more conspicuous. There are claims that bamboo cultivation can help sequester atmospheric carbon but this remains contentious as, although they grow fast, they are not especially durable in comparison to tree wood, and understanding the balance between a high turnover and efficient carbon capture dynamics is still in its infancy. In Singapore today, their most conspicuous use is as ornamental plants, but these are mainly introduced species (see Chua et al., *Bamboos Singapore*, 1996).

Amongst the herbaceous grasses several are used for turfing in parks, gardens and places with specialised uses such as golf courses and football pitches. Commonly used species for such purposes in Singapore include *Digitaria longiflora* (Retz.) Pers., *Axonopus compressus* (Sw.) P.Beauv. and *Stenotaphrum secundatum* (Walter) Kuntze (Chin, *Weed Turfgrass Sci.* 6 (2017) 55–60). Also, some are noxious weeds and others are grown as ornamentals.

Notes. Many of the Poaceae are often confused with Cyperaceae. Although there are exceptions, the species of the Cyperaceae generally have their leaves in 3 rows (tristichous), whereby the culms often are distinctly triquetrous rather than terete, the sheath margins are always connate, and the ligule is usually absent. Also each flower has only one bract (confusingly called a glume), there are no lodicules, but often bristles or scales, the filaments are usually rather broad (ligulate), the anther opens introrsely, and the fruit is an achene (nutlet).

Taxonomy. Based on the results of phylogenies using molecular sequence data, the nearest living relatives of the Poaceae are the small family Ectociaceae, which now is only found in southwestern Australia, the Flagellariaceae, which occur from tropical Africa to the Pacific and northern Australia, and the Joinvilleaceae, in Malesia to the western Pacific (see, for example, Marchant & Briggs, *Telopea* 11(4) (2007) 437–450).

The classification of grasses has differed greatly over time except that the bamboos have almost always been treated rather separately from all other grasses. The latest classification which we employ here is that by Soreng et al. (*J. Syst. Evol.* 55 (2017) 259–290). For each genus after the bamboos (i.e. genus 4 onwards), its classification within the Poaceae is given.

Many species of Poaceae have a very large number of both homotypic and heterotypic synonyms, reflecting considerable differences in opinion over generic and species delimitation. Many species are very variable and/or widespread and have consequently been described over and over again. In this account, synonymy is only given for names that have been used in the literature in Singapore or neighbouring parts of Malaysia.

Typification of many of the names associated with the grasses of Singapore has been discussed and clarified by Turner et al. (*Gard. Bull. Singapore* 71 (2019) 1–44).

For the bamboos, three tribes, Arundinarieae (temperate woody bamboos, characteristically tetraploids), Bambuseae (tropical woody bamboos, tetraploids or hexaploids)

and Olyreae (herbaceous bamboos, diploids), represent the main bambusoid lineages as currently understood (Sungkaew et al., J. Pl. Res. 122 (2009) 95). The Bambuseae is the largest tribe, within which there are some eight subtribes recognised (Bamboo Phylogeny Group [BPG], J. Amer. Bamboo Soc. 24 (2012) 1–10; Wong et al., Sandakania 22 (2016) 11).

Hybridisation. The modern herbaceous grasses are generally reported to be wind-pollinated. Artificially it is quite easy to hybridise between species and even genera. Cytological and molecular analyses have demonstrated that this has been, and likely still is, an important factor in the evolution of and speciation in plants. Yet, in the Malesian region we have encountered very few examples in the grasses. The most obvious is the triumvirate *Bothriochloa* Kuntze, *Capillipedium* Stapf, and *Dichanthium* Willemet which are united by *Bothriochloa bladhii* (Retz.) S.T.Blake, with gene flow at the diploid and tetraploid level. Among bamboos in the continental Southeast Asian and Western Malesian regions, the Bambusinae is the most diverse subtribe, within which occurs an introgressive complex comprising mainly *Bambusa* Schreb., *Dendrocalamus* Nees and *Gigantochloa* Kurz ex Munro, and including smaller genera and demonstrable intergeneric chloroplast capture (Goh et al., Gard. Bull. Singapore 62(2) (2011) 223; Goh et al., Plant Syst. Evol. 299 (2013) 239).

Morphology. Life Forms: For the herbaceous grasses, the absence of pronounced seasons in Singapore makes it difficult to establish whether a plant is an annual or a perennial. In annuals, branching is intra-vaginal, all shoots end in inflorescences, and the whole plant dies after fruiting. If at maturity sterile shoots are also present, the plant is regarded as perennial. Then there often is a rhizome or rootstock, extra-vaginal branching and cataphylls (reduced leaf sheaths at the base of the plant, often indurate and with a sharp apex and no blade). In intra-vaginal branching, the more usual mode, the axillary growing bud merely pushes aside the sheath from the culm. In extra-vaginal branching the axillary bud protected by cataphylls pierces the base of the sheath and sends out an initially horizontal shoot. This self-mutilation is quite exceptional. Grasses, some bamboos excepted, are sympodial, i.e. ultimately the culm will form a terminal inflorescence and then dies; growth is by lateral shoots.

Roots: Poaceae have no primary root. Instead there are vegetative roots sprouting from the base of the culms and often from decumbent nodes. In some cases the root system is easily pulled out of the soil, in others it isn't. Roots forming a ring around the basal nodes of the culms are found in *Rottboellia cochinchinensis* (Lour.) Clayton, *Saccharum* L., *Sorghum* Moench, *Zea mays* L. and some bamboos. When young they are called 'root eyes'; when developed they are called 'prop roots' in the herbaceous grasses.

Culms and rhizomes: The stem of a grass is called a culm (Fig. 1A, B). It is jointed: divided into nodes and internodes. Nodes are the short, (slightly) thickened and solid parts of the culm between the much longer internodes. The nodes bear the leaves and, if present, roots and branches (from within the leaf-axil). The internodes are generally hollow, but sometimes solid (e.g. in *Rottboellia cochinchinensis*, *Saccharum*, *Themeda* Forssk., some bamboos). Stem portions growing horizontally beneath the soil surface before upturning as aerial culm portions are called rhizomes (or rootstocks). They are generally more or less woody in appearance, whitish in colour, and with densely set rooting nodes and cataphylls (Fig. 2D). Sympodially generating rhizomes result in a tufted habit, except when rhizome necks are elongated, and

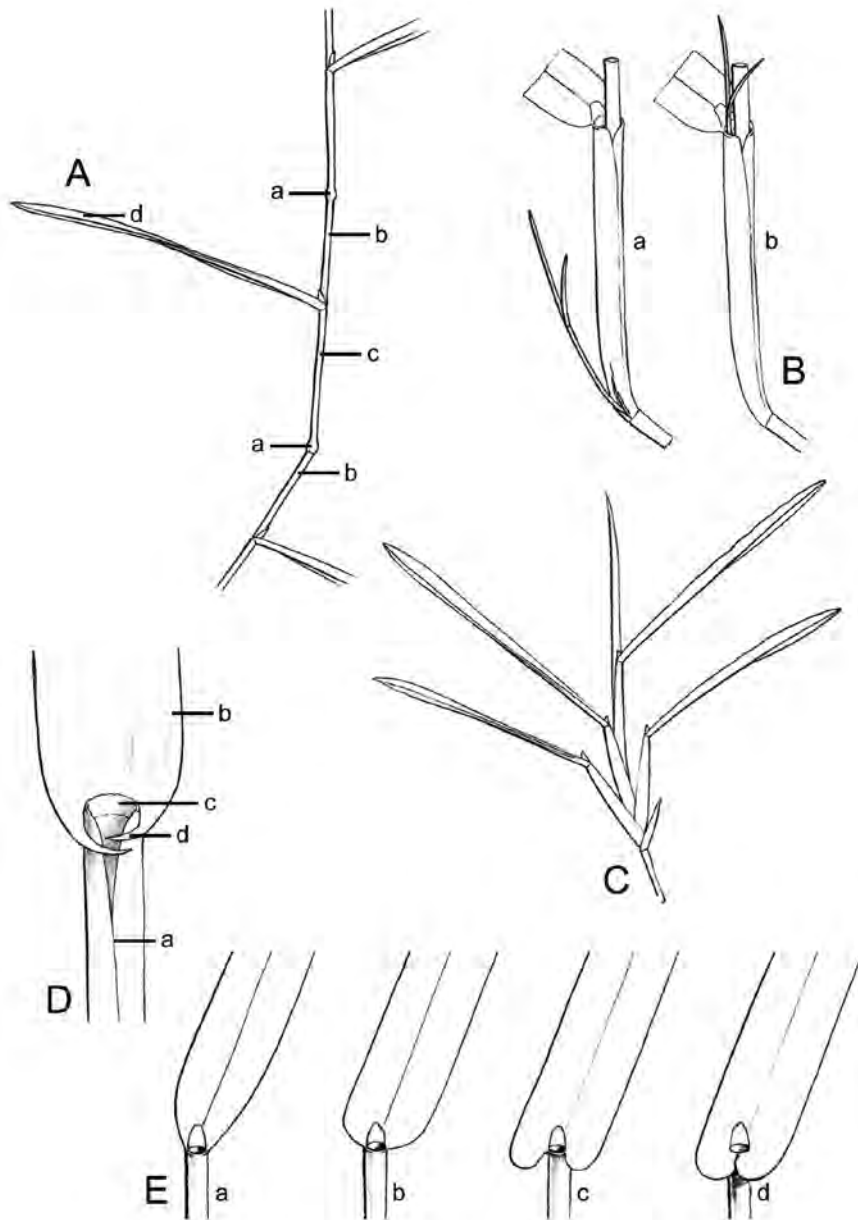


Figure 1. Vegetative morphology. **A.** The jointed culm (stalk) of a grass. **a.** nodes, **b.** internodes, from the node arises **c.** the sheaths with **d.** their blades. **B.** Branching of the culm: **a.** extravaginal, **b.** intravaginal. **C.** Grass leaves arranged in two ranks or distichous. **D.** Grass leaf: **a.** sheath, **b.** blade, **c.** ligule, **d.** auricle. **E.** Blade base: **a.** cuneate, **b.** rounded, **c.** cordate, **d.** amplexicaul. (Drawn by J.J. Vermeulen).

carry the above-ground culms farther apart. In the upper part of the culm the internodes are elongated, e.g. in some bamboos. Above-ground, a typical culm grows vertically: erect, or ascending from a geniculate base. Some culms, however, grow horizontally. Horizontal culms that lie on the soil surface are called runners or stolons. They are generally green, root or not at the nodes, and have well-developed leaves. Some bamboo culms have a clambering or scrambling habit, and, in *Dinochloa* Buse, even a twining habit.

A peculiar growth form is found in the ‘stilt-walkers’. From the nodes of decumbent culms arise a few strong roots that lift them up from the soil, growth is distal, and the proximal part of the plant dies off. In this way the plant ‘walks’ through the vegetation and, when vegetation-forming, all apparently separate plants may actually be a single clone (*Cyrtococcum* Stapf, *Isachne schmidtii* Hack., *Ischaemum timorense* Kunth, *Ottochloa nodosa* (Kunth) Dandy, etc.).

Branching of the culm always occurs at the nodes from an axillary bud between the culm and the basal part of the leaf (sheath, see below). The new shoot either grows upward to emerge at the top of the sheath (intravaginal branching), or with its apex protected by cataphylls it pierces through the base of the sheath and grows outwards and then upwards (extravaginal branching). Rhizomes and stolons are the result of extravaginal branching. Tufted plants are the result of intravaginal branching at the base of the culm. Plants with intravaginal branching may be either annual or perennial, those with extravaginal branching are always perennials. Another feature is that bamboos have complex culm branch systems, whereas the culms in other grasses have mostly simple, basal branching (except in stoloniferous taxa with irregular production of branches at more distal parts), with typically only solitary branches at branching nodes. In some bamboos (including some native Singapore ones) the primary culm branches elongate conspicuously and bear several orders of branches both at the base of the primary as well as along its more distal parts.

Some species (e.g. in *Isachne* R.Br., *Eragrostis* Wolf, *Melinis* P.Beauv., *Scrotochloa* Judz., *Sphaerocaryum* Nees ex Hook.f., *Sporobolus* R.Br.) have what has been termed glands or glandular hairs on various parts.

Prophylls: The prophyll is a scarious bract-like structure, positioned between the culm and the sheath, that initially encloses the young axillary shoot, i.e. the specialised first foliage organ of a branch axis. It is typically two-keeled. Sometimes it is empty, without an enclosed bud. Its taxonomic value in grasses has scarcely been studied, possibly because in dried material this needs destructive dissection and careful field studies. For a number of bamboo genera, Wong (Malayan Forest Rec. 41 (1995) 1–199) has demonstrated distinctive prophyll forms.

Leaves: The leaves of grasses always arise from the node, generally in two alternate ranks along the culm or distichously (Fig. 1C, 4B), but this is often obscured in herbaceous grasses due to twisting of the culm inside the sheath. The leaves are composed of three parts (Fig. 1D, E, 4C) from the base upward: sheath, ligule, and blade. The sheath wraps around the culm with (slightly) overlapping margins (much overlapping in the case of bamboos, and rarely connate among herbaceous grasses). The top of the sheath may have ear-shaped or triangular lateral extensions, referred to as auricles. Auricles can be persistent or deciduous. Their presence and shape is especially important among bambusoids. The ligule is located at the junction of sheath and blade (Fig. 1D, 2C, 4C) on the side facing the culm (the adaxial side) and is either membranous and rim-like or a row of hairs or segments. Only rarely is it absent (e.g.

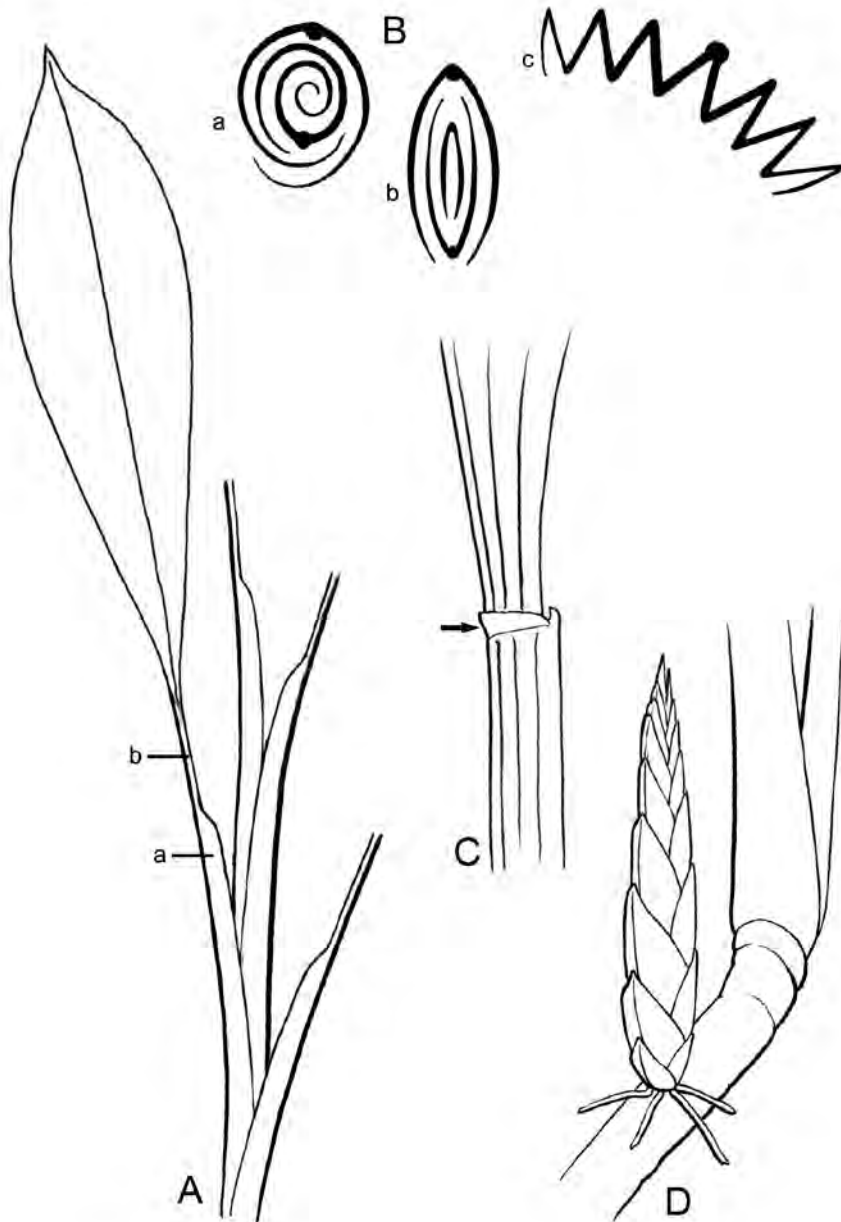


Figure 2. Vegetative morphology. **A.** Leaf blade narrowed at base: **a.** sheath shouldered, **b.** blade pseudopetiolate. **B.** Young leaf blades: **a.** inrolled margin overlapping the other, **b.** folded along the midrib with the margins meeting, **c.** plicate (pleated). **C.** External ligule, a herbaceous rim or a row of hairs at the abaxial side of the sheath's apex. **D.** Cataphylls (sheath-like and bladeless bracts) at the base of the culm. (Drawn by J.J. Vermeulen).

Echinochloa colona (L.) Link). The blade arises from the top of the sheath (Fig. 1D, 2A). It is generally flat and elongated (much longer than wide), with more or less prominent longitudinal veins.

In the descriptions of herbaceous grasses, the blade shapes are described thus: elliptic (length/width ratio 1), oblong (1–3), lanceolate (3–5), linear-lanceolate (5–10), linear (10+), filiform (thread-like). When the greatest width is below the middle of the blade, the term ovate is used; when above the middle, obovate. The base can be cuneate, rounded, cordate, or amplexicaul (Fig. 1E). Sometimes the blade is very narrow at the base, as if stalked, which is referred to as pseudo-petiolate (e.g. nearly all bamboos, *Lophatherum gracile* Brongn., *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda, *Scrotochloa urceolata* (Roxb.) Judz., etc.) (Fig. 2A).

The way the young blades emerge is constant within a species: either inrolled with one margin overlapping the other, folded along the midrib with the margins meeting, or plicate (Fig. 2B).

Among herbaceous grasses, the inflorescence will generally develop from the terminal leaf, the flag leaf. This often differs from leaves lower down in hairiness, size, and ligule length, and in descriptions should not be included, or should be described separately.

The middle vein (midrib) of the longitudinal veins is usually the best developed and is sometimes broad and pale on the upper side of the blade (*Saccharum*) or distinctly winged underneath (e.g. *Chloris barbata* Sw., *Cynodon dactylon* (L.) Pers., *Dinebra chinensis* (L.) P.M.Peterson & N.Snow, *Setaria barbata* (Lam.) Kunth). Transverse veins are common in bamboos and sometimes also present among herbaceous taxa; however, their presence in the blade does not predict their occurrence in the sheath, and *vice versa*.

The anatomy of the blades has been extensively reported on by Metcalfe (Anat. Monocot. I. Gramineae, 1960) and Watson & Dallwitz (Grass Gen. World, 1992) and is of great phylogenetic importance. The so-called ‘Kranz anatomy’ (apparent rings of chlorenchyma around the vascular bundles in transverse section) is indicative of the C₄-type of metabolism, which is wide-spread in tropical grasses, especially in drier and hotter areas. This also occurs independently in e.g. the Amaranthaceae, Asteraceae and Cyperaceae. Grasses also have cells with silica inclusions called the phytoliths that have phylogenetic correlations. Bambusoid and some herbaceous grass subfamilies have the more common C3-type metabolism, and bambusoids predominantly have their unique sub-epidermal arm cells (conspicuously lobed or invaginated chlorophyllous cells) and fusoid cells (cells apparently void of content usually in a layer inner to the arm cells) in the leaf blade anatomy.

Inflorescences and synflorescences: The basic unit of the inflorescence in grasses is the spikelet (Fig. 3, 4), a highly condensed axis bearing 1–several flowers and their accompanying organs. As the flowers and their accompanying and often overlapping bracts are arranged distichously, these condensed units take on a distinctive appearance. The term synflorescence is useful in denoting an aggregation of spikelets (the basic inflorescence units) and such spikelet-bearing axes in herbaceous grasses and some bamboos are usually not subtended by any bracts or bracteoles. The synflorescence develops within the protection of a sheath, emerging only when it is almost ready for flowering. The peduncle is the internode of the culm (or branch, in the case of most bamboos) below the first branching (partial synflorescence) or spikelet and is generally elongated. Sometimes the base of the inflorescence remains partly enclosed (*Ischaemum muticum* L.). In a number of cases it is possible to recognise the main axis of the

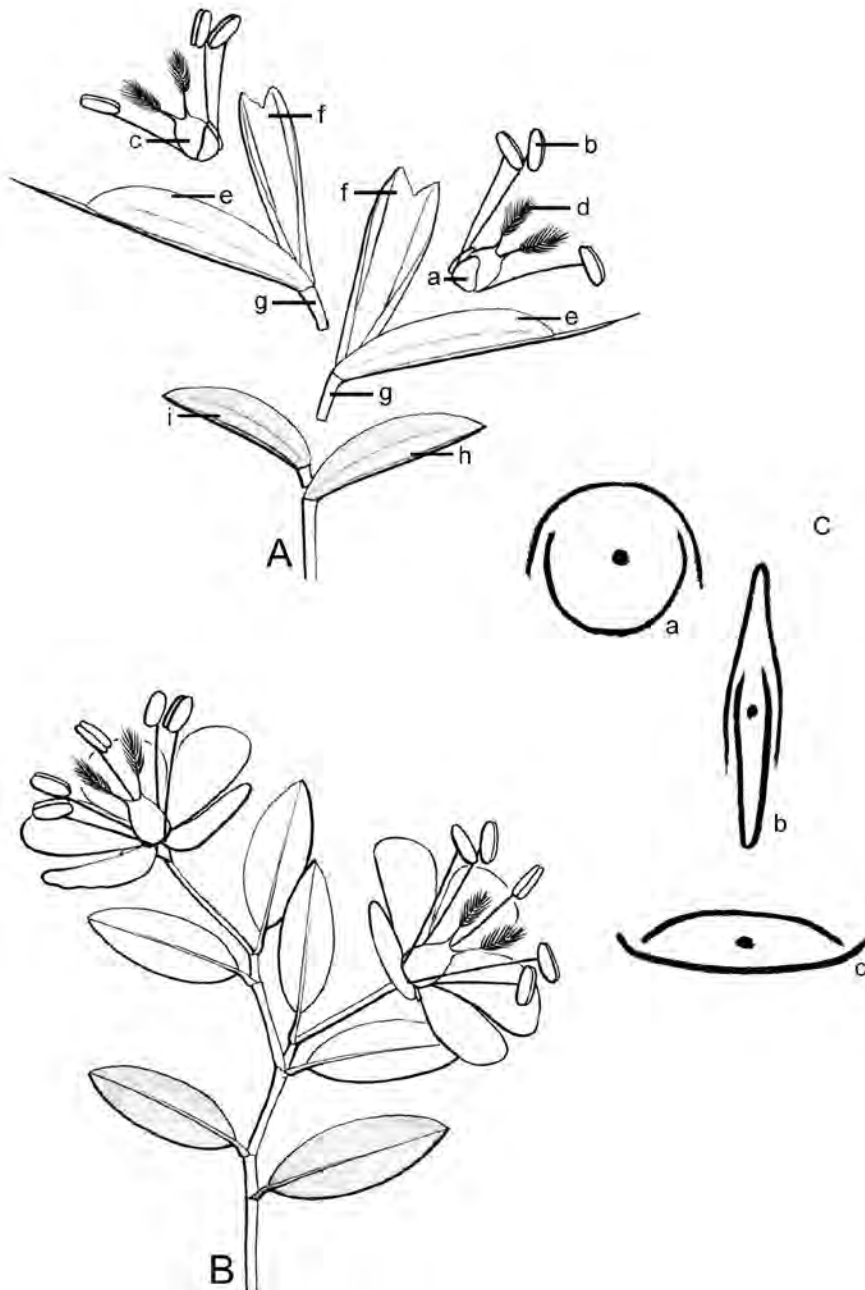


Figure 3. Flower and spikelet. **A.** Grass flowers arranged in a spikelet (exploded view): **a.** lodicule, **b.** anther, **c.** ovary, **d.** stigma, **e.** lemma, **f.** palea, **g.** rachilla, **h.** lower glume, **i.** upper glume. **B.** Branch with flowers in the axils of bracts and pedicels each with a bracteole. **C.** Cross-section of a spikelet: **a.** not flattened, **b.** laterally flattened, **c.** dorsiventrally flattened. ● = rachilla. (Drawn by J.J. Vermeulen).

synflorescence as the common axis and that of the branches (partial inflorescences) as a rachis. The internodes of branches are sometimes called joints. An unbranched synflorescence with sessile spikelets only is called a spike (e.g. *Dimeria* R.Br. and in much reduced *Eleusine indica* (L.) Gaertn.). If all spikelets are pedicelled, or when the spikelets are in pairs or more together and only one is sessile, the inflorescence or its branch is called a raceme (e.g. *Dichanthium*, *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.) or when rather dense a spike-like raceme (e.g. *Polytrias indica* (Houtt.) Veldkamp). An inflorescence is called a panicle if it is repeatedly branched and the individual spikelets (e.g. *Eragrostis*, *Sporobolus*) or groups of spikelets (e.g. *Chrysopogon aciculatus* (Retz.) Trin.) have well-developed pedicels. An intermediary type is the panicle of spikes or racemes, the central rachis absent to well-developed (e.g. *Bothriochloa bladonii*, *Cynodon* Rich., *Dichanthium*, *Paspalum* L.), and sometimes with a single branch lower down underneath the whorl (e.g. *Chloris* Sw., *Dactyloctenium aegyptium* (L.) Willd., *Eleusine indica*). The branches may be spaced (racemosely) or originating from a common point (digitately).

For herbaceous grasses generally, a single synflorescence is terminal on a culm or its lateral branches. Exceptionally, the culm ends in 2 or more synflorescences (e.g. *Axonopus* P.Beauv.). The ultimate in this range is the spatheate inflorescence: branched culms with spathes or sheath-like bracts (reduced leaves) that all develop a separate inflorescence. The ultimate bract, from whose axil no lateral branch is formed, is actually a bracteole, here called a spatheole (andropogonoids such as *Cymbopogon* Spreng., *Rottboellia cochinchinensis*, *Themeda*).

The structure of the synflorescence is diagnostic only in comparatively rare cases, and is rarely particularly distinguished in accounts of grasses or bamboos, for which spikelet structure and details of the florets are considered most important. The more generally used term is 'inflorescence', and this is adopted in the keys and descriptions.

True spikelets and pseudospikelets: The so-called flowering unit or spikelet of grasses is in fact a very specialised, condensed axis bearing chaffs (bracts) clasping the actual flower (Fig. 3). Spikelets may be sessile or stalked; the stalk is called the pedicel (but is not homologous with the pedicel of flowers in other plant families). In the herbaceous species of Singapore, the chaffs are in two rows along an axis (rachilla). In herbaceous grasses, at the base of the spikelet there are two bracteoles, the glumes, probably homologous with cataphylls. Then follow 1 or more florets, composed of two chaffs and a flower. Above the upper floret the rachilla is elongated into a process that often ends in a reduced floret. The two chaffs are the lemma and the palea. They are thought to be homologous with a sheath and a prophyll, respectively. Then follow usually two minute, often microscopic organs, the lodicules, the remnants of one or two whorls of a trimerous perianth. They might have a nectar-secreting function, but this has not been reported, and grasses in general are thought to be wind-pollinated. In the basal extant taxa that live in tropical forests it seems that they are pollinated by insects, like thrips. The structure, shape, nervation, and pubescence of the lodicules are important taxonomic characters. Because they are difficult to observe, they are not described in this Flora account. The actual floret consists of usually 3 stamens and a superior ovary with usually two apical styles with feathery stigmas. Bisexual florets may be cleistogamous: they remain closed even during anthesis resulting in self-pollination. They can be recognised by the presence of usually small anthers on top of mature fruits with the pollen entangled in the fringes of the stigmas (e.g. *Eragrostis*, *Eriachne* R.Br.).

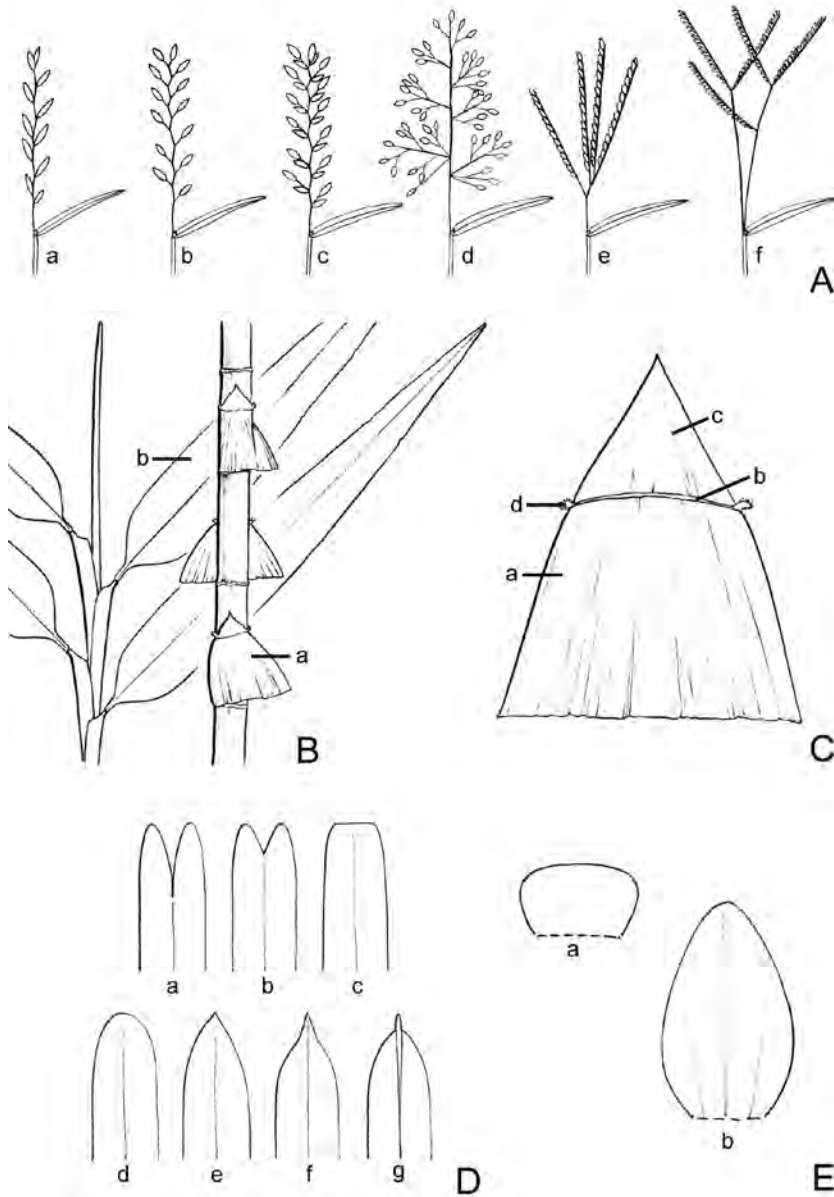


Figure 4. A. Type of inflorescence: **a.** spike with spikelets single and sessile, **b.** raceme with spikelets single and pedicelled, **c.** spike-like raceme with spikelets in pairs of 1 single and 1 pedicelled, **d.** panicle with central rachis present, **e.** panicle without central rachis, **f.** terminal leaf with two panicles. B. Two types of bamboo leaves: **a.** culm leaves, **b.** foliage leaves. C. Culm leaf of bamboo: **a.** sheath, **b.** ligule, **c.** blade, **d.** auricles. D. Tip of the leaf or bract: **a.** bifid, **b.** emarginate, **c.** truncate, **d.** obtuse, **e.** acute, **f.** acuminate, **g.** mucronate. E. Lower glume of spikelets of *Panicum*: **a.** collar-shaped, **b.** ovate. (Drawn by J.J. Vermeulen).

Apart from the size (length, width) of the spikelet, its shape is important in identification. Its outline varies from rounded (orbicular) to linear. In cross-section it can be either terete or flattened (Fig. 3C). In terete spikelets all axes are equally long and the chaffs are generally distinctly rounded on the back. In flattened spikelets one axis is longer than the other. A laterally flattened spikelet has boat-shaped chaffs. A dorsiventrally flattened spikelet has all the glumes and lemmas flattened to only slightly rounded on the back. Finally, a hunchbacked or distinctly lopsided spikelet is called gibbous (*Cyrtococcum*).

Depending on the species, the number of florets per spikelet may vary from one to a few tens. Usually the number is fixed, e.g. spikelets strictly 1-flowered or (most commonly found in Malesia) strictly 2-flowered, or 3–more-flowered (note that florets are here referred to as flowers). However, spikelets with an additional floret may be found as abnormalities within the same inflorescence (e.g. *Isachne*, *Urochloa maxima* (Jacq.) R.D.Webster). It is therefore advisable to always check several spikelets within the same inflorescence. The number of florets is more variable in the species that have 3- or more-flowered spikelets (as in e.g. *Eragrostis*).

In many tropical and subtropical bamboos, the spikelet is replaced by a pseudospikelet as the basic inflorescence unit. In the latter, there will be 1–several prophyll-subtended lateral buds occurring just below the true spikelet borne on the same condensed axis. Such buds develop into similar pseudospikelets which themselves bear basal prophyllated buds, so in time a cluster or tight ball-like bunch of pseudospikelets can form. Thus spikelets will occur individually on synflorescence axes, whereas pseudospikelets are typically clustered or bunched.

Awns are needle-like appendages or the much-narrowed continuations of glumes, lemmas or paleas. They arise either from the tip (e.g. *Dactyloctenium aegyptium*) or from the sinus between two apical lobes (e.g. *Chloris barbata*), or from its back. Awns consist of two parts: a relatively thicker lower part (column), which is spirally twisted when dry, and a thinner part (arista), which is usually straight or twisted the other way. The twisting of the awn is hygroscopic and may burrow the chaff into a substrate. Non-Malesian species of *Aristida* L. and *Stipa* L. are called spear-grasses, as the callus of the lemma is so sharp that it pierces fur, skin, and tissue, and when afflicted with enough of them in Australia may kill animals like sheep. In Malesia the spikelets of *Chrysopogon aciculatus* penetrate socks. When there is only a very short process (less 1 mm long) the chaff is called mucronate when it is the continuation of the midrib, or apiculate if it is the continuation of the midrib with a narrow band of tissue (Fig. 4D). Obviously, the transition between these and a ‘real’ awn is gradual. The number of awns per spikelet may vary from one, three (*Aristida*), or up to twelve (*Lophatherum gracile*).

Distribution of gender: The parts of the spikelet may become reduced. The first to go is the pistil, next the stamens, followed by the palea (or the flower may be epaleate), and finally the lemma. In the Paniceae the lower floret is usually either male or sterile, the upper one bisexual. In *Digitaria* the reduction is extreme: the lower floret is sterile with a microscopic palea or even none. In some works its lemma has therefore been called a ‘third glume’ and the spikelet is apparently 1-flowered. In the andropogonoid *Microstegium* Nees the lower spikelet may be reduced to the glumes and upper lemma leading to a long confusion about its true structure, because in this alliance the awned upper lemma is usually clasped by the upper glume. Generally, spikelets on the same plant are similar (homomorphous). Sometimes they are more or less different from each other (heteromorphous), where the sessile spikelet

of a pair is different in shape, and sometimes gender, from the pedicelled one (*Digitaria*, *Scrotochloa urceolata*, and in Andropogoneae). In some Andropogoneae the paired spikelets at the base of the raceme may be homogamous: alike in shape and male or sterile, resembling the pedicelled spikelets (e.g. *Bothriochloa bladhii*) or transformed into an involucre (e.g. *Microstegium*). Usually, however, they are heterogamous: one spikelet of the pair is sessile and bisexual or female, and the other one is pedicelled with a different shape, and male or sterile. In plants with male and female inflorescences the inflorescences and spikelets are very different in shape (e.g. *Coix lacryma-jobi*, *Zizania latifolia* (Griseb.) Hance ex F.Muell.) but in some monoecious species of *Isachne* the heterogamy is less obvious. There the florets within a single spikelet differ in shape and size. There are no dioecious species in Singapore.

Stamens: In general there are three stamens (all native Singapore bamboos have six). At anthesis the filaments elongate with incredible speed, while the anthers increase in size and cause the lemma and palea to separate. They move out either laterally or apically. The anthers open with longitudinal slits.

Fruit: The ovary of a grass contains a single ovule that will mature into a single seed. The fruit is a grain or caryopsis, with the ovary wall permanently fused with the seed coat (but free in e.g. *Eleusine* Gaertn., *Sporobolus*). Only grasses have this type of fruit. It is orbicular to linear-lanceolate in outline, and flattened to terete in cross-section. The hilum, the funicular scar, faces the palea. It may be subbasal and punctiform to linear along the entire dorsal side. The embryo is on the opposite side at the base. Its structure is of importance at the subfamily level (see Reeder, Amer. J. Bot. 44 (1957) 756 and many later authors). The major part of the caryopsis consists of a starchy to semiliquid mass, the endosperm or food store for the germinating plant. This is what cereals are cultivated for as it is highly nutritious.

Pollination and dispersal. The pollen is deceptively simple, smooth, spheroidal, monoporate with a thickened ring (annulus) around the pore which is covered by an operculum. Pollination is usually by wind (anemophily).

The seed-containing entity that is scattered or dispersed (diaspore) can take various forms. Grasses have a broad range of adaptations for dispersal, depending on where the various parts disarticulate. These range from the actual seed (*Sporobolus*), the caryopsis (the usual case), parts of the inflorescence (the burs and involucre of *Cenchrus* L. sensu lato), the whole inflorescence (*Scrotochloa*, *Thuarea* Pers.), to the entire plant (the ‘tumbleweeds’). Often diaspores have interesting adaptations. Some are dispersed by air-currents (anemochory): *Imperata* Cirillo, *Cenchrus* p.p. Others go by water and sea (hydrochory): *Mnesithea* Kunth, *Rottboellia* L.f. and allies.

Various methods have evolved that allow the diaspore to adhere to passing animals (epizoochory): sticky pericarp (*Sporobolus*), retrorsely barbed awns, bristles, hooks, burs, and hairs. Some species are spread by harvester ants which are attracted by oil-bearing structures (elaiosomes), e.g. the ‘knob’ on the articles of rottboellioids (*Mnesithea*, *Rottboellia*).

Key to genera

Transverse veins are best seen with translucent light. The terms leaves, sheaths and blades do not include cataphylls, prophylls and spathes. Pedicel length is not measured on the uppermost spikelet of a branch. Unless stated otherwise, the size of spikelets is exclusive of the awns if present. The abaxial side of a structure is the side furthest away from the axis, the adaxial side is the side closest to the axis; for leaves this axis is the culm, for inflorescence branches this is the central axis and for spikelets this is the rachis or the branch of the inflorescence they are directly attached to.

Within each couplet of the key, the character states are always balanced (as must always be the case in a key). However, in many leads, supporting characters that are not balanced in the key in the other half of the couplet are also given, preceded by a ‘-’.

Genera which are only known in cultivation in Singapore are included in the key in italics when the genus may either escape in the future, based on this having happened elsewhere, or when there are species with long lived individuals which may appear as remnant plants in abandoned kampongs in secondary forest, or when they are very commonly encountered despite only being in cultivation. *Microstegium* is included in this generic key (with characters of the species rather than the genus) based on the record of *Microstegium fasciculatum* (L.) Henrard in Chen et al. (*Blumea* 57(2) (2012) 160) although we have seen no material of this species from Singapore to verify its occurrence.

1. Culms woody; typically with complex branching, the primary branch axis with several higher orders of branching at its base and often also more distally; leaves strongly heteromorphic between culm and branches: culm-sheath blades typically shorter than or equal to the sheath, foliage leaf blades longer than their sheaths; pseudospikelets arranged in sparse or dense nodal clusters without subtending bracts; internodes hollow; branch-blades pseudopetiolate (*Bambusoideae*) 2
 Culms herbaceous to semi-woody, seldom or irregularly but simply branched; all culm leaves (except for several reduced cataphylls at culm bases in many taxa) similar, with generally longer blade than the sheath; spikelets single or in small groups and never densely clustered, or synflorescences compound and with clusters of spikelets supported by spathes and sometimes spatheoles; internodes hollow or solid; leaf blades sometimes slightly narrowed at base but not highly constricted into a pseudopetiole (*Other subfamilies*) 4
2. Distinctive white-waxy zone present just below nodes on the culms and branches; mature branch complement a cluster of subequal branch axes; style stiff, hollow with a central tissue strand **2. *Schizostachyum***
 White wax on the culms absent or scattered and not consistently restricted to a distinctive sub-nodal zone; mature branch complement with a central primary branch axis dominant in size and length; style flexuous and tissue-filled 3
3. Culm-sheath base with a narrow band of transversely wrinkled tissue and bearing dense coarse deflexed hairs; culm-sheath and branch-sheath auricles large and lobe-like, much more conspicuous than the low rim-like ligules **3. *Soejatmia***

- Culm-sheath base smooth, glabrous or scattered short-appressed hairy; culm-sheath and branch-sheath ligules much prolonged and much more conspicuous than the low rim-like auricles **1. Gigantochloa**
4. Inflorescence(s) either a terminal unbranched spike or a (spike-like) raceme, or branched with the longest branch up to 0.5 cm long and spikelets unawned; ligule present 5
 Inflorescence a panicle with branches at least 1 cm long (sometimes with only 2 racemes closely appressed together: *Ischaemum*); if panicle branches shorter, then either ligule absent or spikelet with 1–6 awns of at least 2 mm long 23
5. Spikelets not or not entirely surrounded by an involucre, bristles when present either less than half as long as spikelet or persistent on pedicel after spikelet has fallen off (see *Setaria parviflora*) 6
 Spikelets (1–4 in groups) surrounded by an involucre of bristles or indurate bracts at least half as long as spikelet, and falling off as a whole **9. Cenchrus**
6. Inflorescence at base with spikelets exposed, either involucre absent or consisting of sterile herbaceous spikelets 7
 Inflorescence at base with a hard, bead-like involucre enclosing 1 female and 2 sterile spikelets and the rachis continuing through pore at tip of involucre, with pairs of male spikelets **13. Coix**
7. Spikelets all either unawned, or awned with awn up to 1 mm long and spikelet including awn shorter than 4 mm 8
 Spikelets, at least part of them, awned, either the awn at least 2 mm long or the spikelet including awn at least 9 mm long 16
8. First glume 0.9–1 times as long as spikelet 9
 First glume 0.05–0.65 times as long as spikelet 12
9. Spikelets paired, pedicelled spikelet sometimes reduced to the pedicel; first glume of sessile spikelet dorsoventrally flattened 10
 Spikelets solitary; first glume either boat-shaped or flattened 11
10. Racemes ending in a triad of well-developed spikelets; lower glume 5–9-nerved; upper glume 3–7-nerved; lower floret palea reduced, sterile **36. Mnesithea**
 Racemes ending in a ‘tail’ of abortive spikelets; lower glume 9–13-nerved; upper glume 9-nerved; lower floret paleate, male **47. Rottboellia**
11. Culms solid; nodes hairy; blades 2–10 mm wide; inflorescence a deciduous, spatheate, single spike, rachis foliaceous, folded lengthwise, attenuating upward, terminating into a spikelet or an acumen, in fruit forming a corky diaspore; spikelets sessile, adaxial, dorsoventrally compressed, 2-flowered, heteromorphous, the basal one (or 2) persistent, bisexual, 4.2–5.4 mm long, the 2–6 other ones male, deciduous, 4–5 mm long. – Sandy beaches **58. Thuarea**

- Culms hollow; nodes glabrous; blades 0.7–2.5(–2.8) mm wide; inflorescence a persistent, spatheate, spiciform raceme, rachis filiform; spikelets pedicelled, lateral to the rachis, bisexual, 1-flowered, 6–20, homomorphous, bisexual, deciduous as a whole, 2–3.8 mm long. – Sandy beaches; cultivated for lawns, greens **61. Zoysia**
12. Young leaf blade folded along midrib; spikelets 3.8–6 mm long 13
 Young leaf blade inrolled; spikelets 1.7–3.4 mm long 14
13. Annuals; culms tufted, terete; spikes lax, unilateral, rachis more or less filiform, straight, ending in a spikelet, not breaking up; spikelets lateral to the rachis, sessile, laterally compressed, 3–9-flowered, disarticulating, rachilla terminated by a reduced floret; lemmas herbaceous. Common, disturbed areas, usually flowering **22. Eleusine**
 Perennials, stoloniferous; culms mat-forming, rooting at the decumbent nodes, compressed; inflorescences spike-like, rachis ribbon-shaped, sinuous, tardily disarticulating into segments, racemes small, alternate, appressed, in 2 rows, more or less sunk into depressions, rachis ending in a point; spikelets alternately embedded in the rachis, abaxial, dorso-ventrally compressed, 2-flowered, rachilla process absent; lemmas chartaceous to coriaceous. Roads-sides, coarse lawns, rarely flowering
 **56. Stenotaphrum**
14. Spikelets not subtended by bristles; upper floret smooth 15
 At least some spikelets subtended by 3–11 mm long bristles or spines (check the uppermost on a branch); upper floret transversally rugose **52. Setaria**
15. Ligules collar-shaped, membranous; blades flat, 2–5.6 mm wide; panicles long-exserted, densely contracted, spike-like with many short branches; spikelets abaxial, asymmetrical, gibbous or nearly so, 2-flowered; lower glume 0.25–0.75 times as long as the spikelet, 3–5-nerved; lemmas mucicous, 3–9-nerved **49. Sacciolepis**
 Ligule a dense row of hairs; blades filiform, 1–2.5 mm wide; racemes little-exserted, spiciform, unbranched; spikelets lateral to the rachis, symmetrical, ellipsoid, laterally flattened, 1-flowered; lower glume usually absent, or much reduced, 0-nerved; lemmas mucronate, 1-nerved. – Sandy beaches; cultivated for lawns, greens **61. Zoysia**
16. Culm with 1–10 inflorescences, spatheate or not; ultimate partial inflorescence without an involucre 17
 Culm with numerous inflorescences in a compound spatheate panicle; ultimate partial inflorescence with an involucre of 2 pairs of sterile unawned spikelets, enclosing 1 or 2 fertile awned spikelets, each with 1 or 2 sterile pedicelled spikelets **57. Themeda**
17. Spikelets solitary; lower glume with an at least 2 mm long awn 18
 Spikelets in pairs or threes; lower glume either unawned or with an up to 0.5 mm long mucro 19
18. Perennial; culms mat-forming, branching intra-vaginally at base, rootstock absent, stoloniferous; culms solid; blades 2.5–20 cm long, base narrowed; inflorescence a spike, disarticulating into joints; spikelets adaxial, distichous, embedded in the rachis, sessile,

- dorsoventrally compressed, 2-flowered; lower glume 0.3–0.5 mm long, upper glume as long as the spikelet (both well-developed in the terminal spikelet but very unequal), acuminate to long-caudate, 0- or 1-nerved; rachilla process terminated by an incomplete floret (well-developed in the terminal spikelet) **33. Lepturus**
 Annual; culms tufted, hollow or filled with pith; blades 1–3.5 cm long, more or less cordate to amplexicaul; inflorescence a raceme, not breaking up; pedicel c. 0.3 mm long, hairy; spikelets lateral to the rachis, pointing to all directions, patent at maturity, more or less laterally compressed, falling entire with the callus, 1-flowered; glumes 2, subequal, as long as the spikelet, dorsally rounded, 1-nerved, awn apical, straight; rachilla process absent **43. Perotis**
19. All spikelets heterogamous 20
 The lower pairs of spikelets homogamous, persistent, muticous, higher spikelets more or less alike, sessile ones awned. – Ligules 0.5–1 mm long. Inflorescence spike-like, dense, but not bottle-brush shaped. Sessile spikelets lower glume dorsally flattened, hairy in lower half, apex more or less truncate with the keel-nerves mucronulate
 **17. Dichanthium**
20. Ligules 1–1.2 mm long; spikelets distant, inflorescence open. – Blades folded along midrib when young 21
 Ligules 0.2–0.5 mm long; spikelets close together, inflorescence rather dense, bottle-brush shaped. – Sheaths rounded, not keeled 22
21. All sheaths terete; blades at least at base with up to 7 mm long hairs; racemes espatheate, solitary, terminal; homogamous spikelets persistent, muticous; callus not inserted in the joint apex, pungent; sessile spikelet subterete; lower glume subterete, not keeled, apex acute; upper lemma basal part very narrow and hyaline, upward widening and somewhat indurate passing into the awn; pedicel glabrous; pedicelled spikelets 5–15 mm long; glumes muticous **27. Heteropogon**
 Basal sheaths keeled, upper ones terete; blades glabrous; racemes spatheate; homogamous pairs of spikelets absent; callus inserted into the joint apex, obconical, short; spikelets dorsoventrally compressed; lower glume two-keeled, apex bifid, convex to flattened on the back; upper lemma 2-lobed to -fid, shortly awned from the sinus; pedicel hairy on one margin; pedicelled spikelet reduced to 1 or 2 glumes, 2.8–5 mm long; lower glume awn 0.5–3 mm long **50. Schizachyrium**
22. Culms tufted without stolons, root-system strongly developed; sessile spikelets laterally compressed and 2-awned; lower glume glabrous; upper glume awn 8–22 mm long. – Rare. Rocky places, facultative rheophyte **45. Pogonatherum**
 Culms densely to loosely mat-forming, geniculate, rooting at the nodes; young leaf blade inrolled; spikelets usually in triads, 2 sessile and 1 pedicelled with the sessile spikelets dorsoventrally compressed and 1-awned; lower glume hairy; upper glume muticous
 **46. Polytrias**
23. Spikelets either bisexual or unisexual with male and female spikelets in the same inflorescence 24

- Spikelets unisexual with male and female spikelets in separate inflorescences on the same plant, the male inflorescence a terminal panicle of racemes, the female inflorescence very dense with a spongy main axis, axillary, covered by persistent sheaths, only the very long stigmas emerging. – Cultivated only *Zea*
24. Blade with transverse veins; stolons absent; blades 8.5–60 mm wide 25
 Blade without transverse veins; stolons absent or present; blades 0.5–50 mm wide 29
25. Spikelets heteromorphous, unisexual 26
 Spikelets homomorphous, bisexual 27
26. Leaf blade twisted with the lower surface upwards, 40–62 mm wide, pseudo-petiolate; inflorescence deciduous as a whole; female spikelet 6–7.5 mm long, globose-obovoid, inflated and hairy when mature; male spikelet 4–6 mm long. – Primary and secondary shady rain forest **51. *Scrotochloa***
 Leaf blade not twisted, up to 30 mm wide, base gradually tapering; inflorescence not deciduous as a whole; female spikelets 15–20 mm long (excl. 15–30 mm long awn); male spikelets 8–12 mm long (excl. 0.75–6 mm long awn). – Cultivated, semi-aquatic *Zizania*
27. Culms not reed-like, up to 1.5 m tall; blades persistent; panicle up to 45 cm long, erect; spikelets long-persistent or disarticulating, distant, 4–13 mm long; glumes 3–7-nerved; lemmas 2.5–6 mm long, 5–11-nerved 28
 Culms reed-like, 1–4(–8) m tall; blades disarticulating from the sheath; panicle usually lax, secund; spikelets falling with the pedicel, crowded, 1.2–2.1 mm long; glumes 0- or 1-nerved; lemmas 1.2–2 mm long, 1- or 3-nerved **59. *Thysanolaena***
28. Plant not bambusoid, without root-tubers; culms solid; ligules 0.75–2 mm long; blade base contracted to gradually cuneate; panicles not composed of racemes; pedicels 2–4 mm long; spikelets in all directions, 1–4-flowered, disarticulating above the glumes and between the lemmas; lemmas usually with retrorse bristles (hidden when young!), 5–7-nerved, first lemma 2.5–4.5 mm long; rachilla process terminated by a reduced floret **10. *Centotheca***
 Plant resembling a small bambusoid, with small root-tubers; culms hollow; ligule up to 0.7 mm long; blades pseudo-petiolate; panicle lax, composed of spike-like, whorled racemes; pedicels 0–0.2 mm long; spikelets distichous, erecto-patent to patent in fruit, 2–13(–22)-flowered, falling as a whole; lemmas without retrorse bristles; first lemma 4.5–6 mm long, 7–11-nerved; other lemmas sterile, imbricate; rachilla process c. 1.5 mm long **34. *Lophatherum***
29. Ligule 0–4 mm long, or longer and then hairy, or inflorescence without a central axis 30
 Ligule at least 6 mm long, membranous, glabrous, inflorescence central axis present, branches branched or not. – Spikelets 1-flowered, 7–11 mm long, at base with 2 lanceolate acute glume-like bracts; lemma and palea indurating **39. *Oryza***

30. Inflorescence with simple branches only 31
 Inflorescence with at least the longest branch branched 61
31. Spikelet 3–many-flowered 32
 Spikelet 1- or 2-flowered 35
32. Spikelet unawned 33
 Spikelet awned 34
33. Terrestrial; blades folded when young; spikes terminal, digitate, divergent to patent, few, often a few alternate ones underneath; spikelets (3.25–)4.25–6 mm long; upper glume 2.25–3.5 mm long; first lemma 2.7–3.5 mm long; pericarp thin, free from the seed, seed ridged. – Very common **22. Eleusine**
 Aquatic to semi-aquatic; blades flat or folded, inrolled when young; panicle of numerous, erecto-patent spikes along a common axis; spikelets 2.1–4.3 mm long; upper glume 1.1–1.8(–2.3) mm long; first lemma 1.1–1.8 mm long; pericarp adnate to the seed, glabrous, smooth **20. Dinebra**
34. Stolons absent; sheaths flattened; ligules 0.3–0.5 mm long; spikes 7–17(–23), rachis ending in a spikelet; spikelets abaxial, 1.9–2.3 mm long; first floret bisexual, upper 2 or 3 reduced, sterile; first lemma margin with a subapical tuft of hairs, awns 3–5.5 mm long; pericarp completely adnate, smooth **11. Chloris**
 Stolons present; sheaths terete; ligules 0.6–1 mm long; spikes (1–)3–6(or 7), rachis ending in a 1–2.5 mm long point; spikelets lateral towards the rachis, 3–5 mm long; with 3 or 4 fertile anthoecia, uppermost floret reduced; first lemma margin glabrous, awns 1.5–2 mm long; pericarp free, withering, seeds rugose **16. Dactyloctenium**
35. Ligule 0.4–2 mm long, either a row of hairs or basal part membranous, margin with hairs as long as to longer than the membrane 36
 Ligule either absent or up to 0.1 mm long, or 1–9 mm long and membranous, margin glabrous or with hairs shorter than the membrane 46
36. Spikelets either unawned or with a mucro 0.35–0.65 mm long, not exerted beyond the glumes 37
 Spikelets awned, awn obvious and exerted 42
37. Culms 0.01–0.2(–0.4) m long; spikelets lateral or abaxial, 1–2.5 mm long, either 1-flowered or upper floret abortive; upper lemma ± obtuse 38
 Culms 0.3–5 m long; spikelets adaxial, 3–4.3 mm long, 2-flowered, upper floret indurate; upper lemma minutely crested to mucronate 41
38. Perennials; blades linear, base cuneate or rounded, margins not fimbriate; inflorescence composed of digitate racemes, eglandular; spikelets sessile or shortly pedicelled, appressed against the rachis 39
 Annuals; blades ovate to ovate-oblong, base cordate, amplexicaul (*Commelina*-like), margins fimbriate; inflorescence a glandular panicle; spikelets long-pedicelled, divergent **54. Sphaerocaryum**

39. Ligules collar-shaped, 0.4–1.1 mm long; spikelets dorso-ventrally appressed against the rachis, abaxial (but may seem adaxial as the lower glume is absent, and the lower epaleate lemma is interpreted as the upper glume!), 2-flowered, falling entire 40
 Ligules collar-shaped or a row of hairs 1–2(–5) mm long; spikelets laterally appressed against the rachis, 1-flowered, laterally compressed, disarticulating above the glumes ...
 **14. Cynodon**
40. Sheaths compressed, keeled; ligules 0.4–0.5 mm long, densely fringed; blades obtuse; inflorescences 1–5 from the upper leaf sheath; racemes subdigitate, lax, 2–7; spikelets abaxial, sessile, oblong, 2–2.5 mm long; upper lemma not indurate. Widely cultivated for lawns, slightly salt tolerant **7. Axonopus**
 Sheaths terete to somewhat flattened; ligules 0.5–1.1 mm long, glabrous; blades acute; inflorescences solitary; spikelets abaxial (but may seem adaxial when the lower glume is absent, and the lower epaleate lemma is interpreted as the upper glume!), shortly pedicelled, 2.7–4.5 mm long; upper lemma indurate. Saline places **42. Paspalum**
41. Common axis 12.5–19 cm long; lower glumes absent, fused with the stipe to a basal ‘bead’, rarely slightly developed above this ‘bead’; lower lemma puberulous to pilose ...
 **25. Eriochloa**
 Common axis 2.5–9(–22) cm long; lower glumes 1.2–1.95 mm long, 0.37–0.5 times as long as the lower lemma, base amplexicaul, apex erose and rounded to acute, glabrous, 5–11-nerved, with or without cross-veins; lower lemma glabrous **60. Urochloa**
42. Lower glume unawned, truncate to mucronate with mucro up to 0.5 mm long 43
 Lower glume awned, awn at least 2 mm long **38. Oplismenus**
43. Leaf blade flat, 2–12 mm wide; spikelet with 1 awn 44
 Leaf blade setaceous, c. 0.5 mm wide; spikelet with 2 or 6 awns **24. Eriachne**
44. Culms tufted, erect to geniculate at base; raceme axes persistent; spikelets paired, secund, 2-flowered; glumes very unequal; lower glume not two-keeled; lemmas glabrous, at least as thick as the glumes, apex entire, awn absent or apical, straight 45
 Culms densely to loosely mat-forming, geniculate, rooting at the nodes; raceme axes disarticulating; spikelets usually ternate, not secund, 1-flowered; glumes more or less equal; lower glume two-keeled; lemmas hairy, thinner than the glumes, apex 2-lobed, awn from the sinus, geniculate **46. Polytrias**
45. Racemes more or less digitate; spikelets abaxial; lemmas as thick as the glumes, aristate, margins lying flat on the palea. Smelling of coumarin. Dry places **5. Alloteropsis**
 Racemes paniculate; spikelets adaxial; lemmas thicker than the glumes, muticous, margins inrolled against the palea. Not fragrant. Semi-aquatic **21. Echinochloa**
46. Culm with 1(–10) inflorescences, not spatheate; inflorescence with central rachis absent or present, branches 2–many. Fresh material without fragrant oils 47
 Culm with more than 20 inflorescences, spatheate; inflorescence without central rachis, branches 2. Fresh material with fragrant oils *Cymbopogon*

47. Spikelets in groups of 1–3(–5), homo- or heteromorphous, 1.2–4.4 mm long; pedicel 0.1–0.4 mm wide, narrower than to as wide as rachis 48
Spikelets in pairs, heteromorphous; sessile spikelet (4–)5–7.5 mm long; pedicel 0.7–2 mm wide, as wide as to wider than rachis **31. Ischaemum**
48. Ligule present, although sometimes a minute rim 49
Ligule absent. – Young leaves inrolled. Panicle with a common axis. Racemes 6–many. Spikelets dorso-ventrally compressed, 1.9–5 mm long, gradually acuminate to awned, awn 0–50 mm long **21. Echinochloa**
49. Spikelets terete or laterally flattened 50
Spikelets dorsoventrally flattened 55
50. Inflorescence without a common axis, racemes 2–4 51
Inflorescence with a common axis, racemes 3–many 52
51. Young leaf blade inrolled. Spikelet 2.3–2.8 mm long, either unawned or awn 5.5–8.5 mm long **19. Dimeria**
Young leaf blade folded along midrib. Spikelet c. 1.2 mm long, mucronate
..... **26. Eustachys**
52. Lower glume 0.9–1 times as long as spikelet 53
Lower glume 0.15–0.7 times as long as spikelet 54
53. Ligule 0.1–0.3 mm long; spikelets in triplets, 1 sessile, 2 pedicelled, sessile spikelet 2-flowered, awn 5.25–8 mm long; glumes herbaceous, not setosely keeled. Dry sunny localities, common in lawns, etc **12. Chrysopogon**
Ligule 1–9 mm long; spikelets solitary, 1-flowered, acuminate, mucinous; glumes absent, lemmas papery, keels setose. Rare subaquatic in and along streams and ponds
..... **32. Leersia**
54. Spikelets abaxial, not gibbous; ligules rim-like, 0.2–0.3 mm high; spikelets terete to laterally compressed, 3.7–5 mm long; apex of glumes and lemmas pinched
..... **4. Acroceras**
Spikelets adaxial, asymmetrical, gibbous; ligules 0.4–1.5 mm long; spikelets laterally compressed, 1.3–1.8 mm long; apex of glumes and lemmas not pinched
..... **15. Cyrtococcum**
55. Sessile spikelets upper lemma continuous with the awn 56
All lemmas mucinous 58
56. Spikelets of each pair dissimilar, sessile spikelet bisexual, pedicelled spikelet male or sterile 57
Spikelets of each pair similar, both bisexual *Microstegium*

57. Racemes whorled, 13–21, the lowest raceme shorter than the common axis; joints and pedicels with a translucent resinous channel; lower glumes elliptic to oblong, basal half and margin upper half hairy, apex acute. Homogamous spikelets absent **8. Bothriochloa**
 Racemes digitate or paniculate, 2–9(–15), the lowest raceme longer than the common axis; joints and pedicels without a resinous channel; lower glumes obovate to oblong-lanceolate, usually with long bulbous-based cilia along the margins above the middle, glabrous to setose, apex obtuse to truncate. Homogamous spikelets 0–6 lower pairs, neuter or male, usually persistent, muticous **17. Dichanthium**
58. Lower glumes absent to 0.3 times as long as the spikelet and 0–3-nerved 59
 Lower glumes (0.45–)0.7–0.8(–1) times as long as the spikelet, 3–5-nerved **40. Ottochloa**
59. Spikelets 2.2–4.2 times as long as wide; upper lemma acute to apiculate 60
 Spikelets 1.1–1.6 times as long as wide; upper lemma apex obtuse **42. Paspalum**
60. Spikelets 2.2–3.3 times as long as wide, one of the pair or triad shortly pedicelled; upper lemma margins lying flat on the palea, apex acute to acuminate **18. Digitaria**
 Spikelets c. 4.2 times as long as wide, paired, all distinctly pedicelled; upper lemma margins inrolled over the palea, apex apiculate **41. Panicum**
61. Spikelets 3–many-flowered (check several spikelets!) 62
 Spikelets 1- or 2-flowered, rarely a few 3-flowered 65
62. Culms (0.8–)1.5–3 m long; panicles 20–75 cm long; spikelets with silky hairs 2–5 mm long; first lemma 3.5–12 mm long 63
 Culms 0.12–1(–1.6) m long; panicles up to 20 cm long; spikelets glabrous, or with hairs up to 0.6 mm long; first lemma 0.7–2 mm long **23. Eragrostis**
63. Culm hollow 64
 Culm solid **37. Neyraudia**
64. Blades often with white stripes; glumes subequal, 11–13 mm long; rachilla glabrous; lemma dorsally keeled, with 6–8 mm long hairs at base, 5–7-nerved, apex usually bifid and with a straight awn, 1.5–3.5 mm long; stamens 3 **6. Arundo**
 Blades green; glumes unequal, lower ones 3–4.5 mm long, upper ones 3.6–6 mm long; rachilla hairs 5–7 mm long; lemma dorsally rounded, 7–9 mm long, glabrous, 3-nerved, apex entire, long-acuminate; stamens 2 **44. Phragmites**
65. Ligule present, although sometimes just a minute rim 66
 Ligule absent **21. Echinochloa**
66. Either glumes indurate (in lower half) and as long as spikelet (excluding awn when present), or each spikelet with 2 glumes only and these indurate 67

- Glumes hyaline to herbaceous, shorter than to as long as spikelet, each spikelet with 2 glumes, lemmas and paleas 68
67. Semi-aquatic on fresh water banks and shallows; leaf blades 3–7 mm wide, margins serrulate; glumes absent; spikelets solitary, laterally compressed, 1-flowered; lemmas carinate, keels fimbriate **32. Leersia**
Terrestrial; leaf blades 20–90 mm wide, margins smooth; glumes present; spikelets paired, the terminal ones in threes, dorsally or laterally compressed, 2–more flowered; lemmas not carinate, keels not fimbriate **53. Sorghum**
68. Spikelets awned, awn exserted, (0.6–)1–14 mm long, if awn 0.6–1 mm long then upper glume and first lemma densely hairy, hairs 2–6.5 mm long and pinkish 69
Spikelet either unawned or awn up to 0.6 mm long, not exserted beyond spikelet bracts and upper glume and first lemma glabrous or with hairs up to 0.5 mm long 75
69. Ligule either 0.05–0.1 mm long and densely fringed or membranous with apical cilia absent to shorter than the membranous part 70
Ligule either a row of hairs or membranous with apical hairs longer than the membranous part 71
70. Nodes hairy; racemes 4–7 cm long; spikelets paired, the terminal ones three together; awn 13–14 mm long **8. Bothriochloa**
Nodes glabrous; racemes 1.5–3 cm long; spikelets ternate, rarely some pairs below the terminals; awn up to 4 mm long **12. Chrysopogon**
71. Ligule in lower third either membranous, or consisting of fused hairs 72
Ligule a row of free hairs 73
72. Culms tufted; ligule 0.3–0.4 mm long; blades linear-lanceolate, smelling of coumarin; spikelets dorso-ventrally compressed, awns absent; lower glumes densely setose along the marginal nerves, acute to acuminate; upper glumes mucicous; upper lemma margins lying flat on the palea, apex with a 1.5–3.1 mm long, straight, scabrous arista
..... **5. Alloteropsis**
Culms mat-forming; ligule c. 2 mm long; blades ovate to lanceolate, not smelling of coumarin; spikelets more or less terete to laterally compressed, awns smooth, viscid; lower glumes sparsely to densely hairy, awn 3–15 mm long; upper glumes with awns 0.4–5 mm long; upper lemma margins inrolled over the palea, apex minutely crested to mucronate **38. Oplismenus**
73. Spikelets (sparsely) hairy, hairs yellowish white, appressed to erecto-patent, up to 1 mm long; awn at least 3 mm long; anthers 0.25–1.8 mm long 74
Spikelets densely hairy, hairs purplish, patent, at least a few longer than 4(–6.5) mm; awn up to 2 mm long; anthers 2–2.5 mm long **35. Melinis**
74. Semi-aquatic; culms creeping at base, spongy, floating, 1.3–1.5 m long; ligule hairs 1.5–2.5 mm long; blades inrolled when young, 16–46 cm by 6–19 mm **21. Echinochloa**

- Terrestrial; culms tufted, hollow, 0.2–0.9 m long; ligule hairs 0.4–0.6 mm long; blades setaceous when young, 2.3–16.6 cm by 0.8–3 mm **24. Eriachne**
75. Spikelets without a cup-shaped callus at base 76
 Spikelets at base with a cup-shaped, 0.2–0.7 mm long, often red-coloured callus
 **25. Eriochloa**
76. Lower glume 0.1–0.7 times as long as the spikelet 77
 Lower glume 0.9–1 times as long as the spikelet 83
77. Pedicels all without bristles, if hairs present then shorter than spikelet; upper lemma smooth 78
 Pedicels (almost) all with 1–9 bristles which are longer than the spikelet, not deciduous with the spikelets; upper lemma transversally rugose **52. Setaria**
78. Spikelets 2-flowered; upper lemma indurate; fruit a caryopsis 79
 Spikelets 1-flowered; lemma herbaceous; pericarp free, expelling the seed
 **55. Sporobolus**
79. Upper lemma smooth 80
 Upper lemma transversally rugulose **60. Urochloa**
80. Spikelets symmetrical, not gibbous 81
 Spikelets asymmetrical, gibbous **15. Cyrtococcum**
81. Glumes unequally long; upper glume 0.8–1 times as long as spikelet 82
 Glumes more or less equally long; upper glume 0.33–0.72 times as long as the spikelet ..
 **40. Ottochloa**
82. Culms with aerenchyma; sheaths with transverse nerves; inflorescences composed of racemes; pedicel apices truncate to discoid; spikelets terete, 3–6 mm long; lower lemma epaleate; upper lemma scarious, white in fruit, the margins lying flat on the palea, germination flap absent **28. Hymenachne**
 Culms hollow, without aerenchyma; sheaths without transverse nerves; inflorescences paniculate; pedicel apices cupuliform; spikelets dorso-ventrally compressed, 1.1–4 mm long; upper lemma indurate, yellow to brown in fruit, margins inrolled against and tightly clasping the palea, germination flap present **41. Panicum**
83. Pedicels and/or spikelets with 2–12 mm long silky hairs 84
 Pedicel and spikelet either glabrous or with hairs up to 0.5 mm long 85
84. Leaves before flowering clustered at the base of the culm; racemes not disarticulating at maturity; spikelets in pairs, unequally pedicelled **29. Imperata**
 Leaves before flowering scattered along elongated culm; racemes disarticulating at maturity; spikelets in pairs, one sessile, one pedicellate **48. Saccharum**

85. Spikelet 3.5–5.2 mm long; sheath at least 4 cm long 86
 Spikelet 1.3–2.5(–3.3) mm long, if longer than 3 mm then sheath not longer than 2 cm ..
 87
86. Culm 1.2–2.5 m long; spikelets in pairs or triplets of 1 sessile and 1 or 2 pedicelled, the
 pedicelled ones reduced; lower glume with many appressed hairs, acute; upper lemma
 smooth **53. Sorghum**
 Culm 0.25–0.4 m long; spikelets in pairs, both pedicelled, similar; lower glume glabrous,
 apiculate; upper lemma transversally rugose **60. Urochloa**
87. Ligule a row of hairs, 0.7–4 mm long; spikelets disarticulating above the glumes; blades
 2.5–12 mm wide, base nearly pseudo-petiolate to cordate **30. Isachne**
 Ligule a membranous glabrous to ciliolate collar, c. 0.5 mm long; spikelets falling as a
 whole; blades 5–27 mm wide, base cordate **41. Panicum**

1. GIGANTOCHLOA Kurz ex Munro

(Greek, *giganto-* = huge, *-chloa* = grass; referring to the plant size)

Trans. Linn. Soc. London 26 (1868) 123; Gamble, Ann. Roy. Bot. Gard. Calcutta 7 (1896) 61; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 185; Ridley, Fl. Malay Penins. 5 (1925) 260; Holttum, Gard. Bull. Singapore 16 (1958) 104; Gilliland, Rev. Fl. Malaya 3 (1971) 31; Widjaja, Reinwardtia 10 (1987) 291; Wong, Malayan Forest Rec. 41 (1995) 122; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 168; Chua et al., Bamboos Singapore (1996) 40; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 183. **Type:** *Gigantochloa atter* Kurz ex Munro.

Clumped bamboos. **Culms** erect to suberect or leaning and tangled with adjacent plants; internodes waxy or not but without a consistent white-waxy zone below each node. **Culm sheaths** with a smooth basal portion that is scattered appressed hairy; blades erect (if so never inflated), spreading or reflexed but typically green and leaf-like when fresh; auricles typically low and rim-like, less often lobe-like, glabrous to bristly on the margin. **Branch buds** solitary, at mid-culm typically developing a **branch complement** with a primary axis dominant by size and length, usually 1-several subdominants from its base, and smaller higher-order branches from these. **Inflorescence** of pseudospikelets, each consisting of several small empty bracts, several bracts subtending prophyllate buds, several transitional (empty) glumes, 2–5 perfect flowers and a vestigial terminal flower. **Flower** with 2-keeled palea with a rounded, truncate or slightly cleft (not distinctly bifid) apex, 0 (rarely 3) lodicules, 6 stamens with filaments fused into a firm tube, ovary with a thickened hairy summit, 1 stigma on a long hairy style that is tissue-filled.

Distribution. A genus of perhaps c. 50 species from India to SW China, Myanmar, Thailand, Indochina, West Malesia and petering out farther eastwards. In Singapore 1 native species.

Ecology. Village bamboos (or Ancient Enduring Clones ‘AECs’) known only in cultivation, including a number of *Gigantochloa* species, seldom flower, do not produce viable seed, and are very different from the native species in continental Southeast Asia including the Malay

Peninsula and Singapore, which flower sporadically (either some culms within a clump, or whole clumps within a population, flowering now and then) or gregariously (most clumps in a population flowering at the same period) and produce viable seed. The hypothesis is that such village bamboos or AECs are highly introgressed forms. Goh et al. (*Plant Syst. Evol.* 299 (2013) 239) have demonstrated that this is indeed feasible. Certainly, Koshy & Jee (*Curr. Sci.* 81 (2001) 375) have shown that the bamboo *Bambusa vulgaris* Schrad. ex J.C.Wendl., always associated with human settlements and pantropical but of uncertain origin, quite certainly an AEC, cannot produce viable seed because of physical impediments in the floral organisation (stigma obstructed by filaments and palea hairs), meiotic irregularities (chromosomal non-orientation, laggards, clumping, uni- or multivalents resulting in variable nuclear content), low pollen viability, and pollen tube inhibition by the stigma; the root-tip cells also showed variable diploid constitution ($2n = 32, 34, 72$ to 82). The value of selecting a clone that is long-persistent in the vegetative state or which does not flower heavily (and therefore at risk of ensuing whole-clump senescence), to maintaining long-term productivity of edible shoots or useful culms, becomes clear in this context.

Uses. Many *Gigantochloa* species (including *Gigantochloa ridleyi*) are useful to Southeast Asian traditional communities but are known only in cultivation; Holttum (*Gard. Bull. Singapore* 16 (1958) 4) was the first to suggest that such ‘village bamboos’ represented clones selected from hybrid swarms, possibly even from previous home ranges of peoples who had migrated southwards from continental Southeast Asia to populate the various islands. These have also been called ‘Ancient Enduring Clones’ (AECs) by Muller (*Amer. Bamboo Soc. Newslett.* 20(5) (1999) 1).

Taxonomy. A member of the subtribe Bambusinae, characterised by solitary primary branch buds developing a primary axis dominant in size and length with 1–few subdominants from its base and smaller higher-order branches, and pseudospikelets (Wong et al., *Sandakania* 22 (2016) 17). The genus typically has culm sheaths with green, leaflike blades and low rim-like auricles, pseudospikelets with a consistently present terminal vestigial flower, and stamens developing a firm filament tube (Wong, *Malayan Forest Rec.* 41 (1995) 122).

Notes. The cultivated bamboos include *Gigantochloa ridleyi* Holttum, *Gard. Bull. Singapore* 15 (1956) 275, a ‘village bamboo’ introduced from Province Wellesley, Peninsular Malaysia, and described without flowers; the type clump is still extant in the Singapore Botanic Gardens but has never flowered. Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 41, have listed *Gigantochloa thoi* K.M.Wong and *Gigantochloa wrayi* Gamble as casual in Singapore but the former is a cultivated sterile bamboo and the latter is rarely cultivated and does not appear to have become casual.

***Gigantochloa ligulata* Gamble**

(Latin, *ligulatus* = ligulate; with a conspicuous ligule)

Ann. Roy. Bot. Gard. Calcutta 7 (1896) 67, pl. 58; Hooker, *Fl. Brit. India* 7, fasc. 22 (1896) 400; Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 188; Ridley, *Fl. Malay Penins.* 5 (1925) 262; Holttum, *Gard. Bull.*

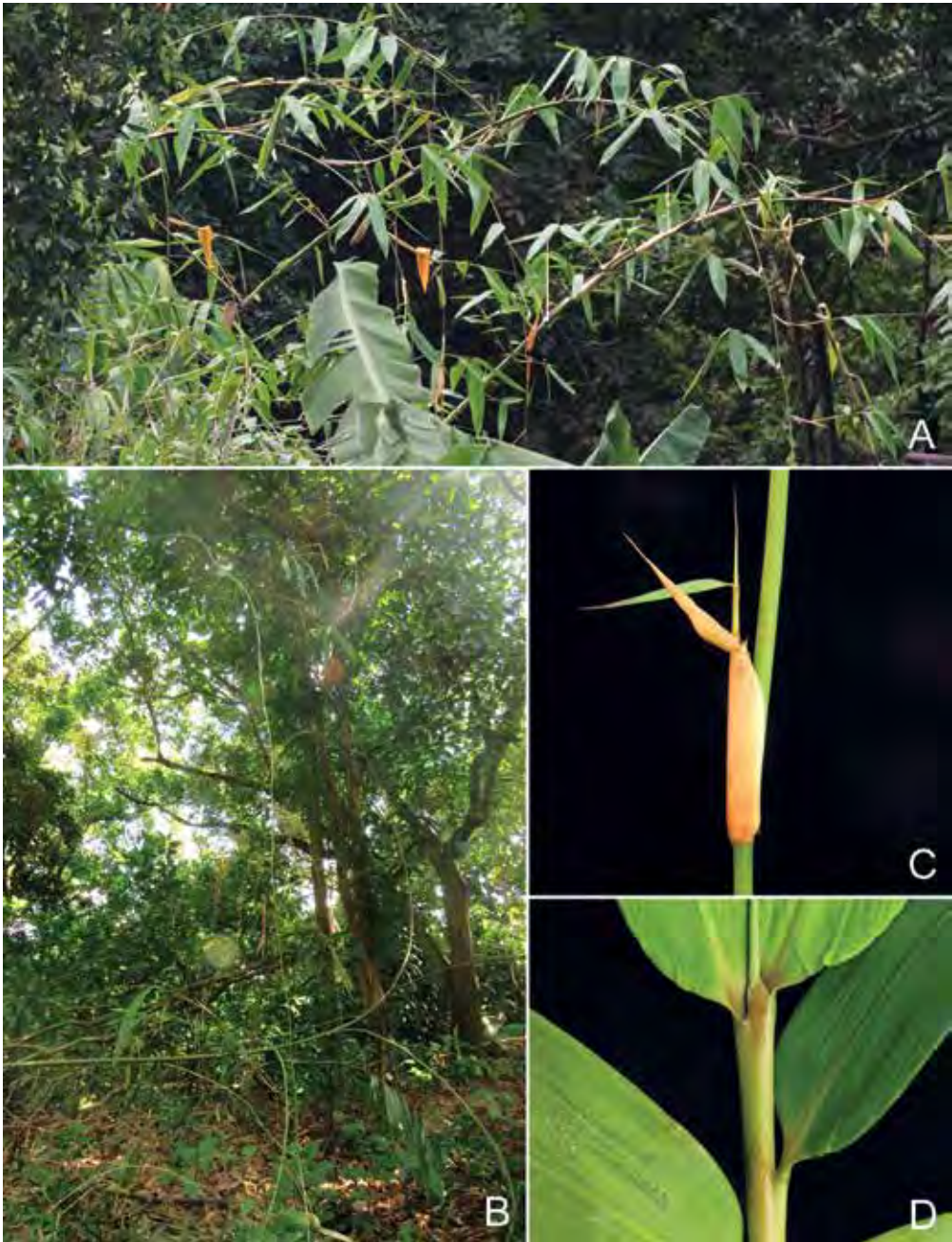


Figure 5. *Gigantochloa ligulata* Gamble. **A.** Weak culms arching over much of their length. **B.** A culm developing long primary branch axes, all flopping over adjacent vegetation and onto the ground. **C.** Young culm with sheath. **D.** Part of leafy branch showing leaf sheaths with conspicuous ligules. (From Singapore, A from Ulu Pandan Road; B–D from Rifle Range (Bukit Timah Nature Reserve), *Lim et al. SING2017-165*. Photos: A, L. Neo; B–D, R.C.J. Lim).

Singapore 16 (1958) 129, fig. 33C; Gilliland, Rev. Fl. Malaya 3 (1971) 34; Widjaja, Reinwardtia 10 (1987) 361; Wong, Malayan Forest Rec. 41 (1995) 131, fig. 70–73; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 169; Chua et al., Bamboos Singapore (1996) 42, fig. 14; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 169, 206. **Type:** *Wray 845*, [Malaysia], Perak, Kuala Wok (lectotype K [K000290550], first step designated by Widjaja, Reinwardtia 10 (1987) 361, second step designated here; isolectotypes CAL, K [K000290551], L). **Fig. 5.**

Culms suberect or leaning and tangled with adjacent plants, to 6–15 m high; internodes 3–5.5 cm diam., medium green, sometimes with pale green or yellowish striations at the culm base, with a narrow band of felty pale hairs above and below the nodal line, with scattered short dark brown hairs at the upper part of the internode, not or only very slightly waxy. **Culm sheaths** at mid-culm pale greenish when fresh, dark-brown hairy all over the back, blade erect, broadly lanceolate, 22–28 cm long, 3–6 cm wide; auricles low and rim-like, 15–25 mm long, c. 1 mm high, glabrous to scattered bristly on the margin; ligule a membranous rim 2–7 mm high with narrow lacerations 3–18 mm long. **Mid-culm branch complement** with a primary axis dominant by size and length, usually 1–several subdominants from its base, and smaller higher-order branches from these, the dominant sometimes developing to several metres long and reiterating the culm in habit. **Leaves** with blades 30–42 cm long, 4–7 cm wide, above glabrous, below scattered fine-hairy, auricles inconspicuous, ligule to 1–1.5 cm long, apically lobed-lacerate; with a scale-like outer ligule 3–15 mm long on the abaxial side of the sheath apex. **Pseudospikelets** 8–14 mm long, with several small empty bracts, several bracts subtending prophyllate buds, 2–3 transitional (empty) glumes, 2–4 perfect flowers and a vestigial terminal flower. **Flower** with lemma 9–12 mm long, margins short brown-hairy; palea about as long as lemma, keels pale fine-ciliate; 0 lodicules; stamens 6, filaments fused into a firm tube, anthers 6–8 mm long, yellow; ovary obovoid, with a thickened hairy summit, style long and hairy, stigma 1, plumose.

Distribution. Malay Peninsula including Peninsular Thailand. In Singapore first recorded by Chua et al. (Bamboos Singapore (1996) 42). Collected from Bukit Timah (*Chua 950825*, edge of Reserve, 25 Aug 1995, SINU; *Chua & Khoo 950614*, foot of Reserve, edge of primary forest, 14 Jun 1995, SINU) and seen at Rifle Range Road, near Jalan Asas, junction of Dunearn Road and Eng Neo Avenue, and in wasteland sites beside Ulu Pandan Road and Queensway in 2015–17. It was also recently collected from Bukit Asam on Pulau Ubin (*Lai SING2015-272*, 30 Oct 2015, SING [SING0229593]). *Pestana s.n.* (SING [SING0041243, SING0041244, SING0041245]) is likely to be a juvenile form of this taxon.

Ecology. The typical form of this species is an erect clumped bamboo with solid or near-solid culm bases, and culms with dominant primary branches that form a loose latticework (Wong, Kew Bull. 41 (1986) 703). The form recorded by Chua et al., al. (Bamboos Singapore (1996) 42) has culms leaning onto adjacent plants or arching over at the base ‘to give a messy appearance’ and appears not to have been documented previous to that. Current evidence from Peninsular Malaysia (Goh & Wong, unpubl.) indicates the possibility that some hybrid or introgressed forms of *Gigantochloa ligulata* are characterised by longer culms that lean or arch over, comparable to that recorded here for Singapore, and could apparently have been establishing in some disturbed sites where the typical form is absent.

Provisional conservation assessment. Globally probably still of Least Concern. Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 44, 169, 206).

Taxonomy. This taxon is still recognisable, by its very long culm-sheath and leaf-sheath ligules, as *Gigantochloa ligulata*, in spite of differences in habit from the typical form.

Notes. Attributes measured vary somewhat throughout the distributional range. The description gives the habit and measurements applicable to known Singapore material.

2. SCHIZOSTACHYUM Nees

(Greek, *schizo-* = splitting, *-stachyum* = spike; referring to the structure of the inflorescence)

Agrostogr. Bras. (1829) 534; Munro, Trans. Linn. Soc. London 26 (1868) 135; Gamble, Ann. Roy. Bot. Gard. Calcutta 7 (1896) 114; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 193; Ridley, Fl. Malay Penins. 5 (1925) 268; Holttum, Gard. Bull. Singapore 16 (1958) 31; Gilliland, Rev. Fl. Malaya 3 (1971) 37; Wong, Malayan Forest Rec. 41 (1995) 163; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 181; Chua et al., Bamboos Singapore (1996) 48; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 185.
Type: *Schizostachyum blumei* Nees.

Clumped bamboos. **Culms** erect to suberect, very rarely (and not in Singapore) leaning and tangled with adjacent plants; internodes always with a consistent white-waxy zone below each node. **Culm sheaths** with a smooth basal portion that is scattered appressed hairy; blades erect (and at least slightly inflated), spreading or reflexed and green and leaf-like or fast turning brown or variously coloured when fresh; auricles lobe-like or low and rim-like, always bristly on the margin. **Branch buds** solitary, at mid-culm typically developing a **branch complement** consisting of a cluster of slender branches of various orders all of similar size, including the primary axis. **Inflorescence** of pseudospikelets, each consisting of several small empty bracts, several bracts subtending prophyllate buds, typically no transitional (empty) glumes, 1–2 (sometimes several) perfect flowers and 1–2 vestigial terminal flowers. **Flower** with 2-keeled palea with acute or bifid apex, 3 (rarely 4–5 or more) lodicules, 6 stamens with filaments free or fused into a tube, ovary glabrous, 3 stigmas on a stiff glabrous style that is hollow with a central tissue strand.

Distribution. A genus of c. 50–60 species in South China, continental Southeast Asia and through Malesia to the Pacific islands. In Singapore 2 native species.

Uses. The cultivated bamboos include *Schizostachyum brachycladum* Kurz, a village bamboo of uncertain origin known in Southeast Asia as the *buluh leman*, the (green) culm internodes of which are widely used for cooking a traditional glutinous rice cake. A yellow culm form of this species is a popular garden ornamental (Chua et al., Bamboos Singapore (1996) 48). *Schizostachyum jaculans* Holttum, the Temuan blowpipe bamboo, was sometimes planted. In the Malay Peninsula, as far as is known, this is always associated with settlements and

also does not produce seed. Another bamboo that was also likely planted in Singapore, but where we have no recent sightings or documentation, is *Schizostachyum zollingeri* Steud. (*S. chilianthum* auct. non Kurz: Gamble, Ann. Roy. Bot. Gard. Calcutta 7 (1896) 115, p.p.; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 194; Ridley, Fl. Malay Penins. 5 (1925) 269). It is much planted south of Selangor in the Malay Peninsula, usually with more slender, shorter culms compared to the taxon where it grows truly wild in large groves much farther north, with taller and more robust culms. The last two were listed as casual by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 263).

Taxonomy. This genus is the only native Malesian genus belonging to the Melocanninae Benth., a subtribe distinctive by its mid-culm branch complement derived from a single primary bud which typically forms a cluster of subequal branches of various orders, culms with a conspicuous white-waxy zone below each node, pseudospikelets, and a stiff hollow style with a central tissue strand (Wong et al., Sandakania 22 (2016) 25).

Key to *Schizostachyum* species

1. Culm-sheath blade erect, ovate-triangular and inflated **1. *S. gracile***
- Culm-sheath blades spreading, lanceolate and leaflike **2. *S. latifolium***

1. *Schizostachyum gracile* (Munro) Holttum

(Latin, *gracilis* = slender; referring to the habit of the plant)

Kew Bull. 2 (1956) 206; Holttum, Gard. Bull. Singapore 16 (1958) 37; Gilliland, Rev. Fl. Malaya 3 (1971) 39; Turner, Gard. Bull. Singapore 45 (1993) 102; Wong, Malayan Forest Rec. 41 (1995) 169, fig. 96, 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 181; Chua et al., Bamboos Singapore (1996) 50, fig. 18; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 198; Chong et al., Biodivers. Conserv. 21 (2012) 2589. **Basionym:** *Melocanna gracilis* Munro, Trans. Linn. Soc. London 26 (1868) 133. **Type:** *Wallich s.n.* [EIC 5032] Singapore, 1822 (lectotype K [K000290736], first step designated by Holttum, Gard. Bull. Singapore 16 (1958) 38, second step designated here; isolectotypes K [K000290732, K000290733, K000290737]). **Fig. 6.**

Schizostachyum tenue Gamble, Ann. Roy. Bot. Gard. Calcutta 7 (1896) 114, pl. 100; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 194; Ridley, Fl. Malay Penins. 5 (1925) 268. **Type:** *Ridley 5596*, [Malaysia], Pahang, Berar (lectotype K [K000290735], designated by Holttum, Gard. Bull. Singapore 16 (1958) 38; isolectotypes BM [BM000959288], SING [SING0054956]).

Culms suberect and arching over strongly or leaning and tangled with adjacent plants, to 3–4 m high; internodes 1.5–2 cm diam., medium to dark green, subglabrous or with scattered short pale silvery hairs on the internodes, with a distinct white-waxy zone just below each node. **Culm sheaths** at mid-culm pale greenish to yellowish orange, scattered pale brown hairy on the back, blade erect, broadly triangular and inflated, 2.5–5.5 cm long, 2–5 cm wide, mostly pale green and purplish at the blade junction; auricles each a rounded lobe, 3–5 mm high and extending beyond the sheath, bristly on the margin; ligule a subentire low rim 0.5–1



Figure 6. *Schizostachyum gracile* (Munro) Holttum. Young culm shoot explored by ants. (From Peninsular Malaysia. Photo: K.M. Wong).

mm high. **Mid-culm branch complement** a cluster of slender branches of various orders all of similar size, including the primary axis. **Leaves** with blades 12–27 cm long, 0.8–2.3 cm wide, above and below glabrous, auricles small lobes with fine bristles to 3 mm long, ligule an inconspicuous subentire rim. **Pseudospikelets** 11–17 mm long, with several small empty bracts, several bracts subtending prophyllate buds, 1 perfect flower and a vestigial terminal flower. **Flower** with lemma c. 10 mm long, margins short pale-hairy; palea slightly longer than lemmas, keels pale fine-ciliate; 3 lodicules; stamens 6, filaments not documented, anthers 3.5–4 mm long, greenish to yellow; ovary ovoid, glabrous, style stiff and glabrous, stigmas 3, plumose.

Distribution. This species is endemic to the southern part of Peninsular Malaysia and Singapore. In Singapore documented from 9th mile Bukit Timah Road (*Ridley 6116*, 1894, SING [SING0017834]), Bukit Mandai (*Ridley 11850*, SING [SING0017835]) and Ulu Pandan (*Holtum s.n.*, 10 Oct 1948, SING [SING0017836]).

Ecology. Lowland forest fringes and exposed places, sometime near wet ground.

Provisional conservation assessment. Globally the species may be considered Vulnerable, as its predominantly lowland habitats have become increasingly disturbed by development and land use transformation. It was listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 198) but listed as rediscovered by Chong et al. (Biodivers. Conserv. 21 (2012) 2589). The numbers are still very low so it is assessed here as Critically Endangered (CR/D) in Singapore.

Notes. The attributes and measurements above are taken from plants from Peninsular Malaysia as documented in Wong (Malayan Forest Rec. 41 (1995) 169).

2. *Schizostachyum latifolium* Gamble

(Latin, *lati*- = broad, *-folium* = leaves; with broad leaves)

Ann. Roy. Bot. Gard. Calcutta 7 (1896) 117; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 196; Ridley, Fl. Malay Penins. 5 (1925) 270; Dransfield, Kew Bull. 38 (1983) 331; Turner, Gard. Bull. Singapore 45 (1993) 102; Wong, Malayan Forest Rec. 41 (1995) 174, fig. 101, 102; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 181; Chua et al., Bamboos Singapore (1996) 54, fig. 20; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 198. **Type:** *Ridley 5602*, [Malaysia] Pahang, Kota Glanggi (lectotype K [K000290717], designated by Dransfield, Kew Bull. 38 (1983) 331; isolectotype SING [SING0055577]).

Ochlandra ridleyi Gamble, Ann. Roy. Bot. Gard. Calcutta 7 (1896) 127; Ridley, Fl. Malay Penins. 5 (1925) 272. **Synonym:** *Schizostachyum ridleyi* (Gamble) Holtum, Gard. Bull. Singapore 11(4) (1947) 296. **Type:** *Ridley 4620*, Singapore, Bukit Mandai (lectotype K [K000290718], first step designated by Dransfield, Kew Bull. 38 (1983) 331, second step designated here; isolectotypes K [K000290719], SING [SING0055578]).

Schizostachyum longispiculatum auct. non (Kurz ex Munro) Kurz: *Holttum*, Gard. Bull. Singapore 16 (1958) 48; Gilliland, Rev. Fl. Malaya 3 (1971) 40.

Culms erect-suberect and arching slightly at first, in older clumps arching over strongly or leaning and tangled with adjacent plants, to 3–5 m high; internodes 1.5–2 cm diam., medium to dark green, subglabrous or with scattered short pale silvery hairs on the internodes, with a distinct white-waxy zone just below each node. **Culm sheaths** at mid-culm green to pale orange-brown, scattered pale brown hairy on the back, blade sometimes erect at first but rapidly spreading to reflexed, lanceolate, 8.5–15 cm long, 0.9–1.7 cm wide, dark green; auricles each an elongate to rounded lobe, 2–6 mm high and extending beyond the sheath, bristly on the margin; ligule a subentire low rim 0.5–1 mm high. **Mid-culm branch complement** a cluster of slender branches of various orders all of similar size, including the primary axis. **Leaves** with blades 10–26 cm long, 2–4.5 cm wide, above glabrous, below scattered short pale-hairy, auricles small lobes with fine bristles to 4 mm long, ligule an inconspicuous subentire rim. **Pseudospikelets** 18–32 mm long, with several small empty bracts, several bracts subtending prophyllate buds, 1 perfect flower and a vestigial terminal flower. **Flower** with lemma 15–23 mm long, margins short pale-hairy; palea slightly longer than lemmas; lodicules 3–10 (exceptionally 1); stamens 6, filaments not documented, anthers 9–10 mm long; ovary ovoid, glabrous, style stiff and glabrous, stigmas 3, plumose.

Distribution. Sumatra, Malay Peninsula and Borneo. In Singapore documented at Chua Chu Kang Road (*Holttum* SFN 38406, 26 Feb 1948, SING [SING0017826, SING0017827, SING0017828]; *Holttum* s.n., 5 May 1954, SING [SING0017824, SING0017825, SING0017826]).

Ecology. Forest fringes and along some streams.

Provisional conservation assessment. Globally the species might be considered Vulnerable because of habitat reduction. In Singapore it has been listed as presumed Nationally Extinct by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 198).

Notes. The attributes and measurements above are taken from plants from Peninsular Malaysia as documented in Wong (Malayan Forest Rec. 41 (1995) 174).

3. SOEJATMIA K.M. Wong

(Soejatmi Dransfield, b. 1939, specialist on Asian and Madagascan tropical bamboos)

Kew Bull. 48 (1993) 530; Wong, Malayan Forest Rec. 41 (1995) 182; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 183; Chua et al., Bamboos Singapore (1996) 58; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 183. **Type:** *Soejatmia ridleyi* (Gamble) K.M. Wong.

Clumped bamboos. **Culms** suberect or leaning and often tangled with adjacent plants; internodes slightly to not waxy, without a consistent white-waxy zone below each node. **Culm**

sheaths with a narrow band of transversely wrinkled tissue at the basal portion that is densely deflexed-hairy; blades erect (and not noticeably inflated), typically green when fresh; auricles typically large and lobe-like, densely bristly on the margin. **Branch buds** solitary, at mid-culm typically developing a **branch complement** with a primary axis dominant by size and length, and usually 1-several subdominants from its base, the dominant central axis often growing very long and reiterating the habit of the main culm. **Inflorescence** of pseudospikelets, each consisting of several small empty bracts, several bracts subtending prophyllate buds, 1 transitional (empty) glume, 1–2 rudimentary flowers below the perfect flowers, 3–5 perfect flowers and 1–2 vestigial terminal flowers. **Flower** with 2-keeled palea with 2 hooked and hairy tips, 3 lodicules, 6 stamens with free filaments, ovary with a thickened hairy summit, 3 stigmas on a hairy style that is solid (tissue-filled).

Distribution. A single species in Peninsular Thailand, Peninsular Malaysia (Kelantan, Pahang) and Singapore.

Soejatmia ridleyi (Gamble) K.M. Wong

(Henry Nicholas Ridley, 1855–1956, prolific botanist
and first Director of Singapore Botanic Gardens)

Kew Bull. 48 (1993) 530, fig. 7; Wong, Malayan Forest Rec. 41 (1995) 182, fig. 107; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 183; Chua et al., Bamboos Singapore (1996) 58. **Basionym:** *Bambusa ridleyi* Gamble, Ann. Roy. Bot. Gard. Calcutta 7 (1896) 34, pl. 32; Hooker, Fl. Brit. India 7, fasc. 22 (1896) 388; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 184; Camus, Bambusées (1913) 118; Ridley, Fl. Malay Penins. 5 (1925) 257, fig. 225; Holttum, Gard. Bull. Singapore 16 (1958) 71, fig. 20; Gilliland, Rev. Fl. Malaya 3 (1971) 21; Tan et al. in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 80, 170, 211. **Type:** *Ridley 1693*, Singapore, Bukit Timah, 26 February 1890 (holotype SING [SING0054687]). **Fig. 7, 8.**

Culms erect-suberect and arching slightly at first, in older clumps arching over strongly or leaning and tangled with adjacent plants, to c. 5 m high; internodes 1.5–2 cm diam., dark green, with scattered short pale silvery and pale brown hairs on the internodes. **Culm sheaths** at mid-culm green, scattered pale silvery and brown fine-hairy on the back, blade erect, ovate-lanceolate, 5–7 cm long, c. 2–2.5 cm wide, dark green; auricles each a spreading ear-shaped to rounded lobe, to 10 mm high, bristly on the margin; ligule a subentire low rim. **Mid-culm branch complement** with a primary axis dominant by size and length, usually 1–several subdominants from its base, the dominant sometimes developing to several meters long and reiterating the culm in habit. **Leaves** with blades 15–40 cm long, 2–6.5 cm wide, above and below glabrous, adaxial auricles conspicuous rounded lobes 4–15 mm long with fine bristles 4–20 mm long, abaxial auricles inconspicuous to 5–10 mm long, ligule an inconspicuous subentire rim, outer ligule a small rounded scale 1–2 mm long. **Pseudospikelets** 22–35(–50) mm long, with several small empty bracts, several bracts subtending prophyllate buds, 1 transitional (empty) glume, 3–5 perfect flowers and 1–2 vestigial terminal flowers. **Flower** with lemma 18–22 mm long, margins glabrous; palea slightly shorter than lemmas; lodicules 3; stamens 6, filaments free, anthers 8–9 mm long; ovary cylindrical, with a thickened hairy summit, style hairy, stigmas 3, plumose.

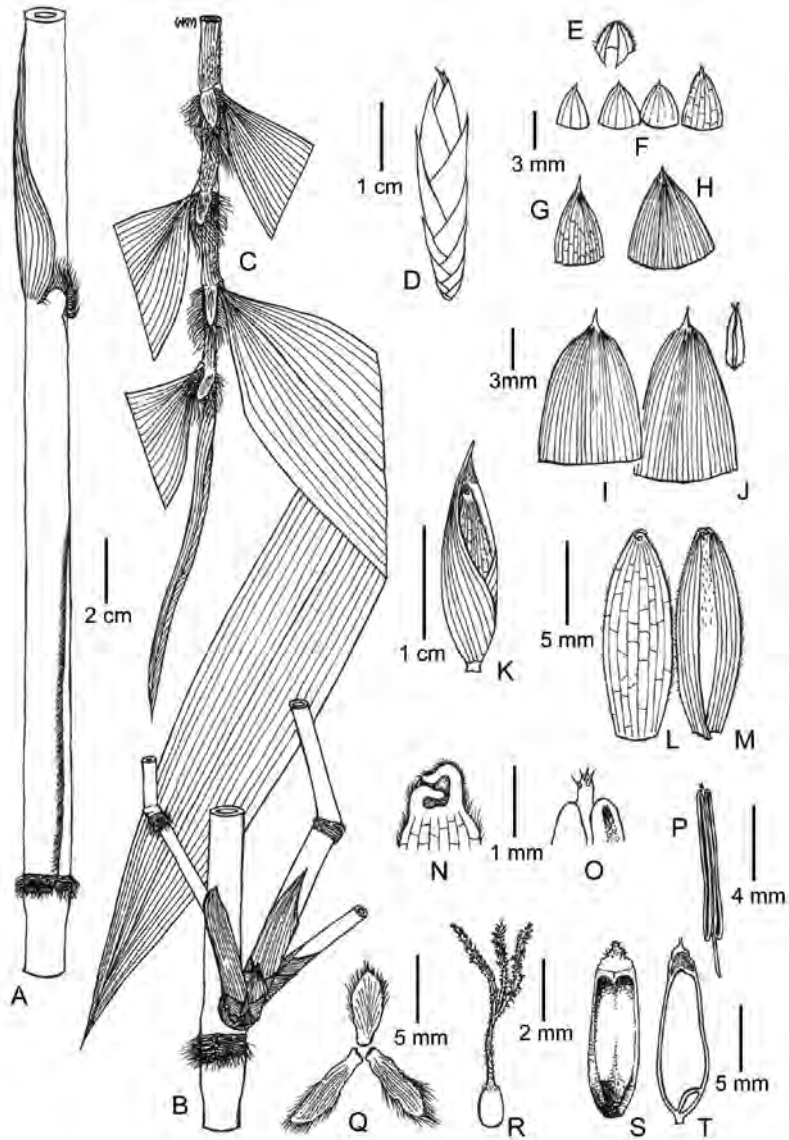


Figure 7. *Soejatmia ridleyi* (Gamble) K.M.Wong. **A.** Culm sheath with wrinkled base bearing spreading to deflexed hairs. **B.** Branch complement. **C.** Part of leafy branch. **D.** Pseudospikelet with (from the base) 4 empty bracts, 2 gemmiferous bracts, one transitional (empty) glume, 2 lemmas subtending vestigial paleas, 4 perfect flowers and a (partly hidden) terminal vestigial flower. **E.** Prophyll of pseudospikelet branch. **F.** Empty bracts at base of pseudospikelet. **G & H.** Gemmiferous bracts. **I.** Transitional (empty) glume. **J.** Transitional glume subtending a vestigial palea. **K.** Lemma of perfect flower tightly clasping the palea. **L.** Palea, dorsal view. **M.** Palea, ventral view. **N.** Detail of palea apex. **O.** Detail of anther apex. **P.** Stamen. **Q.** Lodicule complement. **R.** pistil. **S.** Mature fruit. **T.** longitudinal section of fruit. (From Peninsular Malaysia, A–R from *Dransfield SD 914*, S–T from *Gianno E 104*. Adapted from Kew Bulletin 48 (1993) 531. Drawn by K.M. Wong).



Figure 8. *Soejatmia ridleyi* (Gamble) K.M.Wong. **A.** Young clumps establishing. **B.** Part of leafy branch showing conspicuous bristly leaf-sheath auricles. (From Singapore, Bukit Timah Nature Reserve. Photos: A, R.C.J. Lim; B, X.Y. Ng).

Distribution. As for genus. In Singapore known only from a population on Bukit Timah (*Ridley s.n.*, 12 Aug 1889, SING [SING0017699]; *Ridley s.n.*, 1903, SING [SING0035108]; *Sinclair SFN 40952*, 19 Nov 1955, SING [SING0017698]). This population was recorded to have flowered in 1991 (Chua et al., *Bamboos Singapore* (1996) 58) and then the clumps senesced over the next five years and were eventually survived by seedlings. The present population assessed in 2014–2017 is likely to be that seedling cohort.

Ecology. Dependent on forest gaps and fringes.

Provisional conservation assessment. Globally the species is probably Near Threatened, as it is highly localised in occurrence and its lowland distribution and current levels of land use alteration in its range also imply significantly low chances of discovering further populations. It is listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 238) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 80, 170, 211).

4. ACROCERAS Stapf

(Greek, *acro-* = top, *-ceras* = horn;

referring to the crested apex of the glumes and lemmas)

Fl. Trop. Afr. 9(4) (1920) 621; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 328. **Synonym:** *Panicum* L. subg. *Acroceras* (Stapf) Pilg., *Notizbl. Bot. Gart. Berlin-Dahlem* 11 (1931) 241. **Type:** *Acroceras oryzoides* Stapf, lectotype designated by Phillips, *Gen. S. Afr. Pl.*, ed. 2 (1951) 103 (= *Acroceras zizanioides* (Kunth) Dandy).

Neohusnotia A.Camus, *Bull. Mus. Natl. Hist. Nat.* 26 (1921) 664. **Type:** *Neohusnotia tonkinensis* (Balansa) A.Camus (= *Acroceras tonkinense* (Balansa) C.E.Hubb. ex Bor).

Perennials (in Singapore). **Culms** hollow. **Ligules** rim-like. Leaf blades inrolled when young. **Panicle** composed of lax, unilateral racemes. **Spikelets** abaxial, paired, homomorphous, terete to laterally compressed; lower floret paleate, sterile or male. **Glumes** unequal, muticous, apex crested; lower glume 3–5-nerved, 0.5–0.75 times as long as the spikelet; upper glume 5–7-nerved, about as long as the spikelet. **Lemmas** apically crested; lower lemma similar to the upper glume, paleate, sterile or male, 5–7-nerved; upper lemma coriaceous, germination flap present, margins inrolled over the palea; second palea with the apical teeth exerted below the tip of the lemma.

Distribution. A genus of 19 species, mainly in Madagascar. In Singapore 2 species, both presumed native.

Taxonomy. The genus belongs to the *Panicoideae* – *Boivinellinae* Pilg.

Key to *Acroceras* species

1. Culm nodes glabrous; blades 5–9.5 cm by 4–10 mm, base cordate to amplexicaul, margin glabrous, midrib below inconspicuous; spikelets 3.7–4.5 mm long; lower glume apiculate **1. *A. munroanum***
 Culm nodes hairy; blades 8–19.5 cm by 10–25 mm, base not cordate, margin pectinate, midrib below conspicuously white; spikelets 4.5–5 mm long; lower glume hardly apiculate **2. *A. tonkinense***

1. *Acroceras munroanum* (Balansa) Henrard

(William Munro, 1818–1880, British army officer and plant collector)

Blumea 3(3) (1940) 445; Gilliland, Rev. Fl. Malaya 3 (1971) 165; Turner, Gard. Bull. Singapore 45 (1993) 92; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 154; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 32, fig. 19; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 9, 168, 262. **Basionym:** *Panicum munroanum* Balansa, J. Bot. (Morot) 4 (1890) 140. **Synonyms:** *Panicum helopus* Trin. var. β Munro ex Thwaites, Enum. Pl. Zeyl., fasc. 5 (1864) 358. – *Panicum helopus* Trin. var. *glabrum* Trimen, Syst. Cat. Fl. Pl. Ceylon (1885) 104, as ‘*glabra*’. **Type:** CP 3244, Sri Lanka (lectotype K [K000245280], right-hand plant, designated by Turner et al., Gard. Bull. Singapore 71 (2019) 27). **Fig. 9A.**

Panicum crassiapiculatum Merr., Philipp. J. Sci. 1, Suppl. 5 (1906) 356. **Synonyms:** *Brachiaria crassiapiculatum* (Merr.) Hitchc. in Groff, et al., Lingnaam Agric. Rev. 1 (1923) 48. – *Acroceras crassiapiculatum* (Merr.) Alston in Trimen, Handb. Fl. Ceylon 6 (1931) 324; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 39. **Type:** Merrill 5387, Philippines, Balabac Island, October 1906 (lectotype US [US00604218], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 25; isotype W).

Panicum oryzoides Sw. var. *A* Ridley, Mat. Fl. Malay. Penins. 3 (1907) 138.

Culms prostrate and rooting at base, 0.1–0.5(–1) m tall; nodes glabrous. **Ligules** 0.2–0.3 mm high. Leaf blades 3–9.5 cm by 4–10 mm, base cordate, margins not thickened, glabrous, midrib below inconspicuous, nerves inconspicuous. **Panicles** 4–8 cm long, branches 2–5, simple, lowermost branch 1–4 cm long. **Spikelets** 3.7–4.5 mm long. Lower **glume** 2.9–4 mm long, 5-nerved; upper glume as long as the spikelet, 5–7-nerved. Lower **lemma** 3.5–4.2 mm long, 5-nerved at base, apically 7-nerved; upper lemma 3.5–4 mm long, at base 5-nerved, apically 7-nerved. **Anthers** 1–1.3 mm long.

Distribution. Eastern India, Sri Lanka to southern China and in western Malesia to Sulawesi and the Philippines. It is not entirely clear if the known collections from Singapore are of native or naturalised plants as both are from gardens or parks. As Singapore is within the range of distribution of the species and the species is not generally of horticultural interest it is likely it is native. Collected in Singapore Botanic Gardens (*Ridley s.n.*, 1920, SING [SING0240157]) and Robinson Park (*Jumali 610*, 18 Dec 1961, SINU).

Ecology. Elsewhere known from coastal sands and river flats, moist shady places.

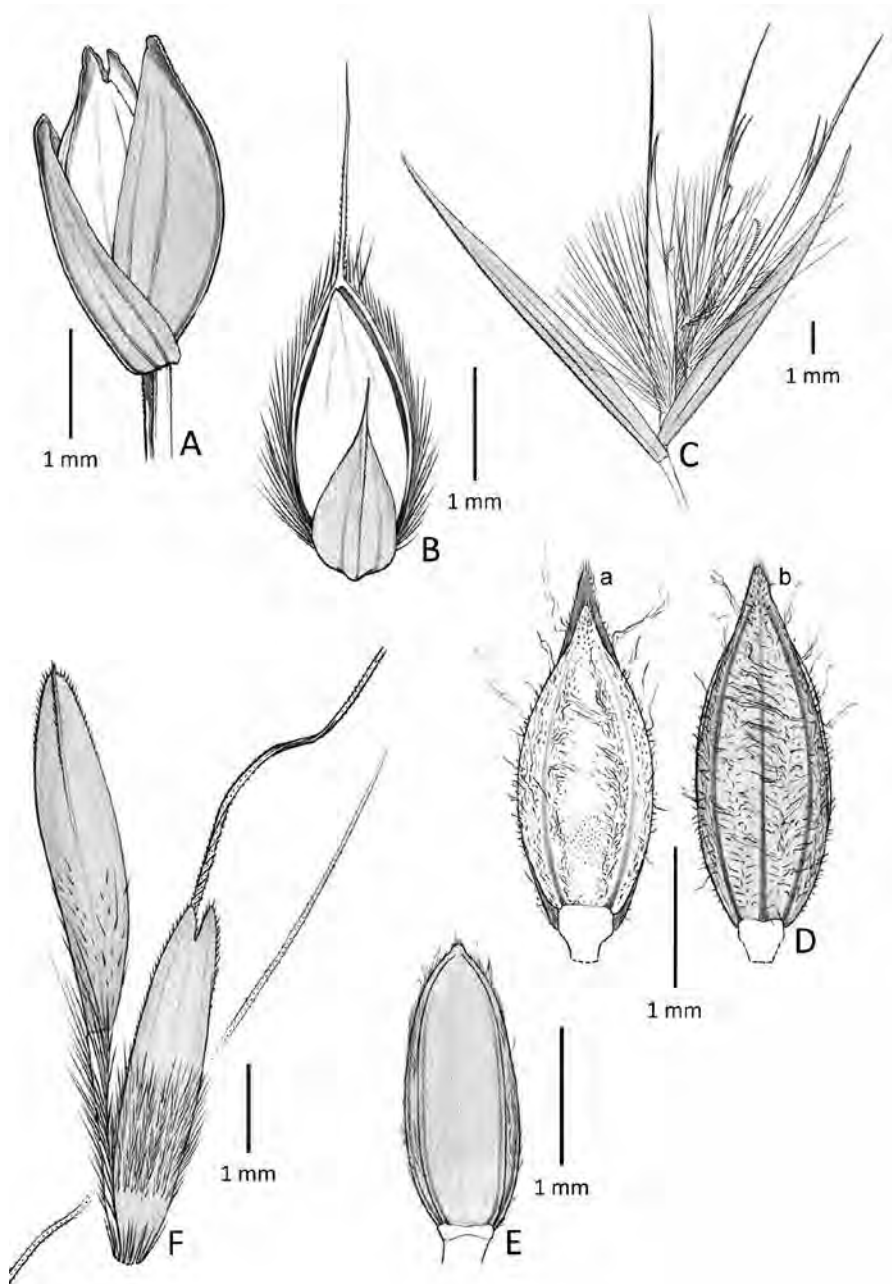


Figure 9. *Acroceras munroanum* (Balansa) Henrard. **A.** Spikelet lateral view. *Alloteropsis cimicina* (L.) Stapf. **B.** Spikelet facing lower glume. *Arundo donax* L. **C.** Spikelet lateral view. *Axonopus compressus* (Sw.) P.Beauv. **D.** Spikelets: **a.** facing the 1st lemma, **b.** facing the upper glume. *Axonopus fissifolius* (Raddi) Kuhlm. **E.** Spikelet facing 1st lemma. *Bothriochloa bladonii* (Retz.) S.T.Blake. **F.** Pair of spikelets. (Drawn by J.J. Vermeulen).

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

2. *Acroceras tonkinense* (Balansa) C.E.Hubb. ex Bor (of Tonkin, northern Vietnam)

Indian Forest Rec., Bot. 1 (1938) 78; Henrard, Blumea 3(3) (1940) 451, isonym; Gilliland, Rev. Fl. Malaya 3 (1971) 165, pl. 18c; Turner, Gard. Bull. Singapore 45 (1993) 93; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 154; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 32. **Basionym:** *Panicum tonkinense* Balansa, J. Bot. (Morot) 4 (1890) 140. **Synonym:** *Neohusnotia tonkinensis* (Balansa) A. Camus, Bull. Mus. Natl. Hist. Nat. 26 (1921) 664. **Type:** *Balansa 1646*, Vietnam, Bois des environs de Tu-Phap, May 1887 (lectotype L [L0043504], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 31; isolectotypes B [B 10 0366230], L [L0043504, L0043505, L0043506], K [K000958868], P, US [US00604217]).

Panicum latifolium L. var. *majus* Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 39. **Synonym:** *Panicum oryzoides* Sw. var. *majus* (Hook.f.) Hook.f. ex Ridl., Mat. Fl. Malay. Penins. 3 (1907) 138. **Type:** *King's Collector [Kunstler] 876*, [Malaysia], Malay Peninsula, [Perak], Goping, October 1888 (lectotype K [K000290228], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 26; isolectotypes CAL, SING [SING0054927]).

Panicum latifolium auct. non L.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185.

Panicum ridleyi Hack., Bot. Tidsskr. 24 (1901) 98. **Synonym:** *Acroceras ridleyi* (Hack.) Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 229, fig. 223. **Type:** *Ridley 61*, [Malaysia], Malacca, Pulau Besar, September 1889 (lectotype W [1916-0024255], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 30; isolectotype SING[SING0054678]).

Acroceras sparsum Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 229. **Type:** *Ridley s.n.*, [Malaysia], Selangor, Klang Gates below the ridge near the river, 2 January 1921 (lectotype K [K000290363], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 2).

Culms decumbent and rooting at base, 0.5–1.4 m tall; nodes pilose. **Ligules** c. 1 mm high. Leaf blades 8–19.5 cm by 10–25 mm, base not cordate, margins thickened, at base with hairs with a bulbous base, midrib below conspicuous, white. **Panicle** 10–35 cm long, branches 3–9, the lower ones further branched, the lowermost 4–27 cm long. **Spikelets** 4.5–5 mm long. Lower **glume** 3.5–4.5 mm long, 5–7-nerved; upper glume 4.5–5 mm long, 5-nerved. Lower **floret** male or neuter, **lemma** 4–5 mm long, 5–7-nerved; upper lemma 4–4.2 mm long, 5-nerved. **Anthers** c. 2 mm long.

Distribution. Northeastern India to Vietnam and Hainan and through Malesia to the Moluccas. Native in Singapore but known only from an unlocalised collection (*Wallich s.n.* [EIC 8706], Sep 1822, K [K000290366]) and from Labrador (*Lai & Saifudin 546*, 20 Apr 1999, SINU).

Ecology. Poorly known in Singapore but elsewhere from forest margins and river banks to 300 m.

Provisional conservation assessment. Globally Least Concern (LC). Assessed here as Critically Endangered (CR/D) in Singapore.

5. ALLOTEROPSIS J.Presl

(Greek, *allotrios* = foreign, strange; *-opsis* = sight, indicates resemblance; of the strange appearance)

in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 343; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 328. **Type:** *Alloteropsis distachya* J.Presl (= *Alloteropsis semialata* (R.Br.) Hitchc.).

Coridochloa Nees, Edinburgh New Philos. J. 15 (1833) 381. **Synonym:** *Alloteropsis* J.Presl subg. & sect. *Coridochloa* (Nees) Butzin, Willdenowia 5 (1968) 130. **Type:** *Coridochloa cimicina* (L.) Nees ex Chase (= *Alloteropsis cimicina* (L.) Stapf).

Annuals or perennials. **Culms** tufted, hollow. **Ligule** a row of hairs. Leaf blades inrolled when young. **Inflorescence** lax, racemes digitate or paniculate. **Spikelets** distichous, secund, abaxial, 2–4 together, dorso-ventrally compressed, callus obtuse, 2-flowered, awned. **Glumes** unequal, membranous to chartaceous, acuminate to mucronate; lower glumes 0.5–0.75 times as long as the spikelet, 3(–5)-nerved, densely setose along the marginal nerves; upper glume about as long as the spikelet, 5-nerved. **Lemmas** 5-nerved, glabrous; lower lemma similar to the glumes, paleate, male; upper lemmas indurate at maturity, germination flap present, dorsally rounded, mucronate or awned, awn straight, margins lying flat on the palea.

Distribution. A genus of 7 species in the Old World tropics. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Boivinellinae* Pilg.

Notes. The genus contains both C₃ and C₄ taxa according to Liebenberg & Fossey (Bot. J. Linn. Soc. 137 (2001) 243–248).

Alloteropsis cimicina (L.) Stapf

(Latin, *cimicinus* = bedbugs; spikelets resembling bedbugs)

Fl. Trop. Afr. 9(3) (1919) 487; Ridley, Fl. Malay Penins. 5 (1925) 223; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 105, as '*cimicinus*'; Gilliland, Rev. Fl. Malaya 3 (1971) 198, fig. 42, pl. 18d; Turner, Gard. Bull. Singapore 45 (1993) 93; Keng et al., Concise Fl. Singapore, vol., vol. 2, Monocot. (1998) 154; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 34, fig. 20; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 12, 168, 269. **Basionym:** *Milium cimicinum* L., Mant. Pl. Altera (1771) 184. **Synonyms:** *Panicum cimicinum* (L.) Retz., Observ. Bot. 3 (1783) 9. – *Milium ciliare* Giseke, Prael. Ord. Nat. Pl. (1792) 146, nom. illeg. superfl. – *Melica cimicina* (L.) Salisb., Prodr. Stürp. Chap. Allerton (1796) 20. – *Axonopus cimicinus* (L.) P.Beauv., Ess. Agrostogr. (1812) 12, 154; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 144. – *Trichachne cimicina* (L.) Brongn. in Duperrey, Voy. Monde, Phan., fasc. 10 (1832) 130. – *Coridochloa cimicina* (L.) Nees ex Chase, Proc. Biol. Soc. Wash. 24 (1911) 129. **Type:** *Collector unknown s.n.*, 'Habitat in Malabaridae et

oppidi Johannis plateis' (neotype LINN [Herb. Linn. no. 83.2], designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 617). **Fig. 9B.**

Annual to short-lived perennial. **Culms** tufted, branching intra-vaginally at base, 0.15–0.75 m long; nodes glabrous or hairy. Basal **sheaths** not silky-tomentose, at most moderately hirsute. **Ligules** 0.3–0.4 mm long. Leaf blades linear-lanceolate, 1.5–9 cm by 5–15 mm, glabrous, smelling of coumarin, base cordate. **Racemes** with or without a common axis, digitate or whorled, 3–8 together, 5–18 cm long. **Spikelets** 3–4 mm long. Lower **glume** 1.6–3 mm long, 0.5–0.7 times as long as the spikelet, acute to acuminate, 3-nerved; upper glume margin densely hairy. Upper **lemma** with a 1.5–3.1 mm long, straight, scabrous arista; **palea** glandular puberulous. **Anthers** 0.5–1 mm long.

Distribution. Tropical East Africa to China and through continental Southeast Asia and Malesia to northern Australia. In Singapore native and recorded from Changi (*Ridley 1700*, 11 Oct 1890, SING [SING0017640]), Chan Chu Kang (*Ridley 52*, May 1889, SING [SING0017643]), East Coast Park (*Duistermaat 216*, 22 Oct 2003, L, SING [SING0059318]), Tivoli (*Ridley 1711*, 29 Dec 1889, SING [SING0017642]) and Singapore Botanic Gardens (*Holttum s.n.*, 27 Feb 1928, SING [SING0017638]).

Ecology. Grassy fields, sunny road sides.

Provisional conservation assessment. Globally Least Concern (LC). Assessed here as Least Concern (LC) in Singapore.

6. ARUNDO L.

(Latin for reed)

Sp. Pl. 1 (1753) 81; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 404. **Type:** *Arundo donax* L., lectotype designated by Niles & Chase, Contr. U.S. Natl. Herb. 24 (1925) 184.

Reed-like **perennials**, branching intra- and extra-vaginally at base. **Culms** rhizomatous and stoloniferous, hollow. **Ligules** membranous, collar-shaped, margin ciliolate. Leaf blades broad, disarticulating from the sheaths. **Panicle** large, contracted to lax. **Spikelets** laterally compressed, 3–5-flowered, disarticulating above the glumes and between the florets, lowest floret(s) bisexual. **Glumes** subequal, with a distinctly developed internode (c. 0.5 mm long), 0.8–1 times as long as the spikelet, 3–5-nerved, glabrous. **Rachilla** subglabrous, process terminated by a reduced floret. **Lemma** callus short, blunt, hairy; membranous, dorsally keeled, hairy below the middle, 5–7-nerved, apex usually bifid, awn from the sinus, straight. **Palea** 0.5–0.67 times as long as the lemma, curved outwards after anthesis, 2-nerved. **Stamens** 3.

Distribution. A genus of 4 species from the Mediterranean to China. In Singapore 1 semi-naturalised species.

Taxonomy. The genus belongs to the *Arundinoideae* – *Arundineae* Dumort.

Arundo donax L.

(Greek, *donax* = reed)

Sp. Pl. 1 (1753) 81; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 262; Gilliland, Rev. Fl. Malaya 3 (1971) 51; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 154; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 34, fig. 21; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 16, 168, 234. **Synonyms:** *Arundo latifolia* Salisb., Prodr. Stirp. Chap. Allerton (1796) 24, nom. illeg. superfl. – *Donax arundinacea* P.Beauv., Ess. Agrostogr. (1812) 77, 152, pl. 16: fig. 4, 5, pl. 19: fig. 1. – *Scolochloa arundinacea* Mert. & J.W.D.Koch in Röhling, Deutschl. Fl., ed. 3, 1 (1823) 539, nom. illeg. superfl. – *Cynodon donax* (L.) Raspail, Ann. Sci. Nat. (Paris) 5 (1825) 302. – *Scolochloa donax* (L.) Gaudin, Fl. Helv. 1 (1828) 202. – *Donax donax* Asch. & Graebn., Fl. Nordostdeut. Flachl., fasc. 1 (1898) 101, nom. inval. – *Arundo glauca* Bubani, Fl. Pyren. 4 (1901–1902) 303, nom. illeg. non M.Bieb. (1808). **Type:** *Collector unknown s.n.*, ‘Habitat in Hispania, Galloprovincia’ (lectotype L [Herb. van Royen, sheet no. 912.356-93], designated by Renvoise in Jarvis, List Linn. Gen. Names Types (1993) 21). **Fig. 9C.**

Arundo versicolor Mill., Gard. Dict., ed. 8 (1768) *Arundo* no. 3. **Synonyms:** *Arundo donax* L. ‘Versicolor’ (Mill.) Stokes, Bot. Mat. Med. 1 (1812) 160; Kunth, Révis. Gramin. 1 (1829) 78, isonym. – *Arundo donax* L. f. *versicolor* (Mill.) Beetle, Phytologia 38 (1978) 174. **Type:** [Published illustration] ‘*Arundo laconica versicolor*, Park.’, Morison, Pl. Hist. Univ. 3 (1699) sect. 8, 219, t. 8: fig. 9, lectotype designated by Turner et al., Gard. Bull. Singapore 71 (2019) 9.

Culms loosely tufted, little-branched, 1.5–8 m long, nodes glabrous, tips erect. **Ligules** 1–3 mm long, sometimes long-hairy on the back. Leaf blades **inrolled** when young, later with some shallow impressions caused by the higher sheaths when in bud, linear, 15–100 cm by 8–70 mm, glabrous, very scabrid, green, base rounded. **Panicles** 30–75 × 6–10 cm, branches many (in whorls), longest branch 20–30 cm long, branched. **Spikelets** 10–14 mm long (excl. awns), rachilla internodes between the glumes c. 0.8 mm long, between the anthoecia c. 1.7 mm long and articulated. Lower **glume** 11–13 mm long, c. 0.8 times as long as spikelet. **Callus** short, blunt, hairy. First **lemma** 8–12 mm long, with 6–8 mm long hairs at base, awn 1.5–3.5 mm long. First **palea** 5–5.5 mm long. **Anthers** 2.5–3 mm long.

Distribution. Mediterranean to southern China, widely cultivated elsewhere, e.g. in Singapore in a form with striped blades (cultivar ‘Versicolor’). In Singapore it was brought into cultivation in the nineteenth century and can appear to be naturalised (*Murton 54*, Dec 1877, SING [SING0041399]).

Ecology. Cultivated, sometimes long-persistent along shores, ditches, marshy places, with fairly nutritious, aerated soil, thereby appearing to be naturalising.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. Apparently rarely flowering, fruits not seen, propagating vegetatively. The leaves of the cultivar ‘Versicolor’ may revert to a standard green colour.

7. AXONOPUS P.Beauv.

(Greek, *axono-* = axis, *-pus* = foot; referring to the subdigitate racemes)

Ess. Agrostogr. (1812) 12; Jagoe, Gard. Bull. Singapore 11 (1940) 109; Black, Advancing Frontiers Pl. Sci. 5 (1963) 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 320. **Synonym:** *Paspalum* L. sect. *Emprosthion* Döll in Martius, Fl. Bras. 2(2), fasc. 72 (1877) 100. **Type:** *Axonopus aureus* P.Beauv., lectotype designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 142.

Perennials. **Culms** rhizomatous, stoloniferous, tufted, solid, branching intra-vaginally at base. **Sheaths** compressed, keeled. **Ligules** collar-shaped, 0.4–0.5 mm long, densely fringed/ciliolate. Leaf blades inrolled when young, flat or folded, obtuse. **Inflorescences** terminal, 1–5 from the upper leaf sheath, racemes subdigitate, lax, 2–7. **Spikelets** solitary, 2-flowered, falling entire, subsessile, secund, abaxial (but may seem adaxial when the lower glume is absent, and the lower epaleate lemma is interpreted as the upper glume!), dorso-ventrally compressed, muticous. Callus truncate. Lower **glume** absent; upper glume as long as the spikelet, 4- or 5-nerved, herbaceous. Lower **lemma** shorter than to about as long as the spikelet, epaleate, sterile; upper lemma coriaceous, germination flap present, margins inrolled over the palea, muticous.

Distribution. A genus of approximately 110 species, mainly in America. In Singapore 2 species are naturalised.

Taxonomy. The genus belongs to the *Panicoideae* – *Paspalinae* Griseb. The two Singapore species were extensively compared by Jagoe (Gard. Bull. Singapore 11 (1940) 109–118).

Key to *Axonopus* species

1. Nodes hairy; blades inrolled when young, later flat, usually distinctly pectinately pilose along the margins; fertile lemma distinctly shorter than the upper glume and sterile lemma **1. A. compressus**
- Nodes (sub)glabrous; blades folded, usually with glabrous margins, sometimes with some long hairs mainly at base; spikelets obtuse to subacute; fertile lemma only slightly shorter than the upper glume and sterile lemma **2. A. fissifolius**

1. *Axonopus compressus* (Sw.) P.Beauv.

(Latin, *compressus* = compressed; referring to the basal sheaths)

Ess. Agrostogr. (1812) 12, 154; Ridley, Fl. Malay Penins. 5 (1925) 216; Henderson, Malay. Wild Fls., Monocot. (1954) 337, fig. 193a,d; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 278; Gilliland, Rev. Fl. Malaya 3 (1971) 187, fig. 39, pl. 20d; Turner, Gard. Bull. Singapore 45 (1993) 93; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 154, fig. 252; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 36, fig. 22, pl. 4; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 17, 168, 265. **Basionym:** *Milium compressum* Sw., Prodr. (1788) 24. **Synonyms:** *Agrostis compressa* (Sw.) Poir. in Lamarck, Encycl., Suppl. 1, fasc. 1 (1810) 259, nom. illeg. non Willd. (1790). – *Paspalum compressum*



Figure 10. *Axonopus compressus* (Sw.) P.Beauv. **A.** Detail of raceme. **B.** Culm with leaves. (From Singapore, exact locality uncertain. Photos: H. Duistermaat).

(Sw.) Raspail, Ann. Sci. Nat. (Paris) 5 (1825) 301, nom. illeg. non Raf. (1817); Nees in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 23; J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 212. – *Anastrophus compressus* (Sw.) Schtdl. ex Nash in Small, Fl. S.E. U.S. (1903) 79. – *Echinochloa compressa* (Sw.) Roberty, Petite Fl. Ouest-Africain (1954) 398; Roberty, Bull. Inst. Franc. Afrique Noire, A 17 (1955) 66. **Type:** *Shakespear s.n.*, Jamaica (lectotype BM [BM000578790], designated by Pohl & Davidse, Fl. Mesoamer. 6 (1991) 357). **Fig. 9D, 10.**

Paspalum platycaulon Poir. in Lamarck, Encycl. 5 (1804) 34; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, as '*platycaule*'; Nees in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 24, as '*platyculmum*'. **Synonyms:** *Digitaria platycaulon* (Poir.) Desv., Opusc. Sci. Phys. Nat. (1831) 62, as '*platycaulis*'. – *Anastrophus platycaulon* (Poir.) Nash in Small, Fl. S.E. U.S. (1903) 79, as '*platycaulis*'. – *Panicum platycaulon* (Poir.) Kuntze, Revis. Gen. Pl. 3(3) (1898) 363, as '*platycaulon*'. **Type:** *Ledru s.n.*, Puerto Rico (holotype P-LA [P00564007]).

Culms erect to geniculate, lawn-forming, 0.15–0.45(–0.8) m long; nodes pubescent, contra ligule a sparse row of hairs. Leaf blades inrolled when young, later flat, 4–15(–25) cm by 4.5–9.5 mm, usually pectinately pilose along the margins. **Peduncles** 1–5. **Racemes** 2–5, 3–13

cm long. **Spikelets** oblong, 2–2.5 mm long, ± obtuse. Upper **glumes** 5-nerved. Fertile **lemma** distinctly shorter than the upper glume and sterile lemma. **Anthers** c. 0.6 mm long.

Distribution. Native of tropical America, introduced elsewhere as a lawn grass and becoming widely naturalised. In Singapore collected in Singapore Botanic Gardens (*Ridley 11467*, 1903, SING [SING0041404]), Bukit Timah (*Corner s.n.*, 15 Jul 1939, SING [SING0041406]), Holland Road (*Duistermaat 14*, 4 Feb 2002, SING [SING0059184]), Upper Pierce (*Duistermaat et al.* 156, 26 Aug 2003, SING [SING0059405]) and many of the offshore islands such as Kusu Island (*Chua et al. K 68*, 28 Jan 1994, SINU).

Ecology. Lawns, pastures, moderately shade-tolerant and entering disturbed places even in primary forest, preferring well-drained lighter soils, becoming dominant.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. Widely cultivated as a lawn grass as it is able to withstand trampling and frequent mowing.

Vernacular names. *Carpet grass* (English), *rumpit tikar* (Malay).

Notes. This is now probably the most common grass species in Singapore.

2. *Axonopus fissifolius* (Raddi) Kuhlmann

(Latin, *fissi-* = divided, *-folius* = leaves; presumably referring to the basal leaves in the type specimens)

Relat. Commiss. Linhas Telegr. Estratég. Matto Grosso Amazonas 5(11) (1922) 87; Chase, J. Wash. Acad. Sci. 13 (1923) 172, isonym; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 154; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 36, fig. 23; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 17, 168, 265. **Basionym:** *Paspalum fissifolium* Raddi, Agrostogr. Bras. (1823) 26, as '*Paspalus fissifolius*'. **Type:** *Raddi s.n.*, Brazil (lectotype PI, designated by Judziewicz, Fl. Guianas, ser. A, Phanerogams 8 (1990) 98; isolectotypes BAA, BM, FI [FI004592], G, K [K000643281], US (fragment), W [W19040012152]). **Fig. 9E.**

Axonopus affinis Chase, J. Wash. Acad. Sci. 28 (1938) 180; Gilliland, Rev. Fl. Malaya 3 (1971) 189; Turner, Gard. Bull. Singapore 45 (1993) 93. **Synonym:** *Axonopus compressus* (Sw.) P.Beauv. var. *affinis* (Chase) M.R.Hend., Malayan Nat. J. 6 (1950) 339. **Type:** *Kearny 175*, USA, Mississippi, Waynesboro, 2 October 1896 (holotype US [US00139602]; isotypes GH [GH00023151], MO [MO-016675], US [US00139603]).

Culms erect to geniculate, mat-forming, 0.25–0.75 m long; nodes glabrous or sparsely appressed hairy. Leaf blades folded when young and later, 5–25 cm by 2–7 mm, margins usually glabrous, sometimes with some long hairs mainly at base. **Peduncles** 1 or 2(–5); racemes 2–7, 2–12 cm long. **Spikelets** oblong, (1.7–)2–2.25 mm long, ± obtuse. Upper **glumes** 4(or 5)-nerved. Fertile **lemma** only slightly shorter than the upper glume and sterile lemma. **Anthers** 0.7–0.8 mm long.

Distribution. Native of (sub)tropical America, widely introduced elsewhere as a lawn grass and widely naturalising. In Singapore it has been collected from Gallop Road (*Duistermaat* 212, 14 Oct 2003, SING [SING0059323]), MacRitchie (*Chin* 4505, 6 Nov 1993, SING [SING0058910]), Pulau Ubin (*Latifah* 1, 17 Jun 1990, SINU) and Upper Pierce (*Duistermaat et al.* 155, 26 Aug 2003, SING [SING0059321]).

Ecology. A more drought-resistant grass than *Axonopus compressus* and better able to tolerate shade.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. Very similar to *Axonopus compressus*. As well as the characters in the key its blades are generally narrower and darker green than those of *Axonopus compressus*. It is no doubt more widely naturalised but under-collected because of confusion with the much more common *Axonopus compressus*.

8. BOTHRIOCHLOA Kuntze

(Greek, *bothrio-* = pitted, *-chloa* = grass; referring to the pit on the lower glume in some species)

Revis. Gen. Pl. 2 (1891) 762; Sumidijaya & Veldkamp, Reinwardtia 12 (2009) 415; Neamsuvan et al., Gard. Bull. Singapore 61(1) (2009) 129; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 311. **Synonym:** *Dichanthium* Willemet sect. *Bothriochloa* (Kuntze) Roberty, Boissiera 9 (1960) 159. **Type:** *Bothriochloa anamitica* Kuntze (= *Bothriochloa bladhii* (Retz.) S.T.Blake).

Andropogon L. sect. *Amphilophis* Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 2 (1832) 285, 279. **Synonyms:** *Andropogon* L. subg. *Amphilophis* (Trin.) Trin. ex Hack. in Martius, Fl. Bras. 2(3), fasc. 90 (1883) 291. – *Amphilophis* (Trin.) Nash in Britton, Man. Fl. N. States (1901) 71. – *Dichanthium* Willemet sect. *Amphilophis* (Trin.) Roberty, Boissiera 9 (1960) 167. **Type:** *Andropogon laguroides* DC., lectotype designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 3 (= *Bothriochloa laguroides* (DC.) Herter).

Perennials. **Culms** tufted. **Sheath** keeled, glabrous. **Ligules** membranous. Leaf blades linear, narrow, flat. **Inflorescence** of subdigitate or paniculate racemes; joints and pedicels with a translucent resinous channel, flattened. Homogamous spikelets absent. **Sessile spikelets** dorsally compressed, lower floret neuter. Lower **glumes** smooth or pitted, 7–11-nerved, chartaceous to membranous, laterally 2-keeled, margin inflexed; upper glumes boat-shaped, 3-nerved, 3-keeled, subchartaceous to hyaline, margin inflexed. Upper **lemmas** continuous with the geniculate and twisted awn. **Pedicelled spikelets** (1- or 2-flowered, the lower floret male or neuter, the upper neuter or more often suppressed; lower lemmas muticous.

Distribution. A genus of approximately 33 (sub)tropical species. In Singapore 1 naturalised species.

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoninae* J.Presl.

Bothriochloa bladhii (Retz.) S.T.Blake

(Peter Johan Bladh, 1746–1866, Finnish merchant of the Swedish East Indian Company in Canton [Guangzhou], China)

Proc. Roy. Soc. Queensland 80 (1969) 62; Turner, Gard. Bull. Singapore 45 (1993) 93; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 157; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 36, fig. 24; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 19, 168, 269. **Basionym:** *Andropogon bladhii* Retz., Observ. Bot. 2 (1781) 27. **Synonyms:** *Andropogon annulatus* Forssk. var. *bladhii* (Retz.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 572. – *Dichanthium bladhii* (Retz.) Clayton, Kew Bull. 32 (1978) 3. **Type:** *Bladh s.n.*, China (lectotype LD [LD1218006], designated by Blake, Proc. Roy. Soc. Queensland 80 (1969) 62). **Fig. 9F.**

Andropogon intermedius R.Br., Prodr. Fl. Nov. Holland. (1810) 202; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 166; Henderson, Malay. Wild Fls., Monocot. (1954) 346, fig. 196c,d. **Synonyms:** *Andropogon intermedius* R.Br. var. *genuinus* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 485, nom. inval. – *Sorghum intermedium* (R.Br.) Kuntze, Revis. Gen. Pl. 2 (1891) 792. – *Amphilophis intermedia* (R.Br.) Stapf, Agric. News (Barbados) 15 (1916) 179; Stapf, Fl. Trop. Afr. 9(1) (1917) 174. – *Bothriochloa intermedia* (R.Br.) A.Camus, Ann. Soc. Linn. Lyon, new ser. 76 (1931) 164; Gilliland, Rev. Fl. Malaya 3 (1971) 281. – [*Dichanthium ischaemum* (L.) Roberty subvar. *intermedium* (R.Br.) Roberty, Boissiera 9 (1960) 160, nom. inval.]. **Type:** *Brown 6184*, Australia, Keppel Bay (lectotype BM [BM000939608], designated by Blake, Proc. Roy. Soc. Queensland 80 (1969) 62; isolectotypes E [E00386956], F, K [K001057467]).

Andropogon glaber Roxb., [Hort. Bengal. (1814) 7, nom. nud.] Fl. Ind. 1 (1820) 271. **Synonyms:** *Andropogon intermedius* R.Br. subvar. *glaber* (Roxb.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 487. – *Amphilophis glabra* (Roxb.) Stapf, Fl. Trop. Afr. 9(1) (1917) 172; Ridley, Fl. Malay Penins. 5 (1925) 209. – *Bothriochloa glabra* (Roxb.) A.Camus, Ann. Soc. Linn. Lyon, new ser. 76 (1931) 164. – *Dichanthium ischaemum* (L.) Roberty subvar. *glabrum* (Roxb.) Roberty, Boissiera 9 (1960) 159. – *Bothriochloa bladhii* (Retz.) S.T.Blake subsp. *glabra* (Roxb.) B.K.Simon, Austrobaileya 3 (1989) 79. **Type:** *Roxburgh s.n.*, Bengal (lectotype BM [BM000959769], designated by Simon, Austrobaileya 3 (1989) 79).

Culms erect to geniculate, stout, 0.4–2 m, nodes glabrous or pubescent. Leaf **sheaths** glabrous; **ligules** 1–1.3 mm long; **leaf** blades inrolled when young, 15–43 by 6–10 mm, lower surface glabrous, upper surface scabrous and covered with long hairs at the base, base subcordate, apex long acuminate, margin scaberulous. **Panicles** 12–17 × 4–5 cm, axis 2.5–15 cm long; racemes whorled, simple or divided, 13–21, 4–7 cm long, the lowest raceme shorter than the common axis, joints 1.5–2.3 mm long. **Sessile spikelets** elliptic, 2.5–3.8 mm long. Lower **glumes** elliptic to oblong, greenish yellow, obscurely 7–9-nerved, occasionally 1-pitted, basal half and margin upper half hairy; upper glumes 2.5–3 × 1–1.2 mm, sparsely hairy on upper part of keel. Upper **lemmas** awn 13–15 mm long. **Anthers** 1–1.5 mm long. **Pedicelled spikelets** 2.5–3 mm long with pedicels 2–2.5 mm long.

Distribution. Tropical Africa to southern China and through continental Southeast Asia and Malesia to Australia. Possibly native in Singapore but doubt arises due to the lack of older collections. It has been collected on Holland Road (*Duistermaat & Vermeulen 091*, 3 Jun 2002, L, K, SING [SING0059376]), Pulau Serangoon (*Tan 1165*, 22 Dec 2003, SINU), Pulau Ubin (*Duistermaat 228*, 15 Nov 2003, SING [SING0059403]), Sungei Buloh (*Duistermaat et al.*

70, 19 Mar 2002, L, SING [SING0059324]), the Western Catchment (*Samsuri et al. WC 50*, Apr 2004, SING [SING0054310]) and many other parts of Singapore.

Ecology. Sunny or slightly sheltered grasslands, *Imperata* fields and roadsides.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC) if it is native at all.

Vernacular name. *Long-leaved beard grass* (English).

Notes. It is a promiscuous species forming hybrids at the tetraploid level with species of *Bothriochloa*, *Capillipedium*, and *Dichanthium*. Recently, 2 specimens (*Chen SING2017-762*, SING [SING0255910] and *Chen SING2017-763*, SING [SING0255911], both from Bishan-Ang Mo Kio Park) were collected that are suspected to be a hybrid with *Dichanthium annulatum*, both with imperfectly furrowed pedicels and malformed pollen (Fig. 22).

The crushed leaves have a turpentine aroma which persists in dried specimens as a ‘warm’ taste (Gardner, Rec. Auckland Mus. 44 (2007) 48).

9. CENCHRUS L.

(Greek, *cenchros* = millet; common millet is, however, *Panicum miliaceum* L.)

Sp. Pl. 2 (1753) 1049; DeLisle, Iowa State Coll. J. Sci. 37 (1963) 259; Veldkamp, Blumea 59(1) (2014) 59; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 333. **Synonyms:** *Echinaria* Heist. ex Fabr., Enum. (1759) 206, nom. rej. – *Raram* Adans., Fam. Pl. 2 (1763) 35, 597, nom. illeg. superfl. – *Nastus* Lunell, Amer. Midl. Naturalist 4 (1915) 214, nom. illeg. non Juss. (1789). **Type:** *Cenchrus echinatus* L., lectotype designated by Nash in Britton & Brown, Ill. Fl. N. U.S., ed. 2, 1 (1913) 166.

Pennisetum Rich. in Persoon, Syn. Pl. 1 (1805) 72; Leeke, Z. Naturwiss. 79 (1907) 1; Chase, Contr. U.S. Natl. Herb. 22 (1921) 209. **Synonyms:** *Penicillaria* Willd., Enum. Pl. (1809) 1036, nom. illeg. superfl.; Kunth, Mém. Mus. Hist. Nat. 2 (1816 [‘1815’]) 71, as ‘*Penicellaria* Sw.’ **Type:** *Pennisetum typhoideum* (L.) Rich., nom. illeg. superfl., lectotype designated by Hitchcock, U.S.D.A. Bull. 772 (1920) 245 (= *Cenchrus americanus* (L.) Morrone).

Annuals or perennials. **Culms** branching intra-vaginally at base, tufted, hollow to solid. **Ligule** a ciliate rim or a row of hairs. Leaf blades inrolled when young. **Inflorescence** a spike or contracted raceme, or spike-like, branches with 1–6 spikelets, surrounded by a sessile to shortly stipitate involucre of setae or bur-like with spiny bracts, usually deciduous as a whole, sometimes apparently 1-flowered by absence of glumes and epaleate first lemma. **Spikelets** quaquaversal, abaxial, sessile or shortly pedicelled, dorso-ventrally compressed. **Glumes** 0–2, very unequal, shorter than the adjacent lemmas, acute, 0–5-nerved; lower glume absent to well-developed, 0- or 1-nerved; upper glume 0–5-nerved. First **lemma** epaleate or paleate, neuter or male, 3–11-nerved; second lemma membranous to leathery, 5–7-nerved, smooth, germination flap present, margins lying flat on the palea.

Distribution. A genus of approximately 110 pantropical species. In Singapore 4 naturalised species.

Taxonomy. The genus belongs to the *Panicoideae* – *Cenchrinae* Dumort. Molecular phylogenetic studies have shown that *Cenchrus* is nested within *Pennisetum* with the first name having priority (Chemisquy et al., *Ann. Bot. (Oxford)* 106 (2010) 107).

Notes. The cultivated species that was included in Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 67, 170, 253) under the name *Pennisetum alopecuroides* (L.) Spreng. is now treated as *Cenchrus purpurascens* Thunb. (not to be confused with the different species *Cenchrus purpureus* (Schumach.) Morrone). As there are suggestions it has naturalised elsewhere it is included in the key in italics but not treated further.

Key to *Cenchrus* species

1. Involucre composed of scales or bristles, usually distinctly connate in the lower parts and bur-like 2
 Involucre composed of bristles, free at base 3
2. Burs crowded, 1–2 mm distant, outer main bristles erect, up to $7 \times 0.1\text{--}0.2$ mm, subequal to longer than the inner spines of the bur, 0.1–0.2 mm wide, margin with up to 0.5 mm long cilia; spikelets 4–7 mm long **1. *C. brownii***
 Burs loosely spaced, 1.5–4 mm distant, outer main bristles recurved, up to $4 \times 0.3\text{--}0.5$ mm, mostly less than one-half the length of the inner spines of the bur, margin with at least a few hairs 1–1.5 mm long; spikelets 5–6.2 mm long **2. *C. echinatus***
3. Ligule c. 0.2 mm long; involucre stipitate **3. *C. purpureus***
 Ligule 1.3–3.5 mm long; involucre not stipitate 4
4. Blades margins scaberulous; peduncle glabrous below the panicle, common axis scaberulous; bristles densely crinkly pilose around the spikelet (some outer ones excepted), a few distinctly longer than the others **4. *C. setosus***
 Blade margins smooth; peduncle puberulous to pilose below the panicle, common axis scaberulous to pubescent; bristles unequal, scaberulous *C. purpurascens*

1. *Cenchrus brownii* Roem. & Schult.

(Robert Brown, 1773–1858, Scottish botanist and pioneering cell biologist)

Syst. Veg., ed. 15 bis, 2 (1817) 258; Keng et al., *Concise Fl. Singapore*, vol. 2, Monocot. (1998) 157, fig. 258; Duistermaat, *Gard. Bull. Singapore* 57, Suppl. (2005) 37, fig. 25; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 24, 168, 265. **Synonym:** *Cenchrus inflexus* R.Br., *Prodr. Fl. Nov. Holland.* (1810)195, nom. illeg. non Poir. (1804). **Type:** *Brown 6140*, Australia, Arnheim South Bay, 6 February 1803 (lectotype BM [BM000795713], designated by DeLisle, *Iowa State Coll. J. Sci.* 37 (1963) 280; isolecotypes E, K [K000215206], P, US (fragment) [US00956314]). **Fig. 11A.**

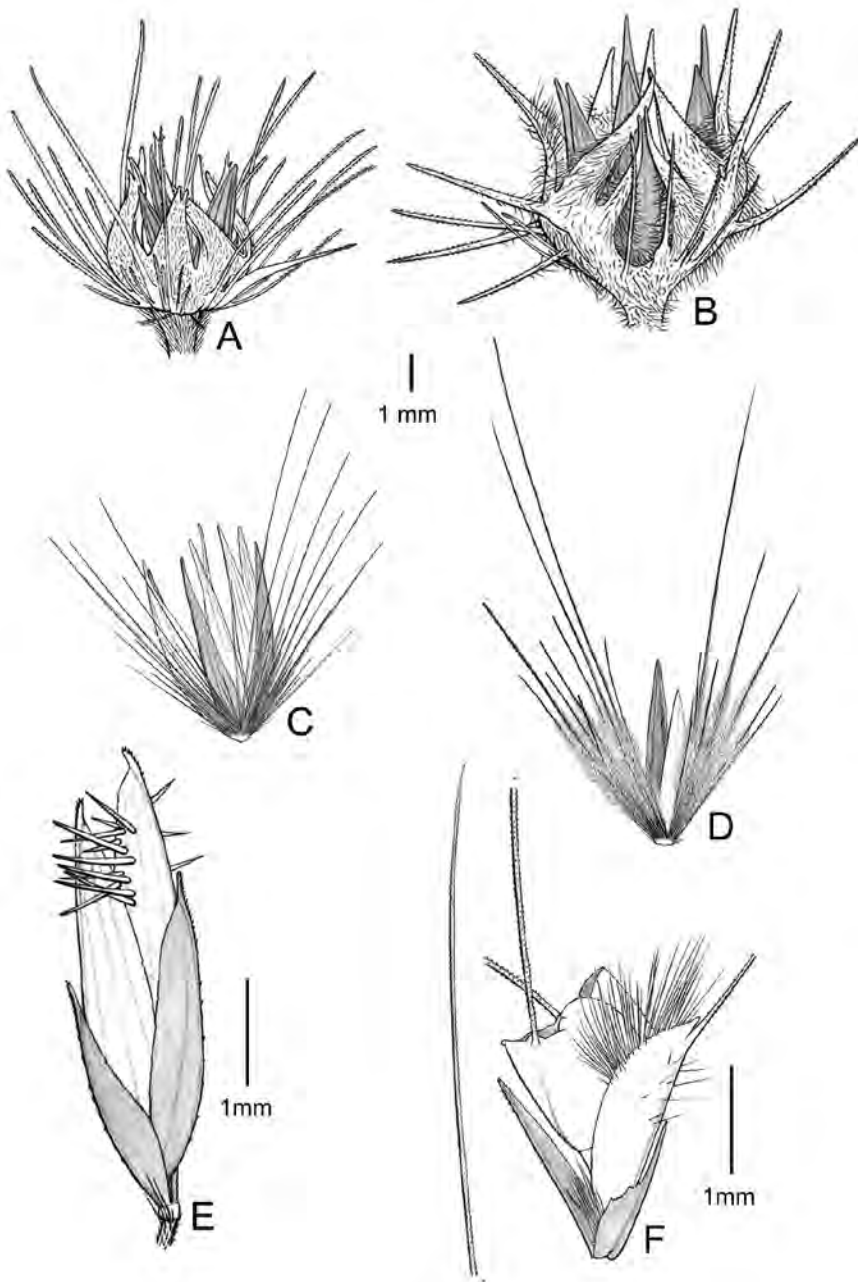


Figure 11. *Cenchrus brownii* Roem. & Schult. **A.** Bur with an involucre and several spikelets. *Cenchrus echinatus* L. **B.** Bur with an involucre and several spikelets. *Cenchrus purpureus* (Schumach.) Morrone. **C.** Group of three spikelets surrounded by involucre of bristles. *Cenchrus setosus* Sw. **D.** Spikelet surrounded by involucre of bristles. *Cenotoheca lappacea* (L.) Desv. **E.** Spikelet lateral view. *Chloris barbata* Sw. **F.** Spikelet lateral view. (Drawn by J.J. Vermeulen).

Annuals. **Culms** 0.25–1 m long, erect to geniculate at base, rooting at the decumbent nodes. **Ligule** 0.75–1.7 mm long. **Leaf** blades 8–38 cm by 4–15 mm. **Inflorescence** 3–8(–12) cm long; common axis scaberulous, internodes 0.8–2.25 mm long; stipe 1–1.5 by 0.45–1.5 mm, base obconical, pubescent. **Burs** crowded, 1–2 mm distant, 4.7–7 × 2.4–5 mm, tawny and becoming purple; outer main bristles subequal to the burs, 0.1–0.2 mm wide, erect, retrorsely barbed, hairs up to 0.5 mm long; inner spines 6–10, connate for more than halfway above the base, erect to interlocking, subequal, puberulous to margins pilose. **Spikelets** 2–4 per bur, 4.3–6.45 mm long. Lower **glume** absent to 2.5 mm long, 1-nerved; upper glume 3.15–5.25 mm long, 3–5-nerved. First **lemma** epaleate to paleate, sterile to male, 4–6 mm long, 3–5-nerved; second lemma 4.3–6.45 mm long. **Anthers** 0.8–1.5 mm long.

Distribution. Originally from Central and South America, introduced and naturalising elsewhere. In Singapore it has been collected from Changi Point (*Wong* 22 May 1959, SINU), East Coast Laguna (*Duistermaat & Vermeulen* 305, 29 Aug 2004, SING [SING0059325]), Pulau Serangoon (*Tan* 1168, 22 Dec 2003, SINU), Pulau Tekong (*Tan et al.* T 2043-a, 20 Aug 1996, SINU), Sungei Punggol (*Tan* 796, 26 Nov 2003, SINU) and many other places around Singapore.

Ecology. Sandy beaches, waste places, road sides.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. A noxious weed because of its clinging burs. Nearly all previous specimen identifications as *Cenchrus echinatus* are actually of *Cenchrus brownii*.

2. *Cenchrus echinatus* L.

(Latin, *echinatus* = spiny like a hedge-hog or sea-urchin;
referring to the shape of the burs)

Sp. Pl. 2 (1753) 1050; Turner, Gard. Bull. Singapore 45 (1993) 93; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 38, fig. 26, pl. 3; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 24, 168, 265. **Type:** *Collector unknown s.n.*, ‘Habitat in Jamaica, Curassao’ (lectotype L [Herb. van Royen, sheet no. 912.356-116], designated by Veldkamp in Jarvis et al., List Linn. Gen. Names Types (1993) 31). **Fig. 11B, 12.**

Annuals. **Culms** 0.15–0.6(–1) m long, erect to geniculate at base, rooting at the decumbent nodes (sometimes). **Ligule** 0.7–1.7 mm long. **Leaf** blades 4–26(–35) cm by 3.5–8(–12) mm. **Inflorescence** 3–7(–10) cm long; common axis scaberulous, internodes 2–3 mm long; stipe 1–3 by 2.2–3.6 mm, base obconical, pubescent. **Burs** loosely spaced, 1.5–4 mm distant, 4–7(–10) × 3.5–6 mm, becoming purple; outer main bristles recurved, shorter than the inner spines, c. 4 × 0.3–0.5 mm, retrorsely barbed, hairs 1–1.5 mm long; inner spines c. 10, connate for more than halfway above the base, forming a closed bur, flat, erect to sometimes interlocking, subequal, puberulous, margins densely pilose. **Spikelets** (1)–2–4(–6) per bur, 5–7 × c. 2 mm. Lower **glume** 1.3–3.4 mm long, 1-nerved; upper glume 3.8–5.7 mm long, 3–5-nerved. First **lemma** paleate, sterile, 4.5–6.4 mm long, 3–5-nerved; second lemma 4.7–7 mm long. **Anthers** 0.8–2.4 mm long.



Figure 12. *Cenchrus echinatus* L. **A.** Habit. **B.** Inflorescence with burs. **C.** Detail of leaf sheath and blade. (From Singapore, Bishan Park, *Chen SING2017-760*. Photos: L.M.J. Chen).

Distribution. Warmer regions of the New World, introduced and naturalising elsewhere. In Singapore it has been collected at Bishan-Ang Mo Kio Park (*Chen SING2017-760*, 12 Dec 2017, SING [SING0255909]), Labrador Villa Road (*Duistermaat 230*, 25 Nov 2003, SING [SING0059326]), Orchard Road (*Duistermaat 149*, 31 May 2003, SING [SING0059375]), Pulau Tekong (*Samsuri et al. 290*, Jan 2002, SING [SING0039961]), Pulau Ubin (*Duistermaat 120*, 16 Mar 2003, L, SING [SING0059183]) and other places.

Ecology. Waste places, beaches, road sides, fields, grassy slopes.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

3. *Cenchrus purpureus* (Schumach.) Morrone

(Latin, *purpureus* = purple; referring to the colour of the bristles and lemmas)

in Chemisquy et al., *Ann. Bot. (Oxford)* 106 (2010) 129. **Basionym:** *Pennisetum purpureum* Schumach., *Beskr. Guin. Pl.* (1827) 44; Henderson, *Malay. Wild Fls., Monocot.* (1954) 325, fig. 186g,h; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 1717; Gilliland, *Rev. Fl. Malaya* 3 (1971) 162, fig. 32, pl. 20c; Turner, *Gard. Bull. Singapore* 45 (1993) 101; Keng et al., *Concise Fl. Singapore*, vol. 2, *Monocot.* (1998) 177, fig. 281; *Duistermaat, Gard. Bull. Singapore* 57, *Suppl.* (2005) 110, fig. 113, pl. 27; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 67, 170, 267. **Type:** *Thonning 355*, Guinea [Ghana] (lectotype C [C10004308], designated by Hepper, *W. Afr. Herb. Isert Thonning* (1976) 149; isolectotype BM). **Fig. 11C, 13A.**

Perennials. **Culms** erect to geniculate at base, rooting at the decumbent nodes, stoloniferous (stolons up to 1 m long), rhizomatous, 1–4(–6) m long, solid, nodes glabrous or rarely pilose. **Sheaths** glabrous. **Ligule** a setose rim, 0.2–0.5 mm long, setae 2–4 mm long. **Leaf blades** flat, 16–150 cm by 4–40 mm, margins spinulose, below glabrous, above (sparsely) pilose. **Inflorescence** paniculate; peduncle pilose below the panicle; panicle 7–30 cm long; common axis smooth to inconspicuously ribbed, densely hairy. **Involucre** stipitate, disarticulating at base; bristles many, rather stiff, the inner ones 5–12 mm long, pilose, one distinctly longer than the others, 14–25 mm long. **Spikelets** 1–4 within the involucre (1 or 2 bisexual, the others ones male, shortly pedicelled, 1-flowered), pedicelled, the bisexual ones 5.5–6.5 mm long. Lower **glume** 0–1 mm long, 0–0.1 times as long as the upper glume; upper glume 1–3 mm long, 0- or 1-nerved. First **lemma** usually epaleate, sterile, sometimes paleate, male, rarely bisexual, acute to acuminate, membranous, 3–5-nerved, glabrous, nerves scaberulous; second lemma 4.7–6.5 mm long, acuminate, membranous. **Anthers** 2.25–3.75 mm long, apex penicillate.

Distribution. Native to tropical Africa, cultivated and escaping elsewhere. In Singapore collected on Buona Vista Road (*Chan 25 Aug 1984*, SINU), Clementi Road (*Chua & Tan 979*, 2 Feb 1994, SINU), Jalan Ulu Seletar (*Chua & Tan 385*, 5 Feb 1991, SINU), Lim Chu Kang (*Keng & Jumali 3222*, 22 Mar 1962, SINU), University grounds (*Jumali 117*, 20 Oct 1955, SINU) and other places.

Ecology. Disturbed sites, roadsides, fallow fields. Drought tolerant.



Figure 13. *Cenchrus purpureus* (Schumach.) Morrone. **A.** Detail of inflorescence with involucre. *Cenchrus setosus* Sw. **B.** Detail of two inflorescences with involucre. (From Singapore, exact locality uncertain. Photos: H. Duistermaat).

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular names. *Elephant grass, Napier grass* (English).

4. *Cenchrus setosus* Sw.

(Latin, *setosus* = setose; with stiff hairs)

Prodr. (1788) 26. **Synonyms:** *Pennisetum setosum* (Sw.) Rich. in Persoon, Syn. Pl. 1 (1805) 72. – *Pennisetum polystachion* (L.) Schult. subsp. *setosum* (Sw.) Brunken, Bot. J. Linn. Soc. 79 (1979) 63. **Type:** Swartz *s.n.*, Jamaica (lectotype S [S-R-969], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 143; possible isoelectotypes BM, G, LD, S [$\times 2$], SBT). **Fig. 11D, 13B.**

Pennisetum polystachion auct. non (L.) Schult.: Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 177; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 110, fig. 112, pl. 25; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 170, 267.

Annuals or perennials. **Culms** shortly rhizomatous, sometimes stoloniferous, erect to geniculate at base, not rooting at the decumbent nodes, 1–3 m long, lower ones hollow, upper ones filled with pith, nodes glabrous. **Sheaths** glabrous to hairy, margins glabrous to hairy in upper half.

Ligule a setose rim, setae 1.3–3.5 mm long. **Leaf blades** flat, 5–45 cm by 4–18 mm, margins scaberulous. **Inflorescence** paniculate; peduncle glabrous below the panicle; panicle 5–25 cm long; common axis with prominent ridges to decurrently winged below the spikelets, smooth to scaberulous. **Involucre** not stipitate, disarticulating at base; bristles many, rather stiff, densely crinkly pilose around the spikelet (some outer ones excepted), a few distinctly longer than the others, 5–11(–24) mm long, longest bristle 10–25 mm long. **Spikelets** 1 within the involucre, sessile, 3.15–5 mm long. Lower **glume** 0–1 mm long; upper glume 3.2–5 mm long, faintly 5-nerved, acute. First **lemma** paleate, sterile, erosely truncate, membranous, faintly 5-nerved, glabrous, nerves smooth; second lemma 1.8–2.25 mm long, acute, chartaceous. **Anthers** 1.1–1.8 mm long, apex glabrous.

Distribution. Originally from tropical Africa, introduced elsewhere. In Singapore it was already in cultivation by 1929 and naturalised by 1959 (Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 110). Collected from Orchard Road / Clemenceau Avenue (*Wong s.n.*, 14 Jun 1959, SINU), Bukit Timah Station (*Gwee SING2011-399*, 5 Oct 2011, SING [SING0166395]), Sungei Buloh (*Chua et al. SB 3020*, 13 Oct 1993, SINU), Pulau Ubin (*Chan 56*, Jun 1990, SINU), Pulau Tekong (*Samsuri et al. 298*, 4 Jan 2002, SING [SING0039969]) and many other parts of Singapore.

Ecology. Roadsides, abandoned fields, and other disturbed areas.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. Originally introduced in the region as a fodder grass but it has developed into a major pest.

Vernacular name. *Feather pennisetum* (English).

Notes. This species has generally been known as *Pennisetum polystachion* (L.) Schult., which was recently transferred to *Cenchrus polystachios* (L.) Morrone. Turner et al. (Gard. Bull. Singapore 71 (2019) 29) note, however, that the name was earlier typified by material that is identifiable as *Setaria flava* (Nees) Kunth and thus is a synonym of that species (the Linnean basionym being unavailable in *Setaria*). The correct name for the plant in Singapore is *Cenchrus setosus*.

Brunken (Bot. J. Linn. Soc. 79 (1979) 63) and Schmelzer (Euphytica 97 (1997) 1) have suggested that the annual diploid and perennial polyploid plants represent two subspecies or should be treated as distinct species. Otherwise there appear to be no morphological differences. As the bases of the plants are rarely collected, and the chromosome number is rarely known, they are usually impossible to distinguish.

10. CENTOTHECA Desv.

(Greek, *cento-* = prickly, *-theca* = a container;
referring to the bristly spikelets)

Nouv. Bull. Sci. Soc. Philom. Paris 2 (1810) 189, as '*Centosteca*', nom. cons.; Monod de Froideville, Blumea 19 (1971) 57; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 287. **Type:** *Centotheca lappacea* (L.) Desv.

Perennials. **Culms** tufted, rhizomatous, solid, branching intra-vaginally at base. **Ligule** membranous. Leaf blades inrolled when young, more or less pseudo-petiolate, broadly lanceolate to linear, with cross-nerves. **Panicles** lax. **Spikelets** 1–4-flowered, disarticulating above the glumes and between the lemmas, laterally compressed, upper floret (when present) reduced. **Glumes** persistent, unequal, shorter than the adjacent lemmas, 3–5-nerved. **Rachilla process** terminated by a reduced floret. **Lemmas** usually with retrorse bristles, dorsally keeled, apex apiculate to mucronate, 5–7-nerved, callus small, glabrous. **Stamens** 2.

Distribution. A genus of 4 species in the tropics of the Old World. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Centotheceae* Ridl.

Notes. *Centotheca longilamina* Ohwi, was reported for Singapore by Gilliland (Rev. Fl. Malaya 3 (1971) 53) but no herbarium or living material has been found. It differs from *Centotheca lappacea* as follows: Leaves 17–29.5 by 1.3–3 cm, 6.3–19.6 times as long as wide, base gradually cuneate, asymmetric. First lemma with retrorse bristles, apex obtuse to notched, at most shortly apiculate between the lobes. Anthers 1–1.25 mm long.

Centotheca lappacea (L.) Desv.

(Latin, *lappaceus* = bur-like;
referring to the retrorse bristles on the lemmas).

Nouv. Bull. Sci. Soc. Philom. Paris 2 (1810) 189; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 181; Ridley, Fl. Malay Penins. 5 (1925) 253; Henderson, Malay. Wild Fls., Monocot. (1954) 309, fig. 177d,f; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 515; Gilliland, Rev. Fl. Malaya 3 (1971) 53, fig. 4, pl. 9b; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 158, fig. 259; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 38, fig. 27, pl. 5; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 24, 168, 202. **Basionym:** *Cenchrus lappaceus* L., Sp. Pl., ed. 2, 2 (1763) 1488. **Synonyms:** *Centotheca latifolia* Trin., Fund. Agrost. (1820) 141, nom. illeg. superfl.; Turner, Gard. Bull. Singapore 45 (1993) 94. – *Melica lappacea* (L.) Raspail, Ann. Sci. Nat. (Paris) 5 (1825) 443. – *Uniola lappacea* (L.) Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 1 (1831) 358. – *Centotheca lappacea* (L.) Desv. f. *typica* Warb., Bot. Jahrb. Syst. 13 (1890) 263, nom. inval. – *Centotheca latifolia* Trin. f. *lappacea* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 765. **Type:** *Collector unknown s.n.*, India (neotype LINN [Herb. Linn. no. 1212.15], designated by Monod de Froideville, Blumea 19 (1971) 59). **Fig. 11E, 14.**



Figure 14. *Centotheca lappacea* (L.) Desv. Habit and detail of raceme in inset. (From Singapore, HortPark, *Chen SING2017-739*. Photos: L.M.J. Chen).

Culms 0.3–1 m tall. **Ligules** 1–2 mm long. Leaf blades (3.5–)5–16(–21) cm by (7.5–)10–30(–35) mm, (3.2–)4–6.9(–8) as long as wide, base asymmetric, contracted. **Panicles** up to 25 cm long, longest branches 6–12.5(–20.5) cm long. **Spikelets** (1–)2–4-flowered, 4–8 mm long. **Glumes** 2–4 mm long. First **lemma** 2.5–4.5 mm long, without retrorse bristles (upper ones with), acute to distinctly mucronate. **Anthers** 0.4–0.67 mm long.

Distribution. India to Polynesia and Australia (Queensland). In Singapore it is native with an unlocalised collection from 1822 (*Wallich s.n.* [EIC 3826B] Aug–Nov 1822, BM, CAL, K) and further collections from many parts of Singapore including Changi (*Ridley s.n.*, 1894, SING [SING0017712]), MacRitchie (*Jumali K 1073*, 11 Feb 1965, SINU), Pasir Panjang-HortPark (*Chen SING2017-739*, 6 Dec 2017, SING [SING0255906]) and Pulau Ubin (*Ali Ibrahim & Lai SING2011-503*, Nov 2011, SING [SING0182057]).

Ecology. Swamps, open places in rain forest, and along shaded roads and fields.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 24, 168, 202) but it is quite widespread and relatively common. It is assessed here as Least Concern (LC) in Singapore.

Vernacular names. *Barbed grass* (English), *rumput darah* (Malay).

Notes. The bristles of the lemmas attach themselves to the fur of animals and to clothing.

11. CHLORIS Sw.

(Greek, *Chloris* = goddess of vegetation; generally used to refer to a pale green colour)

Prodr. (1788) 25; Lazarides, Austral. J. Bot., Suppl. 5 (1972) 3; Anderson, Sci. Bull. Brigham Young Univ., Biol. Ser. 19 (1974) 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 386. **Synonyms:** *Chlorostis* Raf., Princ. Fond. Somiol. (1814) 26, 29, nom. illeg. superfl. – *Chloris* Sw. sect. *Euchloris* Endl., Gen. Pl., fasc. 2 (1836) 93, nom. inval. **Type:** *Chloris cruciata* (L.) Sw., lectotype designated by Nash in Britton & Brown, Ill. Fl. N. U.S., ed. 2, 1 (1913) 25.

Tufted to mat-forming annuals or perennials. **Culms** hollow to solid. **Ligule** a membranous, glabrous to pilose rim or collar. Leaf blades flat or folded, obtuse to acute. **Inflorescence** lax, composed of 4–17(–23) digitate spikes in one or several whorls, rachis not breaking up, ending in a spikelet. **Spikelets** solitary, secund, biseriate, abaxial, sessile, laterally compressed, with 1 fertile floret and distally with 1–3 (or 4) much reduced florets, disarticulating above the glumes. **Glumes** unequal, at least the lower shorter than the floret, 1-nerved, apex entire or shortly bifid, mucous or rarely the upper glume awned. First **lemma** 3-nerved, dorsally keeled, callus obtuse, bearded, apex usually obscurely 2-lobed, sometimes deeply so, awn 1, straight, simple. **Sterile anthoecia** usually reduced to the lemmas (and paleas), sometimes staminate. Sterile lemmas similar to or dissimilar to the fertile lemmas in size and shape, awned or not, always with a more or less conspicuous body, not reduced to only the awn.

Distribution. A genus of approximately 35 species in the tropical and warm temperate regions of the world. In Singapore 1 naturalised species.

Taxonomy. This genus belongs to the *Chloridoideae* – *Eleusininae* Dumort.

Notes. Three intergeneric hybrids with *Cynodon* Rich. have been described, two as *Cynochloris* Clifford & Everist, and another putative one with *Lepturus* R. Br., *Lepturopetium* Morat.

Chloris barbata Sw.

(Latin, *barbatus* = bearded; referring to the long hairs on the 1st lemma)

Fl. Ind. Occid. 1 (1797) 200; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 173; Ridley, Fl. Malay Penins. 5 (1925) 250; Henderson, Malay. Wild Fls., Monocot. (1954) 315, fig. 181a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 536; Gilliland, Rev. Fl. Malaya 3 (1971) 86; Turner, Gard. Bull. Singapore 45 (1993) 94; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 158, fig. 260; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 40, fig. 28, pl. 6; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 26, 168, 265. **Synonym:** *Andropogon barbatus* L., Mant. Pl. Altera (1771) 302, as '*barbatum*', nom. illeg. non L. (1759). **Type:** *Collector unknown s.n.*, 'India orientali' (lectotype LINN [Herb. Linn. no. 1211.21], designated by Judziewicz, Fl. Guianas, ser. A, Phanerogams 8 (1990) 136). **Fig. 11F, 15.**

Chloris inflata Link, Enum. Hort. Berol. Alt. 1 (1821) 105. **Type:** *Link s.n.*, Germany, hort. bot. Berol. [sem. ex California] (lectotype B [B100248047], designated by Merrill, Enum. Philipp. Fl. Pl. 4 (1926) 241; isolectotype US (fragment)).

Annuals. **Culms** without stolons, erect or decumbent and geniculate, rooting at the decumbent nodes, 0.5–0.9 m long; nodes glabrous. **Sheaths** flattened, glabrous. **Ligule** 0.3–0.5 mm long, pilose. Leaf blades inrolled when young, distichous, linear, 10–20 cm by 1–6 mm, base cuneate, apex acute. **Spikes** 7–17(–23), erecto-patent, in one whorl, sometimes with one spike below the whorl, straight to flexuous, (2–)4–7.5 cm by 3–4(–5) mm; rachis very narrowly winged, 0.1–0.2 mm wide, scabrous and hairy. **Spikelets** closely inserted on the rachis, 3- or 4-flowered, 3-awned, 1.9–2.3 mm long. Lower **glumes** 1.2–1.6 mm long; upper glumes 1.7–2.5 mm long. First **lemma** broadly ovate, 1.7–2.2 mm long, dorsally sparsely hairy, margins glabrous or subglabrous at base, margin with a subapical tuft of long hairs, apex obscurely lobed; awns 3–5.5 mm long. **Anthers** 0.4–0.5 mm long. **Sterile lemmas** 1–2(–3) first one moderately reduced, obtriangular, inflated, 0.9–1.2 × 0.8–1.2 mm, glabrous to subglabrous, 3-nerved, awns 1.5–5 mm long.

Distribution. Originally from tropical America, now common throughout the tropics of the world. Naturalised in Singapore and widely and frequently collected, including from Bishan-Ang Mo Kio Park (*Chen SING2017-764*, 12 Dec 2017, SING [SING0255912]), Pasir Panjang (*Feilding 5673*, 1892, SING [SING0229761]), Pulau Hantu (*Chua et al. H 57*, 28 Jan 1993, SINU), St. John's Island (*Teo SJC 28*, 2000, SINU) and Sungei Punggol (*Tan 798*, 26 Nov 2003, SINU).



Figure 15. *Chloris barbata* Sw. **A.** Three inflorescences. **B.** Detail of leaf sheath and blade. (From Singapore, A from Holland Road; B from Bishan Park, *Chen SING2017-764*. Photos: A, H. Duistermaat; B, L.M.J. Chen).

Ecology. Weed in disturbed, dry, sandy sites along roads, swampy land, dunes and grassland. Resistant to trampling and drought, thrives on saline or alkaline soil.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Plush grass* (English).

12. CHRYSOPOGON Trin.

(Greek, *chryso-* = gold, *-pogon* = beard; referring to the callus hairs in some species)

Fund. Agrost. (1820) 187, nom. cons.; Veldkamp, *Austrobaileya* 5 (1999) 503; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 292. **Synonyms:** *Phoenix* Haller, *Hist. Stirp. Helv.* 2 (1768) 202, nom. illeg. non L. (1753). – *Pollinia* Spreng., *Pl. Min. Cogn. Pug.* 2 (1815) 10, nom. rej. – *Andropogon* L. subg. *Chrysopogon* (Trin.) Hack. in Engler & Prantl, *Nat. Pflanzenfam.* 2(2) (1887) 28; Hackel in De Candolle & De Candolle, *Monogr. Phan.* 6 (1889) 547. – *Chalcoelytrum* Lunell, *Amer. Midl. Naturalist* 4 (1915) 212, nom. illeg. superfl. **Type:** *Chrysopogon gryllus* (L.) Trin., lectotype designated by Pfeiffer, *Nomencl. Bot.* 1(1) (1871-1873 [‘1873’]) 745.

Rhaphis Lour., Fl. Cochinch. (1790) 538, 552, nom. rej. **Synonym:** *Chrysopogon* Trin. sect. *Rhaphis* (Lour.) Roberty, Bull. Inst. Franç. Afrique Noire, A 22 (1960) 106. **Type:** *Rhaphis trivialis* Lour., nom. illeg. superfl. (= *Chrysopogon aciculatus* (Retz.) Trin.).

Vetiveria Lem.-Lis., Bull. Sci. Soc. Philom. Paris 1822 (1822) 43; Virey, J. Pharm. Sci. Accessoires 13 (1827) 499. **Synonyms:** *Andropogon* L. sect. *Vetiveria* (Lem.-Lis.) Thouars ex Benth., J. Linn. Soc., Bot. 19 (1881) 72. – *Andropogon* L. sect. *Petiveria* Benth. in Bentham & Hooker, Gen. Pl. 3(2) (1883) 1134, nom. illeg. superfl. – *Andropogon* L. subg. *Vetiveria* (Lem.-Lis.) Benth. ex Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 542. – *Chrysopogon* Trin. sect. *Vetiveria* (Lem.-Lis.) Roberty [Bull. Inst. Franç. Afrique Noire, A. 22 (Jan 1960) 106, nom. inval.] Boissiera 9 (Jul 1960) 291. **Type:** *Vetiveria odoratissima* Bory ex Cloquet (= *Chrysopogon zizanioides* (L.) Roberty).

Perennials. **Culms** tufted. **Leaves** mostly basal, conduplicate to flat. **Ligule** a ciliolate rim. **Panicles** terminal, espatheate, branches usually simple, whorled; racemes 1–14-jointed, fragile, joints and pedicels slender. **Spikelets** paired, heteromorphous; sessile spikelets 2-flowered, the lower floret epaleate, sterile, the upper bisexual; lanceolate in outline, laterally compressed. **Callus** usually pungent, oblique, sometimes rounded, blunt, usually distinctly bearded. Lower **glume** chartaceous to coriaceous, dorsally convex, 5–7-nerved; upper glume boat-shaped, keeled, 3–5-nerved, apex usually long-mucronate. Apex of upper **lemma** rounded to bifid, usually awned, awn (sub)apical, terminal or from a small sinus. **Pedicels** free of the rachis. **Pedicelled spikelets** dorso-ventrally compressed, from reduced to a single glume to 2-flowered, and sterile or male.

Distribution. A genus of approximately 48 species in the Old World tropics, with 1 in Cuba and Florida. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoneae* Dumort., subtribe uncertain.

Notes. *Chrysopogon zizanioides* (L.) Roberty is widely cultivated and represented in herbarium material in much lower numbers than the widespread nature of the species suggests. In Singapore it is only known from an old Ridley collection from Singapore Botanic Gardens that is presumed to be of a cultivated plant and from specimens taken from current cultivation in the Botanic Gardens. However, as this species is widespread elsewhere and may escape in Singapore it is included in the key (Fig. 16B).

Key to *Chrysopogon* species

1. Culms mat-forming, stoloniferous, 0.15–0.5 m tall; blades 1.5–6 cm long, above glabrous; panicle 4–10 cm long, lowermost longest branch 1.5–3 cm long; spikelets in triads; sessile spikelets 7.5–9 mm long (incl. callus), callus more or less acicular, 3.6–6.4 mm long, setose; lower glume smooth; upper glume apex mucicous, rarely mucronate; second lemma awned, awn exserted; pedicelled spikelets 4.9–7.1 mm long; lower glume smooth, setulose **C. aciculatus**
 Culms densely tufted, without stolons, 1.5–2.5 m tall; blades 25–120 cm long, above pilose in the lower part; panicle 20–33 cm long, lowermost longest branch 5.5–12 cm

long; spikelets in racemes; sessile spikelets 3.75–6 mm long (incl. callus), callus rounded, 0.6–0.8 mm long, laterally ciliate at base, especially near the base of the pedicel; lower glume spinulose; upper glume apex muticous; second lemma muticous or mucronate, awn enclosed; pedicelled spikelets 2.85–4.6 mm long; lower glume scaberulous, aculeate, especially on the nerves *C. zizanioides*

Chrysopogon aciculatus (Retz.) Trin.

(Latin, *aciculatus* = marked with very fine irregular streaks, clearly an error for *acicularis* = needle-like; referring to the very sharp callus)

Fund. Agrost. (1820) 188; Ridley, Fl. Malay Penins. 5 (1925) 207; Henderson, Malay. Wild Fls., Monocot. (1954) 344, fig. 196a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 541; Gilliland, Rev. Fl. Malaya 3 (1971) 236, fig. 52, pl. 29b; Turner, Gard. Bull. Singapore 45 (1993) 94; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 158, fig. 261; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 42, fig. 29, pl. 17; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 26, 168, 226. **Basionym:** *Andropogon aciculatus* Retz., Observ. Bot. 5 (1788 [‘1789’]) 22, as ‘*aciculatum*’; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 166. **Synonyms:** *Rhaphis trivialis* Lour., Fl. Cochinch. (1790) 553, nom. illeg. superfl., as ‘*trivalvis*’. – *Holcus aciculatus* (Retz.) R.Br., Narr. Travels Africa, App. (1826) 244, as ‘*acicularis*’. – *Rhaphis aciculatus* (Retz.) Desv., Mém. Soc. Agric. Angers 1 (1831) 173. – *Chrysopogon trivialis* Arn. & Nees, Gramineae (1841) 39 [preprint of Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19, Suppl. 1 (1843) 171], nom. illeg. superfl. – *Rhaphis zizanioides* (L.) Roberty var. *aciculatus* (Retz.) Roberty, Petite Fl. Ouest-Africain (1954) 403, nom. inval. **Type:** *König s.n.*, ‘Ind. Orient.’ (lectotype LD [LD1224666]), designated by Veldkamp, Austrobaileya 5 (1999) 509). **Fig. 16A, 17.**

Culms mat forming, stoloniferous, 0.15–0.5 m tall; nodes glabrous. **Ligule** 0.1–0.3 mm long. **Leaf** blades flat to conduplicate, 1.5–6(–23) cm by 3–7 mm, above glabrous, base cuneate to rounded, margins spiny. **Panicle** 4–10 × 1–3 cm in outline, rachis 6–9 cm long, with many branches and spikelets, purplish; lowermost branches whorled (or sometimes with one or a few separate branches below the lowermost whorl), with longest branch simple, 1.5–3 cm long; raceme peduncles 1.3–2 cm long, smooth, with a terminal triad, and rarely with up to 4 spikelet groups per branch. **Spikelets** in threes of 1 sessile and 2 pedicelled. **Sessile spikelets** 7.5–9 mm long (incl. callus), callus more or less acicular, 3.6–6.4 mm long, setose, with hairs 0.45–1.1 mm long, golden. Lower **glume** smooth, setulose, with apex acute to bi-dentate; upper glume with midrib distally setulose, without a dorsal fringe of hairs, with apex mucronate, mucro (0.5–)1–1.9 mm long. Second **lemma** awned, the awn exerted, straight, 5.25–8 mm long, column glabrous. **Anthers** (0.5–)0.8–1.25 mm long. **Pedicels** of pedicelled spikelets 2.25–3.75 mm long, more than half as long as the sessile spikelet, glabrous, smooth to scaberulous upwards. **Pedicelled spikelets** with 1 male floret rarely reduced to only 2 glumes, 4.9–7.1 mm long. Lower **glume** smooth, setulose, muticous to mucronate, with mucro 0–1.05 mm long; upper glume muticous, rarely mucronate, with mucro 0–1.1 mm long. **Anthers** 1.5–2.7 mm long.

Distribution. Tropical Asia, Polynesia, widespread in Malesia, introduced elsewhere. In Singapore known from Changi (*Ridley s.n.*, 11 Oct 1890, SING [SING0230791]), Holland

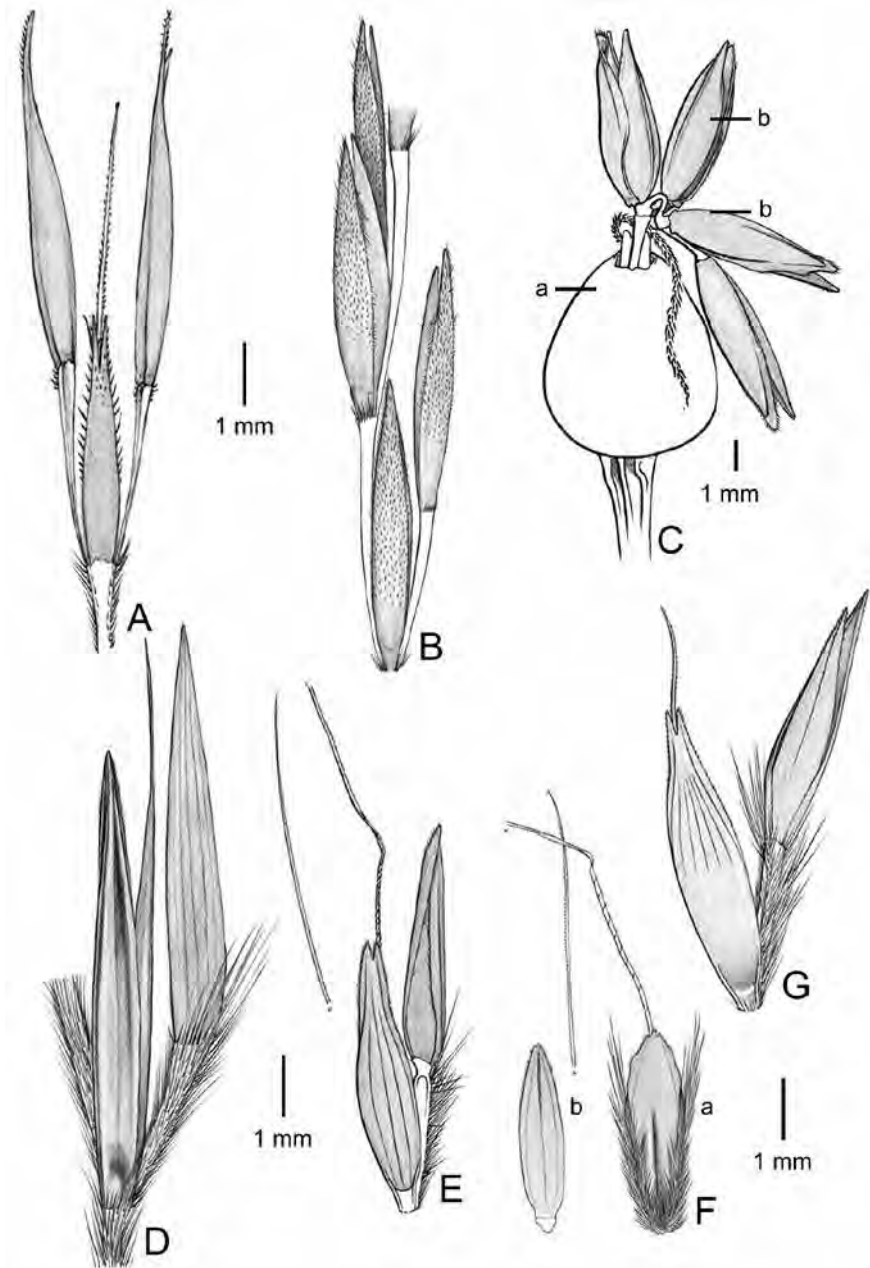


Figure 16. *Chrysopogon aciculatus* (Retz.) Trin. **A.** Group of three spikelets, one sessile and two pedicelled. *Chrysopogon zizanioides* (L.) Roberty. **B.** Two pairs of spikelets. *Coix lacryma-jobi* L. **C.** Inflorescence: **a.** involucre with exserted stigma, **b.** male spikelets. *Cymbopogon citratus* (DC.) Stapf. **D.** Pair of spikelets. *Cymbopogon flexuosus* (Nees ex Steud.) Will. Watson. **E.** Pair of spikelets. *Cymbopogon martini* (Roxb.) Will. Watson. **F.** Spikelets: **a.** sessile spikelet, **b.** pedicelled spikelet. *Cymbopogon nardus* (L.) Rendle subsp. *nardus*. **G.** Pair of spikelets. (Drawn by J.J. Vermeulen).



Figure 17. *Chrysopogon aciculatus* (Retz.) Trin. Inflorescences with detail in inset. (From Singapore, exact locality uncertain. Photos: H. Duistermaat).

Road (*Duistermaat 021*, 15 Feb 2002, K, L, SING [SING0059189]), Kusu Island (*Chua et al. K 66*, 28 Jan 1994, SINU), Pasir Ris Park (*Teo PRC 13*, 8 Sep 2000, SINU), Pulau Ubin (*Ali Ibrahim et al. SING2011-531*, Nov 2011, SING [SING0171407]) and several other areas.

Ecology. Dry, sunny localities, open grasslands, in lawns, beaches, and along roads. It is resistant to trampling and fire.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Uses. Lawns, ground cover in erosion control, may become a noxious weed because the diaspores adhere to clothing and fur and may penetrate the skin in humans and cattle causing itches and sores. Eaten by horses and cattle when not in fruit but of low nutritional value.

Vernacular names. *Love grass* (English), *kemucut* (Malay).

Notes. Usually the inflorescence has only a single terminal triad of spikelets on each branch but Roberty (*Petite Fl. Ouest-Africain* (1954) 403; Boissiera 9 (1960) 290) reported the presence of up to 4 pairs beneath it. JFV has seen such specimens in Peninsular Malaysia.

The anthers of the sessile spikelet are distinctly smaller than those of the pedicelled spikelets and occasionally appear to be staminodial, rendering the floret functionally female.

In the early morning a drop of what appears to be water is seen on top of the sessile spikelets.

13. COIX L.

(Greek, *coix* = formerly the name for an Egyptian palm, *Hyphaene thebaica* (L.) Mart., arbitrarily transferred by Linnaeus)

Sp. Pl. 2 (1753) 972; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 293. **Synonyms:** *Sphaerium* L. ex Kuntze, *Revis. Gen. Pl.* 2 (1891) 793, nom. illeg. superfl. – *Lachrymaria* Heist. [*Syst. Pl. General* (1748) 12] ex Fabr., *Enum.* (1759) 208, nom. illeg. superfl. – *Lachryma-jobi* Ort., *Tab. Bot.* (1773) 30, nom. illeg. superfl. – *Lithagrostis* Gaertn., *Fruct. Sem. Pl.* 1 (1788) 7, nom. illeg. superfl. – *Lacryma* Medik., *Philos. Bot.* 1 (1789) 177, nom. illeg. superfl. **Type:** *Coix lacryma-jobi* L.

Annual or perennial. **Culms** robust, usually solid. **Ligules** membranous. **Leaf** blades flat. **Inflorescences** axillary, fascicled, composed of two racemes separated by a bract, one sessile and female, the other pedunculate and male, subtended by a globose or elongated bony utricule derived from a modified spatheole. **Female raceme** enclosed within the utricule, with 1 sessile, unawned female spikelet and 2 free pedicels with at most reduced spikelets. **Male raceme** projecting from the utricule, deciduous. **Pedicels** free. **Spikelets** in diads or a triad, unawned. **Anthoecia** 2. **Glumes** herbaceous, glabrous, submarginally winged, wings up to 1 mm wide and widest at tip.

Distribution. A genus of either only one or several species depending on taxonomic opinion. Originally from tropical Asia, introduced elsewhere. In Singapore 1 naturalised species.

Taxonomy. The sole member of the *Andropogoneae* – *Coicinae* Rchb.

Coix lacryma-jobi L.

(Latin, *lacrima* = tears, *Jobus* = Job, a figure in the Bible, Talmud and Koran noted for his great suffering; Job's tears is presumably a reference to the large pale fruit)

Sp. Pl. 2 (1753) 972; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186, as '*Lachryma-Jobi*'; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 151; Ridley, Fl. Malay Penins. 5 (1925) 191; Henderson, Malay. Wild Fls., Monocot. (1954) 354, fig. 201c,d; Gilliland, Rev. Fl. Malaya 3 (1971) 304, fig. 66; Turner, Gard. Bull. Singapore 45 (1993) 94; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 159, fig. 262; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 42, fig. 30; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 28, 168, 265. **Synonyms:** *Coix lacryma* L., Syst. Nat., ed. 10, 2 (1759) 1261, nom. illeg. superfl. – *Lithagrostis lacryma-jobi* (L.) Gaertn., Fruct. Sem. Pl. 1 (1788) 7, t. 1: fig. [10]. – *Sphaerium lacryma* Kuntze, Revis. Gen. Pl. 2 (1891) 793, nom. illeg. superfl. – *Coix lacryma-jobi* L. var. *typica* Makino, Bot. Mag. (Tokyo) 20 (1906) 10, nom. inval. **Type:** *Collector unknown s.n.*, India (lectotype LINN [Herb. Linn. no. 1098.1], designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 857). **Fig. 16C, 18.**

Coix ma-yuen Rom.Caill., Bull. Soc. Acclim. France, sér. 3, 8: 442 (1881), as '*ma-yu'én*'. **Synonyms:** *Coix lacryma-jobi* L. var. *ma-yuen* (Rom.Caill.) Stapf in Hooker, Fl. Brit. India 7, fasc. 21 (1896) 100; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 638; Gilliland, Rev. Fl. Malaya 3 (1971) 306. – *Coix lacryma-jobi* L. subsp. *ma-yuen* (Rom.Caill.) T.Koyama, Grasses Japan (1987) 498. **Type:** Not traced.

Annual or perennial. **Culms** single or tufted, erect, 0.6–3 m long, nodes glabrous; sheath rounded, somewhat inflated, glabrous. **Ligule** 0.6–1.2 mm long, ciliolate. **Leaf** blades inrolled when young, linear-lanceolate, 10–42 cm by 15–70 mm, glabrous, base rounded to cordate, margin with minute hairs. **Inflorescence** 1 per sheath, many per culm, spike-like raceme; rachis 3.5–6 cm long. **Utricle** 7–11 by 6–10 mm, white, brown, shiny grey, bluish. **Pedicels** adjoining female spikelet c. 3.5 mm long, glabrous, flattened. **Male spikelets** 6–11 by 3–3.5 mm, dorsoventrally flattened, 2-flowered. First **lemma** 8.2–9.5 mm long, glabrous, hyaline, tip bifid. **Anthers** 4–5 mm long.

Distribution. Origin unknown but presumed to be Southeast Asian. In Singapore it is presumed to not be native but has become naturalised as an escape from former cultivation. The earliest collection in Singapore dates from 1822 (*Wallich s.n.* [EIC 8623J], Sep 1822, K). Also collected on Bukit Timah Road (*Ridley s.n.*, 1907, SING [SING0041413]), Pulau Tekong (*Tan et al. T 1076*, 15 Aug 1996, SINU), Pulau Ubin (*Teo 39*, 18 Jun 1990, SINU), Punggol Road (*Chua & Er 911*, 13 Jan 1993, SINU) and many other areas.

Ecology. Streams, marshes, abandoned fields, road sides, waste places, in secondary vegetation.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. A very ancient crop, perhaps one of the earliest cereals of Southeast Asia (Jansen, PROTA 1 (2006) 46). The caryopses are edible and either eaten like rice or made into flour



Figure 18. *Coix lacryma-jobi* L. Habit with inflorescence in inset. (From Singapore, Bishan Park. *Chen SING2018-125*. Photos: L.M.J. Chen).

to bake bread. It is also used in beer brewing, fermented into wine, or for tea. It is now best known for beads to make jewellery.

Vernacular names. *Job's tears* (English), *jelai* (Malay).

Notes. Many varieties or cultivars have been distinguished, as can be expected from an ancient crop. One, 'adlay', often treated as *Coix lacryma-jobi* L. var. *ma-yuen* (Rom.Caill.) Stapf, with a soft utricle, is widely cultivated.

14. CYNODON Rich.

(Greek, *cyno-* = dog, *-don* = tooth;
referring to the shape of the buds on the stolons)

in Pers., Syn. Pl. 1 (1805) 85, nom. cons.; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 387.

Type: *Cynodon dactylon* (L.) Pers.

Perennials. **Culms** stoloniferous, with or without rhizomes, hollow. **Ligule** a row of hairs or a membranous collar. **Racemes** digitate in whorls, not breaking up, terminated by a spikelet. **Spikelets** alternate, solitary, biseriate, secund, laterally appressed to the rachis, very shortly pedicelled, laterally strongly flattened, 1-flowered, disarticulating above the glumes. **Glumes** 2, unequal, shorter than the lemma, keeled, 1-nerved, acute. **Rachilla process** naked or ending in a much reduced floret. **Lemma** membranous, 3-nerved, hairy, keeled, lateral nerves close to the margin, apex ± obtuse, unawned. **Caryopsis** not longitudinally furrowed, glabrous, smooth, pericarp adnate.

Distribution. A genus of 10 species in the tropics to temperate zones, predominantly in Africa. In Singapore 1 naturalised species.

Taxonomy. The genus belongs to the *Chloridoideae* – *Eleusininae* Dumort.

Cynodon dactylon (L.) Pers.

(Greek, *dactylos* = finger; referring to the digitate inflorescence)

Syn. Pl. 1 (1805) 85; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 173; Ridley, Fl. Malay Penins. 5 (1925) 249; Henderson, Malay. Wild Fls., Monocot. (1954) 314, fig. 180c–e; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 739; Gilliland, Rev. Fl. Malaya 3 (1971) 90, fig 14, pl. 15c; Turner, Gard. Bull. Singapore 45 (1993) 94; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 160; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 44, fig. 35, pl. 7; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 31, 168, 226. **Basionym:** *Panicum dactylon* L., Sp. Pl. 1 (1753) 58. **Synonyms:** *Digitaria dactylon* (L.) Scop., Fl. Carniol., ed. 2, 1 (1771) 53. – *Dactilon officinale* Vill., Hist. Pl. Dauphiné, 2 (1787) 69. – *Paspalum dactylon* (L.) Lam., Tabl. Encycl.

1, fasc. 1 (1791) 176. – *Digitaria littoralis* Salisb., Prodr. Stirp. Chap. Allerton (1796) 19, nom. illeg. superfl. – *Fibichia umbellata* Koel., Descr. Gram. (1802) 308, nom. illeg. superfl. – *Milium dactylon* (L.) Moench, Suppl. Meth. (1802) 67. – *Cynosurus dactylon* (L.) Pers., Syn. Pl. 1 (1805) 85. – *Digitaria stolonifera* Schrad., Fl. Germ. (1806) 165, t. 3: fig. 9, nom. illeg. superfl. – *Chloris cynodon* Trin., Gram. Unifl. Sesquifl. (1824) 229, nom. illeg. superfl. – *Cynodon stoloniferus* A.Rich. ex Hassk., Cat. Hort. Bot. Bogor. (1844) 17, nom. illeg. superfl. – *Cynodon dactylon* (L.) Pers. var. *normalis* Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 11 [(Aug 1854) 351], nom. inval. – *Capriola dactylon* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 764; Hitchcock, Rep. (Annual) Missouri Bot. Gard. 4 (1893) 147, isonym. – *Fibichia dactylon* (L.) Beck, Glasn. Zemaljsk. Muz. Bosni Hercegovini 15 (1903) 26. **Type:** *Collector unknown s.n.*, Sweden, Uppsala, cultivated (lectotype LINN [Herb. Linn. no. 80.35], designated by Clayton & Harlan, Kew Bull. 24 (1970) 186). **Fig. 19A, 20A.**

Cynodon parviglumis Ohwi, Bot. Mag. (Tokyo) 55 (1941) 538. **Type:** *Kanehira & Hatusima 4348*, Caroline Islands, [Federated States of Micronesia], Yap, 29 March 1938 (holotype FU; isotype US (fragment)).

Rhizomatous. **Culms** mat-forming, erect, geniculate to prostrate, 0.1–0.2(–0.4) m long. **Leaves** often in groups of three. **Sheaths** glabrous to hairy. **Ligule** a row of 1–2(–5) mm long hairs, throat on both sides with a tuft of long hairs. **Leaf** blades when young inrolled or seemingly folded along the midrib, linear-lanceolate to linear, 0.5–10 cm by 1.5–2.5(–8) mm, flat or margins infolded. **Racemes** 2–6, rather stiff and straight, erecto-patent to patent, 1–6 cm by 1.2–2 mm; rachis margins smooth to scabrous. **Spikelets** 2–2.5 mm long. Lower **glumes** (0.5–)0.7–1.7 mm long, acute; upper glumes (0.6–)0.7–1.7 mm, 0.33–0.7 times as long as the spikelet. **Lemmas** 1.8–2.5 mm long, minute hairs never club-shaped. **Anthers** 0.8–1.5 mm long.

Distribution. Originally probably from Africa and South Asia but now widely naturalised, also in temperate areas. In Singapore it has previously been reported as native (e.g. Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 44; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 168) but here we treat it as naturalised. It has been collected all over Singapore including on Holland Road (*Duistermaat 29*, 20 Feb 2002, K, L, SING [SING0059445]), MacRitchie (*Duistermaat et al. 192*, 27 Sep 2003, SING [SING0059185]), Pulau Ubin (*Chua & Tan 447*, 24 Apr 1991, SINU), Sungei Buloh (*Turner & Choong SB 1107*, 22 May 1991, SINU) and West Coast Park (*Dahlia P 116*, 7 Apr 1991, SINU).

Ecology. In lawns, open grasslands, on seashores and sandy soil. It is resistant to drought, fire, flooding and trampling.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. It is a good soil binder and used for lawns, tennis courts and golf fairways, especially under dry conditions where it may crowd out other plants.

Vernacular names. *Bermuda grass* (English), *rumpit bermuda* (Malay).

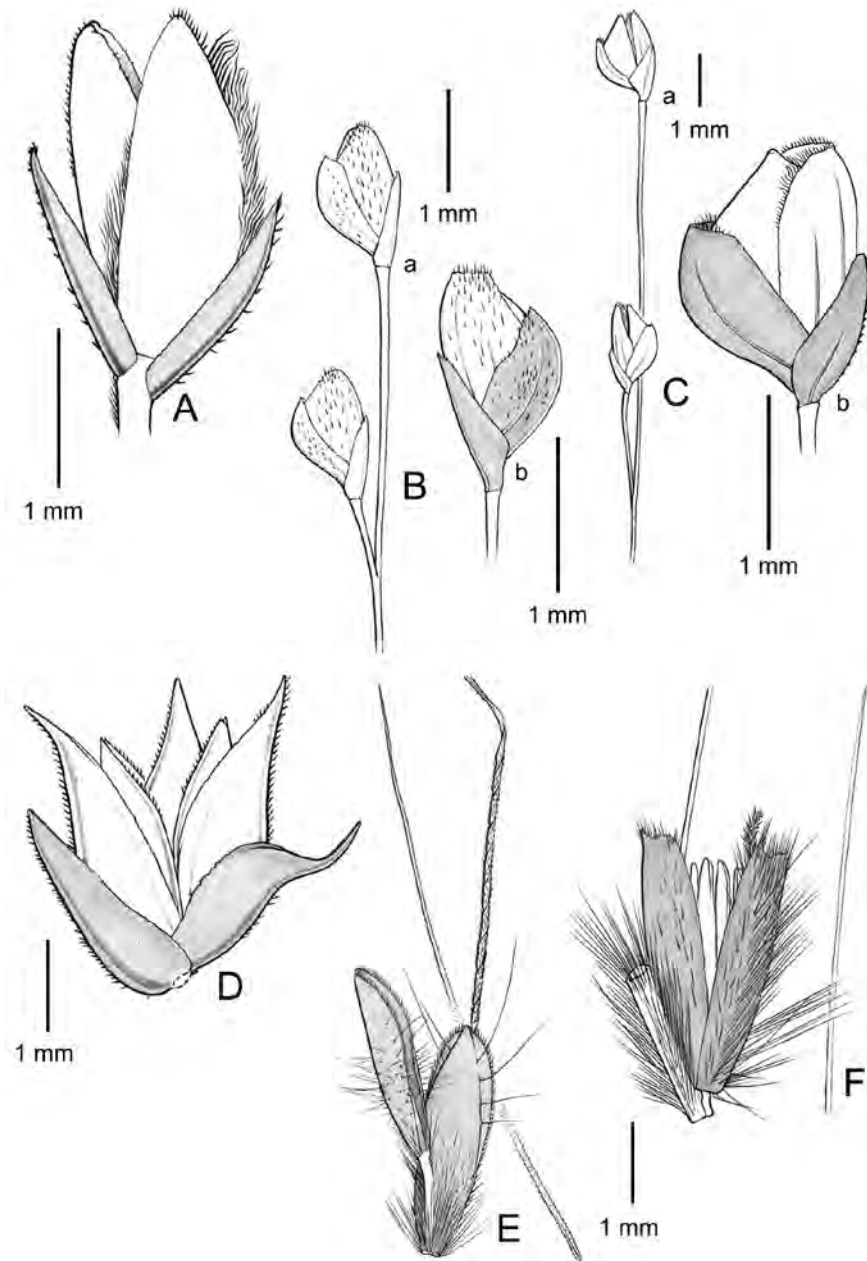


Figure 19. *Cynodon dactylon* (L.) Pers. **A.** Spikelet lateral view. *Cyrtococcum accrescens* (Trin.) Stapf. **B.** Spikelets: **a.** pair of spikelets, **b.** spikelet. *Cyrtococcum patens* (L.) A.Camus. **C.** Spikelets: **a.** pair of spikelets, **b.** spikelet. *Dactyloctenium aegyptium* (L.) Willd. **D.** Spikelet lateral view. *Dichanthium annulatum* (Forssk.) Stapf. **E.** Pair of spikelets. *Dichanthium caricosum* (L.) A.Camus. **F.** Pair of spikelets. (Drawn by J.J. Vermeulen).



Figure 20. *Cynodon dactylon* (L.) Pers. **A.** Inflorescence. *Digitaria radicata* (J.Presl) Miq. **B.** Inflorescence. *Echinochloa colona* (L.) Link. **C.** Inflorescence. (From Singapore, exact locality uncertain. Photos: H. Duistermaat).

15. CYRTOCOCCUM Stapf

(Greek, *cyrto-* = bent, *-coccum* = berry;
referring to the asymmetrical gibbous spikelets)

Fl. Trop. Afr. 9(1) (1917) 15; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 330. **Type:** *Cyrtococcum setigerum* (P.Beauv.) Stapf, nom. illeg. superfl. (= *Cyrtococcum chaetophorum* (Roem. & Schult.) Dandy).

Panicum L. sect. *Gibbosae* Hook.f., *Fl. Brit. India* 7, fasc. 21 (1896) 28, 56; Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 131. **Type:** *Panicum patens* L., lectotype designated by Veldkamp, *Gard. Bull. Singapore* 71 (2019) 22 (= *Cyrtococcum patens* (L.) A.Camus).

Perennials. **Culms** stoloniferous, decumbent to scrambling, rooting at the decumbent nodes, branching intra-vaginally at base, hollow. **Ligule** a membranous rim. **Leaf blades** inrolled when young. **Inflorescence** a panicle. **Spikelets** more or less biseriata (difficult to see!), pedicelled, adaxial, paired, laterally flattened, asymmetrical, gibbous, callus truncate. Lower **glume** shorter than the spikelet, 3-nerved; upper glume about as long as the spikelet, cucullate, 3–5-nerved. Lower **lemma** usually with a small palea, sterile, 5-nerved; upper lemma half-rotund, germination flap present, margins inrolled over the palea, apically crested, indurate, smooth; upper lemma herbaceous, muticous.

Distribution. A genus of approximately 12 species in the Old World tropics. In Singapore 2 native species.

Taxonomy. The genus belongs to the *Panicaceae* – *Boivinellinae* Pilg.

Notes. *Cyrtococcum oxyphyllum* (Hochst. ex Steud.) Stapf was recorded for Singapore by a number of authors but no material has been found to verify this. It is included in the key in italics but not described further.

Key to *Cyrtococcum* species

1. Panicle loosely contracted to very lax, longest pedicels of the pair of spikelets longer than the spikelet 2
Panicle contracted to somewhat lax, longest pedicels of the pair of spikelets shorter than the spikelet *C. oxyphyllum*
2. Erect part of culms 0.3–1 m long; nodes glabrous; sheaths usually pilose all over; panicle usually very lax, 20–50 × 6–30 cm, longest branch 11–18 cm long; spikelets usually 1.35–1.5 mm long **1. *C. accrescens***
Erect part of culms 0.1–0.3 m long; nodes hairy at one side; sheaths usually pilose along the margins only; panicle usually more or less contracted, 3–18 × 0.8–2.3 cm, longest branch 3–5 cm long; spikelets usually 1.5–1.8 mm long **2. *C. patens***

1. *Cyrtococcum accrescens* (Trin.) Stapf

(Latin, *accrescens* = increasing; application uncertain)

in Hooker's Icon. Pl. 31 [ser. 5, 1], fasc. 4 (1922) t. 3096 (page 2); Ridley, Fl. Malay Penins. 5 (1925) 234, isonym; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 755; Gilliland, Rev. Fl. Malaya 3 (1971) 149, pl. 19d, colour pl. 8; Turner, Gard. Bull. Singapore 45 (1993) 94; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 46, fig. 36; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 31, 168, 203. **Basionym:** *Panicum accrescens* Trin., Sp. Gram. 1(8) (1827) t. 88. **Synonyms:** *Panicum trigonum* Retz. f. *accrescens* (Trin.) Kuntze, Revis. Gen. Pl. 2 (1891) 786. **Type:** [Published illustration] Trinius, Sp. Gram. 1(8) (1827) t. 88, lectotype designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 22. **Fig. 19B.**

Panicum carinatum J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 309. **Synonym:** *Cyrtococcum carinatum* (J.Presl) Stapf ex Ridley, Fl. Malay Penins. 5 (1925) 233. **Type:** *Haenke s.n.*, Philippines, Luzon (lectotype MO [MO-2151007], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 46; isolectotypes BM, HAL, LE [Herb. Trinius 620.1], PR [sheet nos. 194825A-E, 194826A-C], S (fragment), W [×3]).

Panicum patens auct. non L.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185, p.p.; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 142, p.p.

Erect part of **culms** 0.3–1 m long; nodes glabrous. **Sheaths** pilose all over (rarely only along the margins). **Ligule** c. 1.5 mm long. **Leaf** blades linear-lanceolate to linear, 3.5–17.5(–25) cm by 5–15(–22) mm, below with 7–13 main nerves. **Panicle** very lax, with many spikelets, 20–50 × 6–30 cm, branches glabrous, longest branch 11–18 cm long, simple or branched; pedicels 4–17 mm long, the longest ones longer than the spikelet. **Spikelets** 1.3–1.5(–1.8) mm long. Lower **glume** 0.75–0.9(–1.1) mm long, 0.5–0.67 times as long as the spikelet. Lower **lemma** glabrous to setulose, smooth to verrucose (rarely). **Anthers** 0.5–0.67 mm long.

Distribution. From eastern India to southern China, through continental Southeast and Malesia to Australia. In Singapore it is native and has been collected in Bukit Timah (*Hullett 441*, 5 Apr 1885, SING [SING0058856]), Changi (*Ridley 77*, 6 Apr 1889, SING [SING0058859]), Choa Chu Kang (*Ridley s.n.*, 1894, SING [SING0058857]), Pulau Tekong (*Samsuri et al. 322*, 31 Jan 2002, SING [SING0040006]), Pulau Ubin (*Latifah & Neo 5*, 18 Jun 1990, SINU) and several other parts of Singapore.

Ecology. More or less shaded, not too dry places, and in clearings in forest.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 31, 168, 203) but although it is not a common species it is found in many parts of Singapore and is often overlooked for collection. It is assessed here as Vulnerable (VU/D) in Singapore.

Vernacular names. *Diffuse panic grass* (English), *rumput telur ikan* (Malay).

2. *Cyrtococcum patens* (L.) A. Camus

(Latin, *patens* = spreading; referring to the inflorescence branches)

Bull. Mus. Natl. Hist. Nat. 27 (1921) 118; Ridley, Fl. Malay Penins. 5 (1925) 148; Gilliland, Rev. Fl. Malaya 3 (1971) 148, pl. 19f, colour pl. 7; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 48, fig. 37; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 31, 169, 203. **Basionym:** *Panicum patens* L., Sp. Pl. 1 (1753) 58; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185, p.p. **Type:** *Collector unknown s.n.*, India (lectotype LINN [Herb. Linn. no. 80.63], designated by Mitra & Jain in Manilal, Bot. Hist. Hort. Malabaricus (1980) 151). **Fig. 19C.**

Cyrtococcum carinatum auct. non Stapf: Ridley, Fl. Malay Penins. 5 (1925) 233, p.p.

Cyrtococcum trigonum auct. non A. Camus: Henderson, Malay. Wild Fls., Monocot. (1954) 330, fig. 189a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 755.

Erect part of culms 0.12–0.3(–0.5) m long; nodes hairy at one side. **Sheaths** with pilose margins, rarely pilose all over. **Ligule** 0.4–0.8 mm long. **Leaf** blades linear, 1–9(–13) cm by 2.7–7.5(–14) mm, below with 5–9 main nerves. **Panicle** loosely contracted, rarely very lax at maturity, with many spikelets, 3–10(–18) × 0.8–2.3(–11) cm, branches glabrous (exceptionally pilose), longest branch 3–5 cm long, branched; pedicels (longest of the pair) 0.75–8 mm long,

longer than the spikelet. **Spikelets** (1.4–)1.5–1.8 mm long. Lower **glume** 0.8–1.1 mm long, 0.55–0.65 times as long as the spikelet. Lower **lemma** glabrous to setulose, smooth, rarely verrucose. **Anthers** 0.6–0.8 mm long.

Distribution. Sri Lanka, India to southern China and through Malesia to northern Australia (Queensland). In Singapore it is likely to be native and has been collected in Bukit Timah (*Duistermaat S219*, 28 Oct 2003, SING [SING0059187]) and Pulau Ubin (*Duistermaat et al. S176*, 23 Sep 2003, K, L, SING [SING0059186]; *Ali Ibrahim SING2008-354*, 6 Sep 2008, SING [SING0146631]; *Ali Ibrahim et al. SING2011-489*, Nov 2011, SING [SING0146631]; *Ali Ibrahim & Veldkamp SING2017-079*, 19 Mar 2017, KEP, L, SING [SING0231211]).

Ecology. More or less shaded, not too dry places.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Critically Endangered (CR/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 31, 169, 203) but this would imply fewer than 50 plants in Singapore. We estimate a higher figure of 250–1000 plants and so it is assessed here as Vulnerable (VU/D) in Singapore.

Vernacular names. *Diffuse panic grass* (English), *rumput telor ikan* (Malay).

16. DACTYLOCTENIUM Willd.

(Greek, *dactylo-* = finger, *-ctenium* = comb;
small comb finger, referring to the digitate racemes)

Enum. Pl. (1809) 1029; Phillips, Kew Bull. 37 (1982) 154; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 373. **Type:** *Dactyloctenium aegyptium* (L.) Willd.

Annuals. **Culms** solid. **Ligule** a membranous, ciliolate collar. **Leaf** blades inrolled when young. **Spikes** digitate, spreading, ending in a point, unilateral. **Spikelets** solitary, secund in 2 rows, lateral to the rachis, sessile, laterally flattened, 3- or 4-flowered, disarticulating above the glumes, but not between the anthoecia. **Glumes** unequal, shorter than the adjacent lemmas, 1-nerved; upper glume subapically awned. Rachilla process ending in a reduced, muticous floret. **Lemmas** dorsally keeled, glabrous, 3-nerved (the upper ones often 1), not excurrent, callus obtuse, glabrous. **Pericarp** free, early withering, **seed** transversally rugose, not longitudinally grooved.

Distribution. A genus of 5 species from tropical East Africa to Australia. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Chloridoideae* – *Dactylocteniinae* P.M.Peterson, Romasch. & Y.Herrera

Dactyloctenium aegyptium (L.) Willd.
(of Egypt)

Enum. Pl. (1809) 1029, as '*aegyptiacum*'; Beauvois, Ess. Agrostogr. (1812) 72, pl. 15: fig. 2; Richter, Pl. Eur. 1 (1890) 68, isonym; Ridley, Fl. Malay Penins. 5 (1925) 251; Henderson, Malay. Wild Fls., Monocot. (1954) 316, fig. 181c,e; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 758; Gilliland, Rev. Fl. Malaya 3 (1971) 81, fig. 11, pl. 14b; Turner, Gard. Bull. Singapore 45 (1993) 94; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 161, fig. 264; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 48, fig. 38, pl. 30; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 32, 169, 226. **Basionym:** *Cynosurus aegyptius* L., Sp. Pl. 1 (1753) 72. **Synonyms:** *Eleusine aegyptia* (L.) Forsyth f., Bot. Nomencl. (1794) 70; Desfontaines, Fl. Atlant. 1 (1798) 85, as '*aegyptiaca*'; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 174, as '*aegyptiaca*'; Roberty, Petite Fl. Ouest-Africain. (1954) 386. – *Eleusine cruciata* Lam., Tabl. Encycl. 1, fasc. 2 (1791) 203, t. 48: fig. 2, nom. illeg. superfl. – *Eleusine pectinata* Moench, Suppl. Meth. (1802) 68, nom. illeg. superfl. – *Dactyloctenium meridionale* Ham., Prodr. Pl. Ind. Occid. (1825) 6, nom. illeg. superfl. – *Dactyloctenium mucronatum* (Michx.) Willd. var. *aegyptium* (L.) Nees, Hooker's J. Bot. Kew Gard. Misc. 2 (1850) 102, nom. inval., as '*aegyptiacum*'. **Type:** *Collector unknown s.n.* (lectotype LINN [Herb. Linn. no. 91.11], designated by Kit Tan, Fl. Turkey 9 (1985) 578. **Fig. 19D, 21.**

Culms stoloniferous, geniculate, up to 0.7 m long; nodes glabrous. **Sheaths** terete. **Ligules** 0.6–1 mm long. **Leaf** blades 2–28 cm by 2.5–10(–12) mm. **Spikes** (1–)3–6(or 7), spreading, 1–6.5 cm long. **Spikelets** ovate, 3–5 mm long. **Glumes** 1.5–3 mm long; upper glume mucro 0.5–2.5 mm long. First **lemma** ovate, 2.5–4 mm long, mucro up to 1 mm long. **Anthers** 0.25–0.8 mm long.

Distribution. (Sub)tropical Old World, introduced in America and Australia and as a casual in Europe. In Singapore it is native and very widely distributed including on Bukit Timah Road (*Duistermaat S018*, 14 Feb 2002, K, L, SING [SING0059533]), Pasir Panjang-HortPark (*Chen SING2017-735*, 6 Dec 2017, SING [SING0255903]), Geylang (*Ridley s.n.*, 1893, SING [SING0229625]), Pulau Ubin (*Ali Ibrahim & Veldkamp SING2017-090*, 18 Mar 2017, SING [SING0231217]) and Sungei Buloh (*Chua et al. SB 3024*, 13 Oct 1993, SINU).

Ecology. Disturbed areas on poor soil, open grasslands and secondary forests, road-sides, lawns, locally abundant, not salt tolerant; common.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Egyptian finger grass* (English).

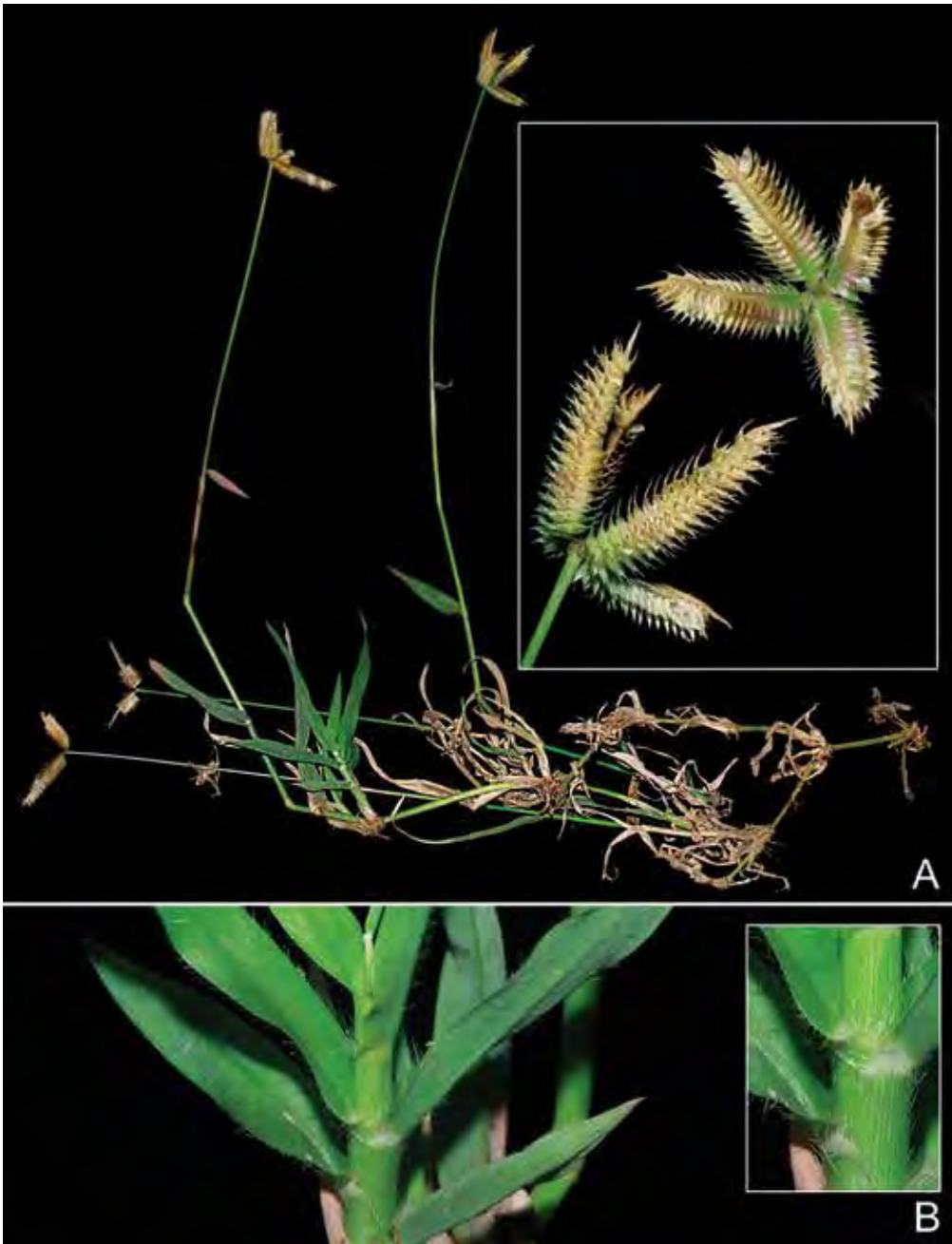


Figure 21. *Dactyloctenium aegyptium* (L.) Willd. **A.** Habit with two inflorescences in inset. **B.** Culm with leaves with detail of leaf sheath and blade in inset. (From Singapore, Pasir Panjang, *Chen SING2017-735*. Photos: L.M.J. Chen).

17. DICHANTHIUM Willemet

(Greek, *dich-* = pair, *-anthium* = flowered; due to the difference between the basal homogamous and the other heterogamous spikelets)

Ann. Bot. (Usteri) 18 (1796) 11; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 312. **Synonym:** *Andropogon* L. subg. *Dichanthium* (Willemet) Hack. in Engler & Prantl, Nat. Pflanzenfam. 2(2) (1887) 28; Hackel in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 566. **Type:** *Dichanthium nodosum* Willemet, nom. illeg. superfl. [= *Dichanthium annulatum* (Forssk.) Stapf].

Annual or perennial. **Ligule** a membranous collar. **Leaf** blades inrolled when young. **Racemes** digitate or paniculate, rarely solitary; rachis fragile; joints and pedicels slender, without a resinous channel. **Spikelets** paired, homo- to heteromorphous, one sessile, one pedicelled, 0–6 lower pairs homogamous, neuter or male, usually persistent; heterogamous spikelets 2-flowered, dorso-ventrally compressed. **Glumes** subequal, thin; lower glume 2-keeled, flat or dorsally rounded; upper glume boat-shaped, keeled, muticous. Upper **lemma** bisexual, gradually passing into a geniculate awn (awns easily caducous in mature racemes). **Pedicelled spikelets** similar to the sessile ones, but reduced from empty glumes up to 2 male flowers, muticous.

Distribution. A genus of approximately 22 species in the (sub)tropics of the Old World. In Singapore 2 species, 1 native and 1 naturalised.

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoninae* J.Presl. Known to hybridise with *Bothriochloa bladonii* (Retz.) S.T.Blake.

Notes. *Dichanthium mucronulatum* Jansen, otherwise known from southern Thailand and the Malay Peninsula (Langkawi, Pahang, Selangor), was once found in the Singapore Botanic Gardens as a casual (*Ridley s.n.*, 1897, SING [SING0041424]). Ridley (Mat. Fl. Malay. Penins. 3 (1907) 160; Fl. Malay Penins. 5 (1925) 204) incorrectly referred to this as *Ischaemum beccarii* Hack. It is distinct by the ovate-lanceolate, mucronulate, glabrous lower glume of the sessile spikelets (Gilliland, Rev. Fl. Malaya 3 (1971) 283). As it was only ever found once it is included in the key but not otherwise further treated.

Key to *Dichanthium* species

1. Lower glume of sessile spikelets ovate-lanceolate, apex mucronulate... *D. mucronulatum*
 Lower glume of sessile spikelets oblong to oblong-lanceolate or obovate to obovate-lanceolate, apex obtuse to truncate 2
2. Sheaths terete; ligule 1–4 mm long; blades hairy above; lower glume of sessile spikelets oblong to oblong-lanceolate, usually with long bulbous-based cilia along the margins above the middle, apex truncate, marginal veins protruding **1. D. annulatum**
 Sheaths compressed, keeled; ligule 0.5–1 mm long; blades more or less glabrous; lower glume of sessile spikelets obovate to obovate-lanceolate, glabrous above 0.5–0.67th, or shortly ciliate, apex obtuse **2. D. caricosum**

1. *Dichanthium annulatum* (Forssk.) Stapf

(Latin, *annulatus* = marked with rings; referring to the bearded nodes)

Fl. Trop. Afr. 9(1) (1917) 178; Gilliland, Rev. Fl. Malaya 3 (1971) 284, pl. 35b; Turner, Gard. Bull. Singapore 45 (1993) 94; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 50, fig. 39; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 33, 169, 266. **Basionym:** *Andropogon annulatus* Forssk., Fl. Aegypt.-Arab. (1775) 173, as ‘*annulatum*’. **Synonyms:** *Dichanthium nodosum* Willemet, Ann. Bot. (Usteri) 18 (1796) 11, nom. illeg. superfl. – *Lepeocercis annulata* (Forssk.) Nees, Fl. Afr. Austral. III. (1841) 98. – *Andropogon annulatus* Forssk. var. *genuinus* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 572, nom. inval. – *Andropogon nodosus* Nash in Britton, N. Amer. Fl. 17, 2 (1912) 122, nom. illeg. superfl. – *Dichanthium caricosum* (L.) A.Camus subvar. *annulatum* (Forssk.) Roberty, Boissiera 9 (1960) 164. – *Dichanthium caricosum* (L.) A.Camus subvar. *nodosum* Roberty, Boissiera 9 (1960) 165, nom. inval. **Type:** *Forsskål 127*, Egypt (lectotype C [C10001661], designated by Blake, Proc. Roy. Soc. Queensland 80 (1969) 65; isolectotype LD). **Fig. 19E.**

Perennials. **Culms** tufted, geniculate to decumbent at base, 0.3–2 m long, green; nodes bearded. **Sheaths** terete. **Ligule** 1–4 mm long, obtuse. **Leaf** blades 3–30 cm by 2–8 mm, base rounded, glabrous or pilose above. **Peduncle** glabrous. **Inflorescence** common axis 0–1.5 cm long; racemes (1–)2–9(–15), pedunculate, 4–7 cm long, axils pilose. **Homogamous spikelets** in 0–6 pairs, persistent, sterile or male, muticous. **Sessile spikelets** 3–5 × 1–1.2 mm. Lower **glumes** oblong to oblong-lanceolate, usually with long bulbous-based cilia along the margins above the middle, 5–11-nerved, glabrous to setose, keels ciliolate, not or hardly winged, apex obtuse to truncate; upper glumes keels ciliate, apex acute to obtuse. **Awns** geniculate, 10–25 mm long. **Anthers** 1.6 mm long. **Pedicelled spikelets** sterile or male with pedicels 1.8–2 mm long.

Distribution. Northwestern Africa to China and Malesia, introduced to Polynesia, South Africa and Australia, and naturalising in (sub)tropical regions. In Singapore possibly native but has only been infrequently collected on Holland Road (*Duistermaat 16*, 6 Feb 2002, L, SING [SING0059532]; *Duistermaat 25*, 20 Feb 2002, K, SING [SING0059191]; *Duistermaat 118*, 12 Mar 2003, L, SING [SING0059531]) and Newton (*Teruya 2012*, 11 Nov 1932, SING [SING0041338]).

Ecology. In Singapore found on roadsides.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it is now only known in the Holland Road area and is assessed as Critically Endangered (CR/D).

Notes. Some authors have treated it only as a form of *Dichanthium caricosum* (L.) A.Camus (e.g. Gould & Clayton, Revis. Handb. Fl. Ceylon 8 (1994) 158). It is known to hybridise with *Bothriochloa bladhii* (Fig. 22; see notes under that species).



Figure 22. *Dichanthium annulatum* × *Bothriochloa bladhii*. **A.** Inflorescence with detail of raceme in inset. **B.** Detail of culm with node and leaf blade. (From Singapore, Bishan Park, *Chen SING2017-762*. Photos: L.M.J. Chen).

2. *Dichanthium caricosum* (L.) A. Camus

(Latin, *caricosus* = pertaining to *Carex* L.;
referring to a similarity to the sedge genus *Carex*)

Bull. Mus. Natl. Hist. Nat. 27 (1921) 549; Camus, Fl. Indo-Chine 7, fasc. 3 (1922) 318; Haines, Bot. Bihar Orissa (1924) 1039; Ridley, Fl. Malay Penins. 5 (1925) 210; Gilliland, Rev. Fl. Malaya 3 (1971) 284, fig. 61; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 162; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 50, fig. 40; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 33, 169, 270. **Basionym:** *Andropogon caricosus* L., Sp. Pl., ed. 2, 2 (1763) 1480, as '*caricosum*', nom. cons. **Synonym:** *Andropogon caricosus* L. subsp. *genuinus* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 568, nom. inval. **Type:** *Wight s.n.* [Herb. Wight prop. 1687], Peninsula Ind. Orientalis (holotype K [K001050468]; possible isotype E), typ. cons. **Fig. 19F.**

Annual or perennial. **Culms** stoloniferous (stolons to 2 m long), tufted, geniculate, rooting at the nodes, 0.3–1 m tall, bluish; nodes glabrous to pilose. **Sheaths** compressed, keeled. **Ligules** 0.5–1 mm long, truncate, margin ciliate. **Leaf** blades 1.5–20 cm by 2–5 mm, more or less glabrous. **Peduncle** glabrous. **Inflorescence** common axis 0–2.5 cm long; racemes 1–7, pedunculate, 2.5–6 cm long, axils pilose. **Homogamous spikelets** in 1–3 pairs, persistent, sterile or male. **Sessile spikelets** 3–4 mm long. Lower **glumes** obovate to obovate-lanceolate, glabrous to ciliate above 0.5–0.67th, 5–12-nerved, keels winged, ciliate, apex obtuse to truncate, marginal nerves excurrent; upper glume ciliate in upper half, obtuse to notched. **Awns** geniculate, 6.5–25 mm long. **Anthers** sometimes staminodial, or up to 2 mm long. **Pedicelled spikelets** sterile or male with pedicels c. 2 mm long.

Distribution. Sri Lanka, India to southern China and Malesia. Introduced in the Caribbean, Argentina and several Pacific islands. In Singapore it is likely naturalised rather than native as it prefers a distinct dry season. It has been collected from Bedok Corner (*Ali Ibrahim* 337, 11 Aug 1998, SING [SING0041421]), Dempsey Road (*Lai* 498, 27 Feb 1999, SINU), Newton (*Teruya* 2013, 11 Nov 1932, SING [SING0058911]), Puay Hee Avenue (*Chua* 360, 23 Jan 1991, SINU) and Tanjong Pagar Docks (*SF* 39429, *Sinclair*, 13 Nov 1951, L, SING [SING0041423]).

Ecology. Sunny, dry soil on road sides in Singapore. Elsewhere vegetation-forming

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

18. DIGITARIA Haller

(Latin, *digitarius* = having fingers;

referring to the often digitate position of the racemes)

Hist. Stirp. Helv. 2 (1768) 244, nom. cons., non Heist. ex Fabr. (1759); Henrard, Monogr. Digitaria (1950) 1; Veldkamp, Blumea 21(1) (1973) 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 327; Boonsuk et al., Phytotaxa 246 (2016) 250. **Synonyms:** *Panicum* L. sect. *Digitaria* (Haller) Trin., Gram. Panic. (1826) 48, 76; Nees in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 20, isonym. – *Panicum* L. subg. *Digitaria* (Haller) A.Gray, Manual (1848) 611; Hackel, Oesterr. Bot. Z. 51 (1901) 290, isonym. – *Panicum* L. ser. *Digitarieae* Benth., Fl. Austral. 7 (1878) 464. – *Paspalum* L. sect. *Digitaria* (Haller) Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 10, 13. – *Paspalum* L. subg. *Digitaria* (Haller) A.Camus, Notul. Syst. (Paris) 2 (1912) 216. **Type:** *Digitaria sanguinalis* (L.) Scop., typ. cons.

Annuals or perennials, tufted or mat-forming, branching intra- and extra-vaginally at base, sometimes rhizomatous and/or stoloniferous. **Culms** hollow, occasionally filled with pith. **Ligule** collar-shaped or membranous, triangular to fimbriate, glabrous. **Leaf** blades inrolled when young, linear. **Panicles** composed of digitate or whorled racemes; common axis absent to 5 cm long, usually lax. **Spikelets** 2-flowered, biseriate, secund, abaxial (see notes), paired or ternate, in unequally pedicelled combinations, one shortly pedicelled, dorso-ventrally compressed, glabrous or beset with minute hairs of various types, callus obtuse, glabrous. **Glumes** 1 or 2, very unequal, free, retuse to acute; lower glume sometimes absent, much shorter than the spikelet, 0(–3)-nerved; upper glume shorter than to as long as the spikelet, 1–5-nerved. Lower **lemma** sterile; palea absent to very inconspicuous. Upper lemma chartaceous, smooth, inconspicuously 0(–3)-nerved, dorsally flattened, germination flap present, glabrous, margins lying flat on and covering most of the palea, apex muticous.

Distribution. A genus of approximately 250 species, cosmopolitan, mainly (sub)tropical. In Singapore 10 species, one of which is naturalised.

Taxonomy. The genus belongs to the *Panicoideae* – *Anthephorinae* Benth. The genus was revised in continental Southeast Asia by Boonsuk et al. (Phytotaxa 246 (2016) 248–280). Additional synonyms to those listed here can be found there.

Notes. The rachis is considered distinctly serrate if the spicules are visible with 10× magnification.

The spikelet sometimes seems to be 1-flowered and adaxial when the lower glume is absent and the lower lemma is mistaken for the upper glume. The lower lemma may not be recognised as such, as the palea is usually absent to very inconspicuous.

Key to *Digitaria* taxa

1. Spikelets 2–3.5 mm long, all in pairs; abscission of pedicels truncate 2
 Spikelets 1.3–2 mm long, at least in the middle of the branches in groups of 3(–5), sometimes apparently in pairs, then pedicel of third spikelets adnate to the rachis and this spikelet apparently solitary, or pedicels with an abortive spikelet at base; abscission of pedicels discoid to cupuliform 10
2. Lower glume absent to very small, up to 0.25 mm long 3
 Lower glume distinct, at least 0.25 mm long 7
3. Margins of rachis distinctly serrate, teeth at least 0.05 mm long 4
 Margins of rachis smooth to minutely serrulate, teeth up to 0.03 mm long **8. *D. radicata***
4. Spikelets either homomorphous and all lower lemmas in the second interspace with yellowish bristles (appressed at anthesis), or at least the upper pair of the raceme heteromorphous, i.e. lower lemma of the sessile spikelet *either* glabrous and nerves equidistant *or* slightly pubescent and nerves inequidistant, that of the pedicelled spikelet always more pubescent to bristled, nerves inequidistant. (The basal spikelets may be homomorphous, then completely glabrous) 5
 All spikelets homomorphous, with a hairy fringe, but never bristled 6
5. Upper glume 1–2.75 mm long, 0.35–0.8 times as long as the spikelet; bristles of the sterile lemma absent or obscured by the other pubescence, especially during anthesis, spreading in fruit **1. *D. bicornis***
 Upper glume 0.3–1 mm long, 0.15–0.3 times as long as the spikelet; bristles of the lower lemma at most with only a few hairs between them **9b. *D. setigera* var. *calliblepharata***
6. Spikelet 2–2.5 mm long; upper glume 1–1.5 mm long, 0.4–0.8 times as long as the spikelet; anthers 0.3–0.6 mm long **7. *D. nuda***
 Spikelet (2–)2.8–3.1 mm long; upper glume 0.25–1.25 mm long, 0.2–0.25(–0.4) times as long as the spikelet, usually much less; anthers 0.65–1.3 mm long **9a. *D. setigera* var. *setigera***
7. Blades 2–9 mm wide; spicules of pedicels absent to triangular 8
 Blades up to 2 mm wide; spicules of pedicels often more or less hair-like **3. *D. didactyla***

8. Spikelets homomorphous, never bristled 9
Spikelets either homomorphous and bristled, or at least upper pair of branch heteromorphous: i.e. lower lemma of the sessile spikelet *either* glabrous and nerves equidistant *or* slightly pubescent and nerves inequidistant, that of the pedicelled spikelet always more pubescent to bristled, nerves inequidistant **1. D. bicornis**
9. Rachis distinctly serrate, spicules at least 0.05 mm long **2. D. ciliaris**
Rachis smooth to minutely serrulate, spicules up to 0.03 mm long **8. D. radicata**
10. Spikelets puberulous to pubescent, (appressed) hairs present at least along the margins of the upper glume and sterile lemma; fertile floret not protruding, pale yellow to dark brown in fruit 11
Spikelets glabrous; fertile floret protruding (at maturity), pale yellow to yellow-brown in fruit, often with a bluish tip **4. D. fuscescens**
11. Plant stoloniferous; racemes 2–4(or 5), common axis only rarely developed, then up to 1.5 cm long; pedicels smooth to sparsely serrate; fertile floret pale yellow to dark yellow-brown in fruit 12
Plant not stoloniferous; racemes (1–)2–7(–14), common axis usually well-developed, 0.3–2.5(–4) cm long; pedicels sparsely to densely serrate; fertile floret dark brown to black in fruit **10. D. violascens**
12. Spikelets 1.3–1.7(–1.9) mm long; upper glume as long as the spikelet; lower lemma with 5–7 more or less inequidistant nerves, obtuse **5. D. longiflora**
Spikelets 1.8–2 mm long; upper glume 0.7–1 times as long as the spikelet; lower lemma with 7 equidistant nerves, acute to acuminate **6. D. mollicoma**

1. *Digitaria bicornis* (Lam.) Roem. & Schult.

(Latin, *bi-* = two, *-cornis* = horned; alluding to the often paired racemes)

Syst. Veg., ed. 15 bis, 2 (1817) 470; Turner, Gard. Bull. Singapore 45 (1993) 95; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 54, fig. 41; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 227; Boonsuk et al., Phytotaxa 246 (2016) 254. **Basionym:** *Paspalum bicorne* Lam., Tabl. Encycl. 1, fasc. 1 (1791) 176. **Synonyms:** *Panicum bicorne* (Lam.) Kunth, Révis. Gramin. 1 (1829) 33. – *Digitaria bicornis* (Lam.) Roem. & Schult. subsp. *lamarckiana* Henrard, Monogr. Digitaria (1950) 979, nom. inval. **Type:** *Sonnerat s.n.*, India (holotype P-LA [P00563991]; isotype US (fragment)). **Fig. 23A.**

Annuals or short-lived perennials, at first tufted, culms later decumbent, rooting at the nodes, forming loose mats. **Culms** 0.3–0.6 m high; nodes sparsely hairy. **Ligules** 1–3.5 mm high. **Leaf** blades linear, 2.5–14(–23) cm by 2–9 mm, glabrous, rarely sparsely pilose. **Racemes** 2–5(–10), digitate or in up to 3 whorls along a 0–5 cm long common axis, the longest ones 3.5–14.5 cm long; rachis winged, margins serrate, teeth at least 0.05 mm long; pedicels serrate, abscission truncate. **Spikelets** paired, usually quite heteromorphous, 2.75–3.5 mm long. Lower **glume** very variable, from nearly absent to triangular, 0.1–0.4(–0.75) mm long; upper glume 1–2.75 mm long, 0.35–0.8 times as long as the spikelet. Lower **lemma** as long as the spikelet

(inspect the whole raceme!) that of the sessile spikelets usually glabrous and equidistantly 7-nerved (nerves often apically serrate) to slightly pubescent and inequidistantly nerved (that of the pedicelled spikelet then always bristled!), to pubescent and bristled (spikelets then homomorphous!), those of the pedicelled spikelets usually more or less pubescent and inequidistantly nerved, pubescence usually mixed with bristles, the 'normal' hairs acute, with smooth walls, apex acute. **Fertile floret** slightly shorter than the spikelet, yellowish in fruit. **Anthers** 0.5–0.6 mm long.

Distribution. Throughout the tropics and subtropics. In Singapore it is native and has been collected in Changi (*Ridley s.n.*, 1890, SING [SING0017718]), Newton (*Teruya* 2221, 26 Jan 1932, SING [SING0041397]) and Tanah Merah Besar (*Burkill SF* 4669, 19 Jan 1919, SING [SING0017719]).

Ecology. Waste places, often on sand.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it has not been collected or recorded since 1932 and is presumed Nationally Extinct.

2. *Digitaria ciliaris* (Retz.) Koeler

(Latin, *ciliaris* = ciliate; referring to the pubescence of the lower lemma)

Descr. Gram. (1802) 27; Persoon, Syn. Pl. 1 (1805) 85, isonym; Schlechtendal, Index Seminum Hort. Hal. 1854 (1855) 7; Gilliland, Rev. Fl. Malaya 3 (1971) 196, fig. 40, pl. 25c; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 162, fig. 265; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 54, fig. 42; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 270; Boonsuk et al., Phytotaxa 246 (2016) 255. **Basionym:** *Panicum ciliare* Retz., Observ. Bot. 4 (1786) 16. **Synonyms:** *Milium ciliare* (Retz.) Moench, Suppl. Meth. (1802) 66, as '*ciliatum*', nom. illeg. non Giseke (1792). – *Syntherisma ciliare* (Retz.) Schrad., Fl. Germ. (1806) 160, t. 3: fig. 7. – *Paspalum ciliare* (Retz.) DC. in Lamarck & De Candolle, Fl. Franç., Suppl. 5 (1815) 250. – *Panicum sanguinale* L. var. *ciliare* (Retz.) St.-Amans, Fl. Agen. (1821) 25. – *Digitaria sanguinalis* (L.) Scop. var. *ciliaris* (Retz.) Parl., Fl. Ital. 1(2) (1850) 126. – *Digitaria sanguinalis* (L.) Scop. subsp. *ciliaris* (Retz.) Arcang., Comp. Fl. Ital. (1882) 762. – *Paspalum sanguinale* (L.) Lam. var. *ciliare* (Retz.) Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 15; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125. – *Sanguinaria ciliaris* (Retz.) Bubani, Fl. Pyren. 4 (1901–1902) 257. – *Syntherisma sanguinalis* (L.) Dulac var. *ciliaris* (Retz.) Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 120. – *Digitaria sanguinalis* (L.) Scop. f. *ciliaris* (Retz.) Hook.f. ex Haines, Bot. Bihar Orissa (1924) 1008. – *Digitaria marginata* Link var. *ciliaris* (Retz.) Ridl., Fl. Malay Penins. 5 (1925) 214, p.p. – *Syntherisma sanguinalis* (L.) Dulac subsp. *ciliaris* (Retz.) Masam. & Yanagih., Trans. Nat. Hist. Soc. Formosa 31 (1941) 327. **Type:** [*Wennerberg s.n.*] China, Cant[on] (lectotype LD [LD1244766], designated by Blake, Proc. Roy. Soc. Queensland 81 (1970) 10). **Fig. 23B, 24.**

Digitaria marginata Link, Enum. Hort. Berol. Alt. 1 (1821) 102; Ridley, Fl. Malay Penins. 5 (1925) 213; Henderson, Malay. Wild Fls., Monocot. (1954) 340, fig. 194a–d; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 820. **Synonyms:** *Panicum linkianum* Kunth, Révis. Gramin. 1 (1829) 33, nom. illeg. superfl. – *Panicum marginellum* Schrad., Linnaea 12 (1838) 428, nom. illeg. superfl. – *Syntherisma marginata* (Link) Nash in Britton, N. Amer. Fl. 17 (1912) 154. – *Panicum sanguinale*

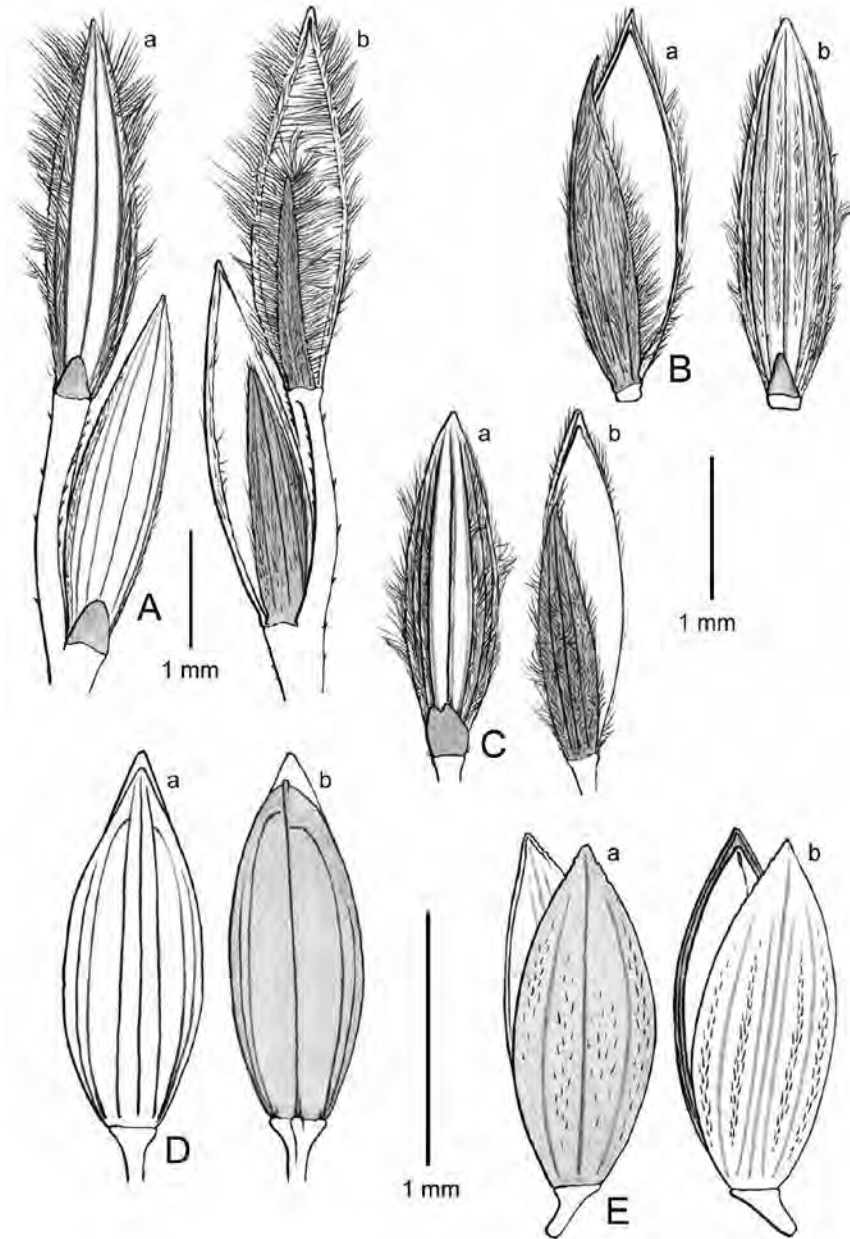


Figure 23. *Digitaria bicornis* (Lam.) Roem. & Schult. **A.** Pair of heteromorphous spikelets: **a.** facing lower glume, **b.** facing upper glume. *Digitaria ciliaris* (Retz.) Koeler. **B.** Spikelets: **a.** facing upper glume, **b.** facing lower glume. *Digitaria didactyla* Willd. **C.** Spikelets: **a.** facing lower glume, **b.** facing upper glume. *Digitaria fuscescens* (J.Presl) Henrard. **D.** Spikelets: **a.** 1st lemma, **b.** facing upper glume. *Digitaria longiflora* (Retz.) Pers. **E.** Spikelets: **a.** facing upper glume, **b.** facing 1st lemma. (Drawn by J.J. Vermeulen).

L. subsp. *marginatum* (Link) Thell., Vierteljahrsschr. Naturf. Ges. Zürich 64 (1919) 699. – *Digitaria sanguinalis* (L.) Scop. var. *marginata* (Link) Fernald, Rhodora 22 (1920) 103. – *Digitaria adscendens* (Kunth) Henrard subsp. *marginata* Henrard, Monogr. Digitaria (1950) 998, nom. inval. – *Digitaria ciliaris* (Retz.) Koeler subsp. *marginata* (Link) Jain & Das, Indian Forester 99 (1973) 572. – *Digitaria ciliaris* (Retz.) Koeler var. *marginata* (Link) Link ex Moulik, Grasses Bamboos India 1 (1997) 91. **Type:** *Collector unknown s.n.* (lectotype B [B200272564], part annotated ‘a’ only, designated by Henrard, Monogr. Digitaria (1950) 429).

Digitaria fimbriata Link, Hort. Berol. 1 (1827) 226. **Synonyms:** *Panicum fimbriatum* (Link) Kunth, Révis. Gramin. 1 (1829) 33; J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 298, isonym. – *Syntherisma fimbriata* (Link) Nash, Bull. Torrey Bot. Club 25 (1898) 302. – *Panicum sanguinale* L. var. *fimbriatum* (Link) A.Usteri, Vierteljahrsschr. Naturf. Ges. Zürich 50 (1905) 455. – *Digitaria marginata* Link var. *fimbriata* (Link) Stapf, Fl. Trop. Afr. 9(3) (1919) 440. – *Digitaria sanguinalis* (L.) Scop. var. *fimbriata* (Link) Stapf ex Merr., Enum. Philipp. Fl. Pl. 1 (1923) 55. – *Digitaria adscendens* (Kunth) Henrard var. *criniformis* Henrard, Monogr. Digitaria (1950) 255, nom. illeg. superfl. – *Digitaria adscendens* (Kunth) Henrard var. *fimbriata* (Link) Cufod., Bull. Jard. Bot. État 39 (1969) Suppl. 1327, nom. illeg. superfl. – *Digitaria ciliaris* Koeler var. *criniformis* R.R.Stewart, Biologia (Lahore) 16 (1970) 23, nom. illeg. superfl. – *Digitaria ciliaris* Koeler var. *fimbriata* (Link) Jain & Das, Indian Forester 99 (1973) 572. **Type:** *Collector unknown s.n.* (lectotype B [B100272564], part annotated ‘b’ only, designated by Henrard, Monogr. Digitaria (1950) 255).

Digitaria chinensis auct. non Hornem.: Ridley, Fl. Malay Penins. 5 (1925) 215, p.p.

Digitaria marginata Link var. *commutata* auct. non (Schult.) Ridl.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.

Paspalum sanguinale auct. non (L.) Lam.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184, p.p.; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p.

Paspalum sanguinale (L.) Lam. var. *commutatum* auct. non (Schult.) Hook.f.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p.

Annuals or short-lived perennials. **Culms** at first tufted, later decumbent, rooting at the nodes, forming loose mats, up to 0.6 m high. **Ligules** 1–3 mm high, erose. **Leaf** blades linear, 3–15 cm by 3–7 mm, glabrous to sparsely pilose. **Racemes** (2–)3–7(–10), digitate or in up to 2(or 3) whorls along an up to 2(–4) cm long common axis, the longest ones (3–)5–15(–22) cm long; rachis winged, margins serrate, teeth at least 0.05 mm long; pedicels serrate, abscission truncate. **Spikelets** paired, homomorphous, 2.5–3.5 mm long, hairs smooth, acute. Lower **glume** more or less triangular, 0.25–0.5 mm long; upper glume 1–2.4(–2.75) mm long, 0.5–0.8 times as long as the spikelet. Lower **lemma** as long as the spikelet, inequidistantly (3–)7-nerved, variously pubescent, rarely glabrous, nerves then more or less equidistant, apex acute. **Fertile floret** slightly shorter than the spikelet, yellowish in fruit. **Anthers** 0.6–1 mm long.

Distribution. Throughout the tropics and subtropics, rare in Africa. In Singapore it is native and has been collected in many places including East Coast Park (*Duistermaat 217*, 22 Oct 2003, L, SING [SING0059193]), MacRitchie (*Duistermaat et al. 193*, 27 Sep 2003, SING [SING0059196]), Pulau Ubin (*Furtado SF 18637*, 31 Jul 1927, SING [SING0058861]), St. John’s Island (*Teo SJC 13*, 18 Aug 2000, SINU) and Pasir Panjang-HortPark (*Chen SING2017-737*, 6 Dec 2017, SING [SING0255904]).



Figure 24. *Digitaria ciliaris* (Retz.) Koeler. **A.** Culm with leaves and inflorescence. **B.** Detail of two racemes. **C.** Detail of leaf sheath and blade. (From Singapore, HortPark, *Chen SING2017-737*. Photos: L.M.J. Chen).

Ecology. Waste places, often on sand.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Common crab grass* (English).

Notes. Although the pubescence of the lower lemma may be variable, truly heteromorphous spikelets have never been encountered, nor are bulbous-based bristles present.

3. *Digitaria didactyla* Willd.

(Latin, *di-* = two, *-dactyla* = fingers; alluding to the shape of the racemes)

Enum. Pl. (1809) 91; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 820; Gilliland, Rev. Fl. Malaya 3 (1971) 195, pl. 25d; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 162; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 55, fig. 43; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 266; Boonsuk et al., Phytotaxa 246 (2016) 257. **Synonyms:** *Panicum didactylum* (Willd.) Kunth, Révis. Gramin. 1 (1829) 33. – *Panicum commutatum* (Schult.) Nees var. *didactylum* (Willd.) Nees, Fl. Afr. Austral. III. (1841) 26. – *Paspalum sanguinale* (L.) Lam. var. *didactylum* (Willd.) A.Camus, Notul. Syst. (Paris) 2 (1912) 223. **Type:** *Bory de Saint-Vincent s.n.*, Insula Bourboniae [Réunion] (lectotype B-W [B-W01646010], designated by Henrard, Monogr. Digitaria (1950) 179; islectotype BM). **Fig. 23C.**

Digitaria peninsulae Ohwi, Bull. Tokyo Sci. Mus. 18 (1947) 7; Gilliland, Rev. Fl. Malaya 3 (1971) 196. **Synonym:** *Digitaria didactyla* Willd. var. *peninsulae* (Ohwi) Henrard, Monogr. Digitaria (1950) 991. **Type:** *Ohwi* 5, Singapore, 20 September 1941 (lectotype BO, designated by Henrard, Monogr. Digitaria (1950) 538; islectotype L [L0044144]).

Digitaria marginata Link var. *debilis* auct. non (Desf.) Ridl.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.

Paspalum sanguinale (L.) Lam. var. *debile* auct. non (Desf.) Hook.f.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p.

Perennials. **Culms** densely tufted, stoloniferous, mat-forming, rooting at the decumbent nodes, glabrous or pilose at base, 0.2–0.4 m high; nodes glabrous. **Ligules** 0.5–2(–2.5) mm high. **Leaf** blades linear, 2–7(–14.5) cm by 1–2 mm, glabrous or with a few hairs in the throat. **Racemes** (1–)2–3(–4), digitate or corymbosely paniced, the longest ones 1–6 cm long; common axis 0(–1) cm long; rachis winged, margins at base smooth, upwards serrate, spicules often hair-like; pedicels serrate, abscission truncate. **Spikelets** paired, homomorphous, 2–2.75 mm long, hairs smooth, acute. Lower **glume** quadrangular to triangular, 0.2–0.5 mm long; upper glume 1–2 mm long, (0.4–)0.5–0.75 times as long as the spikelet. Lower **lemma** as long as the spikelet, more or less inequidistantly (5–)7-nerved, variously pubescent, apex acute. **Fertile floret** slightly shorter than the spikelet, yellowish to leaden in fruit. **Anthers** 1–1.25 mm long.

Distribution. Southern Africa, Madagascar, Mauritius, Réunion and St. Denis. Cultivated and naturalised elsewhere, including in Singapore. Collected from Singapore Botanic Gardens

(*Ridley s.n.*, 1892, SING [SING0018128]), Dover Road (*Duistermaat 144*, 30 May 2003, L, SING [SING0059200]), Geylang (*Teruya 1933*, 13 Oct 1932, SING [SING0041389]), Holland Road (*Duistermaat 152*, 6 Jun 2003, K, SING [SING0059201]) and Telok Paku (*Sinclair 10765*, 23 Dec 1964, K, L, SING [SING0017722]).

Ecology. Roadsides, lawns.

Provisional conservation assessment. Globally Least Concern (LC). Naturalised in Singapore.

Uses. A good lawn-grass in areas without a prolonged dry season, forming a soft, close turf.

Vernacular names. *Serangoon grass* (English), *rumpu Serangoon* (Malay).

4. *Digitaria fuscescens* (J.Presl) Henrard

(Latin, *fuscescens* = turning dark brownish; referring to the fertile floret in fruit)

Meded. Rijks-Herb. 61 (1930) 8; Moore, Bernice P. Bishop Mus. Bull. 102 (1933) 19, isonym; Gilliland, Rev. Fl. Malaya 3 (1971) 193; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 162; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 55, fig. 44; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 227; Boonsuk et al., Phytotaxa 246 (2016) 257. **Basionym:** *Paspalum fuscescens* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 213, 351. **Synonyms:** *Syntherisma fuscescens* (J.Presl) Scribn., Rep. (Annual) Missouri Bot. Gard. 10 (1899) 49, pl. 10: fig. 1. **Type:** *Haenke s.n.* [USA, California, Monte-Rey] (lectotype MO [MO-440063], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 49; isolectotypes BM, BR, HAL, L, PR, US (fragment), W). **Fig. 23D.**

Paspalum longiflorum auct. non Retz.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184, p.p.

Digitaria longiflora auct. non (Retz.) Pers.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 820, p.p.

Perennial, mat-forming, stolons widely creeping. **Culms** ascendingly erect, 0.15–0.4 m high; nodes hairy. **Ligules** 0.5–2 mm high. **Leaf** blades linear-lanceolate to linear, 1–5(–11) cm by 2–5 mm, glabrous to sparsely hairy. **Racemes** 2 or 3(–5), digitate, longest ones (2–)3–7(–9) cm long; common axis 0–0.5 cm long; rachis winged, smooth to very finely serrate; pedicels smooth, abscission discoid to cupuliform. **Spikelets** ternate, homomorphous, 1.3–1.6(–1.7) mm long, glabrous. Lower **glume** 0–0.1 mm long; upper **glume** 1.4–1.7 mm long, 0.85–0.95 times as long as the spikelet. Lower **lemma** as long as the upper glume, (in)equidistantly 5–7-nerved, apex acute. **Fertile floret** about as long as the spikelet, yellowish to brownish in fruit, apex often purplish. **Anthers** 0.5–0.75 mm long.

Distribution. Mauritius, Madagascar, Sri Lanka to southern China and through Malesia to the Pacific. Native in Singapore and collected from Changi (*Ridley s.n.*, 1898, SING [SING0017726]), Geylang (*Ridley s.n.*, Mar 1903, SING [SING0017725]), Jurong Road (*Burkill SF 4652*, 29 Dec 1918, SING [SING0017723]), Ulu Pandan Road (*Duistermaat 313*,

16 Nov 2004, L, SING [SING0058920]) and Yeo Chu Kang (*Corner s.n.*, 6 Sep 1941, SING [SING0229932]).

Ecology. Sandy to rocky soil, disturbed places.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

5. *Digitaria longiflora* (Retz.) Pers.

(Latin, *longi-* = long, *-flora* = flower; with long flowers)

Syn. Pl. 1 (1805) 85; Henderson, Malay. Wild Fls., Monocot. (1954) 342, fig 194e–g; Gilliland, Rev. Fl. Malaya 3 (1971) 192, pl. 21d; Turner, Gard. Bull. Singapore 45 (1993) 95, p.p.; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 162; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 55, fig. 45; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 227; Boonsuk et al., Phytotaxa 246 (2016) 261. **Basionym:** *Paspalum longiflorum* Retz., Observ. Bot. 4 (1786) 15; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184, p.p.; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p. **Synonyms:** *Panicum longiflorum* (Retz.) J.F.Gmel., Syst. Nat., ed. 13[bis] 2(1) (1791) 158. – *Paspalum brevifolium* (Retz.) Flügge, Gram. Monogr., Paspalum (1810) 150, nom. illeg. superfl. – *Panicum parvulum* Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 3 (1834) 205, nom. illeg. superfl. – *Panicum pseudodurva* Nees var. *minus* Nees, Fl. Afr. Austral. Ill. (1841) 21. – *Digitaria pseudodurva* (Nees) Nees ex Miq. var. *minus* Miq., Fl. Ned. Ind. 3, fasc. 3 (1857) 439, nom. inval. – *Syntherisma longiflora* (Retz.) Skeels, Bull. Bur. Pl. Industr. U.S.D.A. 261 (1912) 30. – *Digitaria longiflora* (Retz.) Pers. var. *prorrepens* Henrard, Monogr. Digitaria (1950) 824, 881, nom. inval. **Type:** *König s.n.*, India (lectotype LD, designated by Henrard, Monogr. Digitaria (1950) 410; isolectotypes BM, K). **Fig. 23E.**

Tufted annual or perennial, stoloniferous, rooting at the decumbent nodes. **Culms** tufted, 0.1–0.5 m high; nodes glabrous or hairy. **Ligules** 0.75–2 mm high. **Leaf** blades linear-lanceolate to linear, (0.75–)1–5.5(–11.5) cm by 2–5(–6) mm, usually glabrous. **Racemes** 2 or 3 (or 4), digitate, longest ones (1.5–)2–7.5(–10) cm long; common axis 0(–1) cm long; rachis winged, serrate; pedicels smooth, abscission discoid to cupuliform. **Spikelets** ternate, homomorphous, 1.3–1.7(–1.9) mm long, hairs verrucose. Lower **glume** 0–0.15 mm long; upper glume about as long as the spikelet. Lower **lemma** about as long as the spikelet, inequidistantly (5–)7-nerved, apex obtuse. **Fertile floret** slightly shorter than the spikelet, yellowish to brownish in fruit. **Anthers** (0.5–)0.6–0.8 mm long.

Distribution. (Sub)tropical Old World. Introduced in the Americas (Antigua, Costa Rica, Cuba, Florida). Native in Singapore and collected in Alexandra (*Gilliland 1782*, 25 Sep 1958, SINU), Bidadari (*Sinclair s.n.*, 19 Dec 1948, L), Newton (*Teruya 2008*, 11 Nov 1932, SING [SING0068027]), Pulau Selatar (*Loo et al. PS 28*, 10 Sep 1998, SINU) and Pulau Ubin (*Ridley s.n.*, 1894, SING [SING0017736]).

Ecology. Pioneer on humid sandy to rocky soil, weed in open grasslands, open forests. Rare.

Provisional conservation assessment. Globally Least Concern (LC). Listed as common in

Singapore by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 227) but there are very few recent collections and it is likely to be at least Vulnerable (VU/D).

Vernacular name. *Lesser crab grass* (English).

Notes. Very similar to *Digitaria violascens* Link, but differing especially in the pale colour of the fertile lemma in fruit, this happening only late in development. Also similar to *Digitaria mollicoma* (Kunth) Henrard, which differs by the lower lemma being equidistantly nerved, the fertile lemma as long as the spikelet.

6. *Digitaria mollicoma* (Kunth) Henrard

(Latin, *molli-* = soft, *-coma* = hairs; soft long hairs on the sheaths and leaves in the type collection)

Blumea 1(1) (1934) 97; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 188; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 56, fig. 46; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 227; Boonsuk et al., Phytotaxa 246 (2016) 262.

Basionym: *Paspalum mollicomum* Kunth, Enum. Pl. 1 (1833) 47. **Synonyms:** *Paspalum molle* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 213, nom. illeg. non Poir. (1804). – *Syntherisma molle* Scribn., Rep. (Annual) Missouri Bot. Gard. 10 (1899) 50, nom. illeg. superfl. **Type:** *Haenke s.n.* [Philippines, Luzon] (lectotype MO [MO-2151004], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 50; isoelectotypes B, BM, LE [Herb. Trinius 495.1], PR [197877-B], US (fragment), W). **Fig. 25A.**

Digitaria elevatovenulosa Ohwi, Bull. Tokyo Sci. Mus. 18 (1947) 6. **Type:** *Ohwi 6*, Singapore, 20 September 1941 (lectotype BO, designated by Henrard, Monogr. Digitaria (1950) 818; isoelectotype L [L0044204]).

Digitaria elevatovenulosa Ohwi var. *glabra* Ohwi, Bull. Tokyo Sci. Mus. 18 (1947) 6. **Type:** *Backer 7318*, Java (holotype BO).

Paspalum longiflorum auct. non Retz.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184, p.p.

Digitaria longiflora auct. non (Retz.) Pers.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 820, p.p.

Mat-forming perennial, stoloniferous, rooting at the decumbent nodes. **Culms** up to 0.5 m high. **Ligules** 1–2 mm high. **Leaf** blades linear-lanceolate to lanceolate, 1.25–6(–12.5) cm by 2–5(–7) mm, glabrous to appressed pilose. **Racemes** 2 or 3(–5), digitate, longest ones (2.5–)3–9(–12.5) cm long, common axis usually absent, up to 2 cm long; rachis winged, serrate; pedicels smooth to sparsely serrate, abscission discoid to cupuliform. **Spikelets** ternate, homomorphous, (1.7–)1.8–2.3(–2.5) mm long, hairs smooth to verrucose. Lower **glume** 0–0.25 mm long; upper glume 1.6–2.5 mm long, 0.8–1 times as long as the spikelet. Lower **lemma** about as long as the spikelet, equidistantly 7-nerved, acute to acuminate. **Fertile floret** about as long as the spikelet, yellowish to pale brownish in fruit. **Anthers** 0.5–0.9 mm long.

Distribution. Cambodia, Taiwan, Malesia, very local. Native in Singapore and collected from many localities including Bedok (*Kassim s.n.*, 21 Sep 1955, SINU), Gallop Road (*Duistermaat 214*, 14 Oct 2003, SING [SING0058922]), MacRitchie (*Gilliland s.n.*, 26 Aug 1961, SINU), Pierce (*Gilliland s.n.*, 31 Aug 1962, SINU) and Sungei Jurong (*Ridley 456*, Aug 1890, SING [SING0017740]).

Ecology. Locally common on open, humid, sandy to rocky soil, roadsides, lawns.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

7. *Digitaria nuda* Schumach.

(Latin, *nudus* = naked; perhaps alluding to the glabrous nodes in some specimens)

Beskr. Guin. Pl. (1827) 65; Henrard, Monogr. *Digitaria* (1950) 500, fig. 952 (incl. var. *schumacheriana* Henrard, nom. inval.); Turner, Gard. Bull. Singapore 45 (1993) 95; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 56, fig. 47; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 270; Boonsuk et al., Phytotaxa 246 (2016) 262. – **Type:** *Thonning 367*, Guinea [Ghana] (lectotype C [C10003772], designated by Henrard, Monogr. *Digitaria* (1950) 500; isolectotype L (fragment)). **Fig. 25B.**

Annuals. **Culms** tufted, 0.3–0.6 m high, finally decumbent, forming loose mats, glabrous to sparsely pilose; nodes glabrous to sparsely hairy. **Ligules** 1–1.5 mm high. **Leaf** blades linear, 1.5–12(–16) cm by 2.5–8 mm, scabrous or with some hairs in the throat. **Racemes** (2–)3–8(–18), digitate or in a corymbose panicle, the longest ones (4–)5–11(–12.5) cm long, common axis 0(–1) cm long; rachis winged, margins serrate, teeth at least 0.05 mm long; pedicels serrate, abscission truncate. **Spikelets** paired, homomorphous, (1.75–)2–2.5(–2.75) mm long, hairs smooth, acute. Lower **glume** 0(–0.15) mm long; upper glume 1–1.5(–2.2) mm long, 0.4–0.8 times as long as the spikelet. Lower **lemma** as long as the spikelet, equidistantly 7-nerved, pubescent, never bristled, apex acute. **Fertile floret** slightly shorter than the spikelet, yellowish to brownish to leaden in fruit. **Anthers** 0.3–0.6 mm long.

Distribution. Pantropical. Native in Singapore and collected on Bukit Timah Road (*Wong s.n.*, 1 Aug 1959, SINU), Lam Hoc (*Wong s.n.*, 23 Jun 1959, SINU) and University Kent Ridge (*Chua 408*, 4 Mar 1991, SINU).

Ecology. In open areas, preferably on sand.

Provisional conservation assessment. Globally Least Concern (LC). Assessed here as Critically Endangered (CR/D) in Singapore.

Vernacular name. *Naked crab grass* (English).

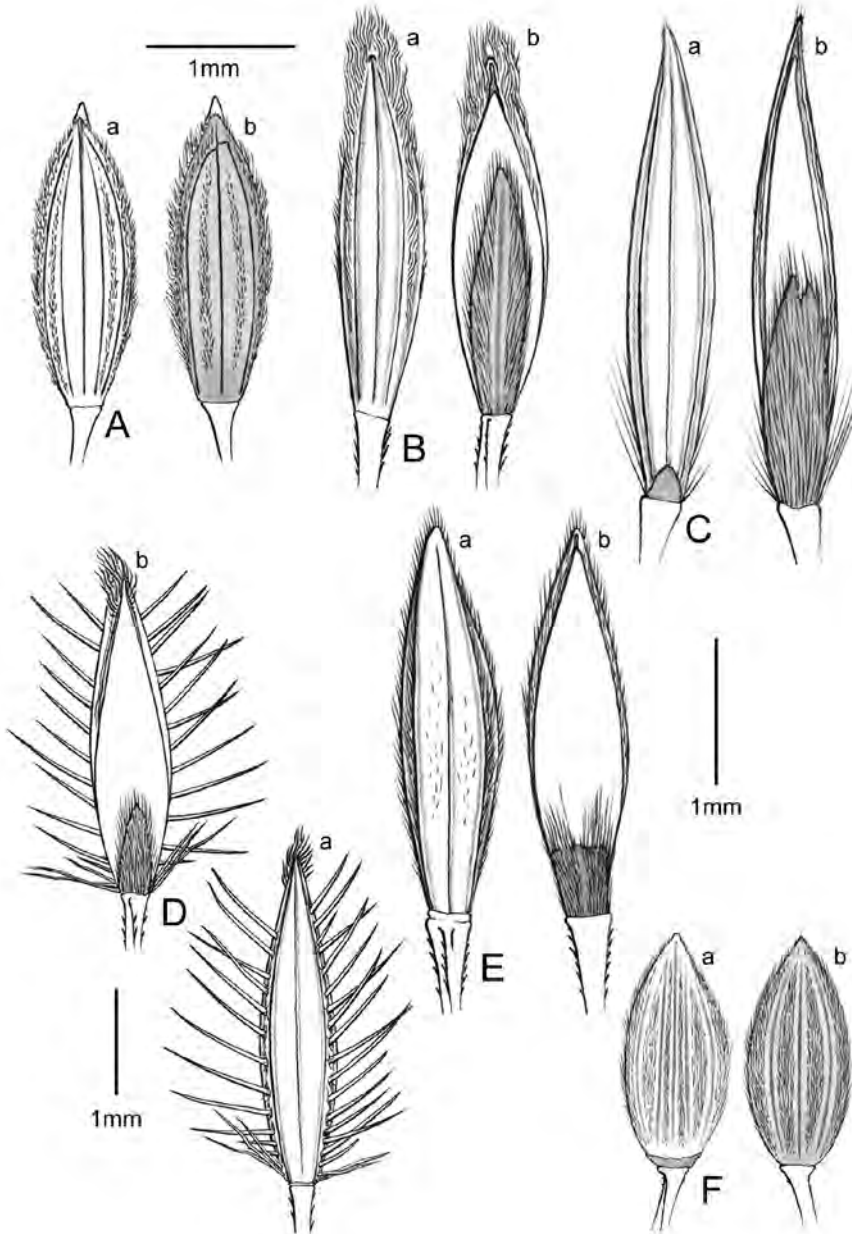


Figure 25. *Digitaria mollicoma* (Kunth) Henrard. **A.** Spikelets: **a.** 1st lemma, **b.** facing upper glume. *Digitaria nuda* Schumach. **B.** Spikelets: **a.** 1st lemma, **b.** facing upper glume. *Digitaria radicata* (J.Presl) Miq. **C.** Spikelets: **a.** facing lower glume, **b.** facing upper glume. *Digitaria setigera* Roth var. *calliblepharata* (Henrard) Veldkamp. **D.** Spikelets: **a.** 1st lemma, **b.** facing upper glume. *Digitaria setigera* Roth var. *setigera*. **E.** Spikelets: **a.** 1st lemma, **b.** facing upper glume. *Digitaria violascens* Link. **F.** Spikelets: **a.** facing lower glume, **b.** facing upper glume. (Drawn by J.J. Vermeulen).

8. *Digitaria radicosus* (J.Presl) Miq.

(Latin, *radicosus* = with many roots)

Fl. Ned. Ind. 3, fasc. 3 (1857) 437; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 163; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 58, fig. 48, pl. 8; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 270; Boonsuk et al., Phytotaxa 246 (2016) 264. **Basionym:** *Panicum radicosum* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 297. **Type:** *Haenke s.n.*, Philippines, Luzon, Sorsogon (lectotype PR [sheet no. 194788], designated by Blake, Proc. Roy. Soc. Queensland 81 (1970) 19). **Fig. 20B, Fig. 25C.**

Digitaria propinqua Gaudich., Voy. Uranie, fasc. 10 (1829) 410, nom. illeg. non (R.Br.) P.Beauv. (1812). **Synonyms:** *Panicum timorense* Kunth, Enum. Pl. 1 (1833) 83. – *Digitaria timorensis* (Kunth) Balansa, J. Bot. (Morot) 4 (1890) 138; Gilliland, Rev. Fl. Malaya 3 (1971) 198, fig. 41. **Type:** *Gaudichaud s.n.*, Timor (lectotype P [P00898398], first step designated by Veldkamp, Blumea 21(1) (1973) 35, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 14; possible isolectotypes L, P [P00898396], US (fragm.)).

Digitaria longiflora auct. non (Retz.) Pers.: Henderson, Gard. Bull. Straits Settlem. 4(6-10) (1928) 356, p.p.

Digitaria marginata Link var. *debilis* auct. non (Desf.) Ridl.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.

Panicum sanguinale L. var. *debile* auct. non (Desf.) Hook.f.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p.

Annuals or perennials (?). **Culms** becoming decumbent, rooting at the nodes, forming loose mats, sometimes stoloniferous (?), 0.2–0.6 m high; nodes glabrous to sparsely short-hairy. **Ligules** 0.75–2 mm high. **Leaf** blades linear, 2.5–11 cm by 2–8 mm, glabrous to moderately appressed-pilose. **Racemes** 2 or 3 (or 4 or 5), digitate, rarely paniced, the longest ones (2–)3–11(–14) cm long, common axis usually absent; rachis winged, margins smooth to minutely serrulate (teeth up to 0.03 mm long); pedicels more or less smooth, abscission truncate. **Spikelets** paired, homomorphous, 2.25–3.5 mm long. Lower **glume** very variable, 0.03–0.25 mm long; upper glume very variable, 0.75–2 mm long, 0.25–0.6 times as long as the spikelet. Lower **lemma** as long as the spikelet, nerves 5–7, inequidistant, glabrous or with overtopping pubescence, apex acute. **Fertile floret** slightly shorter than the spikelet, yellowish in fruit. **Anthers** 0.7–1 mm long.

Distribution. Old World tropics, from Madagascar to the Pacific, Japan and Australia (Queensland). Native in Singapore and collected in many areas such as Singapore Botanic Gardens (*Ridley 11368*, 1892, SING [SING0041393]), Bukit Timah Road (*Duistermaat 23*, 18 Feb 2001, K, L, SING [SING0059527]), Gallop Road (*Duistermaat 211*, 14 Oct 2003, L, SING [SING0059334]), Newton (*Teruya 2010*, 11 Nov 1932, SING [SING0034099]) and Pulau Satumu (*Tan et al. RL 40*, 23 Feb 1996, SINU).

Ecology. In open places, lawns, and on roadsides.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Timorese crab grass, trailing crab grass* (English).

Notes. This is an extremely variable species in its spikelet characters, resembling forms found in *Digitaria ciliaris* (Retz.) Koeler and *D. setigera* Roth. It is especially distinct in the absence or small size of the spicules on the rachis.

9. *Digitaria setigera* Roth

(Latin, *setigerus* = bristle-bearing;
referring to the setose raceme axes in the type)

in Roemer & Schultes, Syst. Veg., ed. 15 bis, 2 (1817) 474; Roth, Nov. Pl. Sp. (1821) 37; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 163; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 58, fig. 50; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 270; Boonsuk et al., Phytotaxa 246 (2016) 266. **Synonyms:** *Cynodon setigerus* (Roth) A.Rich. ex Hassk., Cat. Hort. Bot. Bogor. (1844) 17. – *Panicum setigerum* (Roth) Boerl., Ann. Jard. Bot. Buitenzorg 8 (1890) 52, nom. illeg. non Retz. (1786). – *Panicum fimbriatum* (Link) J.Presl var. *setigerum* (Roth) E.Fourn., Mexic. Pl. 2 (1886) 18. **Type:** *Heyne s.n.*, India (lectotype B [B100272556], designated by Veldkamp, Blumea 21(1) (1973) 37; isolectotype B [B100272555]). **Fig. 25E.**

Panicum pruriens Fisch. ex Trin., Gram. Panic. (1826) 77. **Synonyms:** *Digitaria pruriens* (Fisch. ex Trin.) Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 39 [(Aug 1854) 379]. – *Panicum sanguinale* L. var. *pruriens* (Fisch. ex Trin.) Drake, Fl. Polynésie Franç. (1893) 249. – *Paspalum sanguinale* (L.) Lam. var. *pruriens* (Fisch. ex Trin.) Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 15; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125. – *Digitaria sanguinalis* (L.) Scop. var. *pruriens* (Fisch. ex Trin.) Prain, Bengal Pl. (1903) 889. – *Syntherisma pruriens* (Fisch. ex Trin.) Arthur, Torreya 19 (1919) 48, 83, as ‘*Sanguinale pruriens*’. – *Digitaria marginata* Link var. *pruriens* (Fisch. ex Trin.) Hook.f. ex Ridl., Fl. Malay Penins. 5 (1925) 214. – *Syntherisma sanguinalis* (L.) Dulac var. *pruriens* (Fisch. ex Trin.) Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 299. **Type:** *Von Langsdorff s.n.* [French Polynesia, Marquesas], Nukahiva (lectotype LE [Herb. Trinius 906.5], designated by Henrard, Monogr. Digitaria (1950) 598; isolectotype BM).

Panicum microbachne J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 298. **Synonyms:** *Panicum sanguinale* L. var. *microbachne* (J.Presl) Hack., Bot. Jahrb. Syst. 13 (1890) 259. – *Syntherisma microbachne* (J.Presl) Hitchc., Mem. Bernice Pauahi Bishop Mus. 8 (1922) 177. – *Digitaria microbachne* (J.Presl) Henrard, Meded. Rijks-Herb. 61 (1930) 13; Henrard, Monogr. Digitaria (1950) 449, fig. 945; Gilliland, Rev. Fl. Malaya 3 (1971) 194, pl. 25a. – *Digitaria pruriens* (Fisch. ex Trin.) Buse var. *microbachne* (J.Presl) Fosberg, Phytologia 5 (1955) 289. **Type:** *Haenke s.n.*, Philippines, Luzon, Sorsogon (lectotype PR [sheet no. 24357], designated by Reeder, J. Arnold Arbor. 29 (1948) 292; isolectotypes BISH, HAL, US (fragment), W).

Panicum dilatatum Steud., Syn. Pl. Glumac. 1, fasc. 1 (1853) 39. **Synonyms:** *Paspalum sanguinale* (L.) Lam. var. *extensum* Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 15. – *Digitaria extensa* Henrard, Blumea 1(1) (1934) 100. **Type:** *Wight 2340*, India, Courtallam (lectotype K [K000245353], first step designated by Henrard, Monogr. Digitaria (1950) 241, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 25).

Digitaria microstachya Henrard, Monogr. Digitaria (1950) 454, fig., 942. **Type:** *Griffith s.n.* [ex Herb. Lehmann] [Malaysia], Malacca, Goldmines Clearings (holotype CGE [05576(CGE)]).

Digitaria marginata Link var. *commutata* auct. non (Schult.) Ridl.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.

Paspalum sanguinale (L.) Lam. var. *commutatum* auct. non (Schult.) Hook.f.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p.

Annuals, rarely perennials. **Culms** tufted, sometimes stoloniferous, geniculately ascending, rooting at the decumbent nodes, (0.2–)0.4–1.2 m high; nodes glabrous to sparsely hairy. **Ligules** 1.5–3.5 mm high, erose. **Leaf** blades linear-lanceolate to linear, 2.5–28 cm by 3–12(–16) mm, glabrous to sparsely pilose above. **Racemes** 2–17(–21), digitate or whorled, longest one 4–17(–22) cm long, common axis 0–6(–9) cm long; rachis winged, serrate; pedicels serrate, abscission truncate. **Spikelets** paired, homomorphous to heteromorphous, 2–4 mm long. Lower **glume** absent, rarely present, then rim-like to triangular, 0(–0.25) mm long; upper glume (0.1–)0.25–1.25 mm long, (0.05–)0.1–0.4 times as long as the spikelet. Lower **lemma** as long as the spikelet, inequidistantly 7-nerved, pubescent or bristled, hairs smooth, apex acute. **Fertile lemma** slightly shorter than the spikelet, yellow to brownish in fruit. **Anthers** 0.65–1.3 mm long.

a. var. *setigera*

Spikelets homomorphous. Upper **glume** 0.25–1.25 mm long, 0.2–0.25(–0.4) times as long as the spikelet. Lower **lemma** variously pubescent, never bristled. **Anthers** 0.65–1.3 mm long.

Distribution. Tropical Asia from India and Sri Lanka to the Pacific islands and Australia. Native in Singapore and collected in many areas including Bidadari (*Ridley s.n.*, Apr 1897, SING [SING0017731]), Geylang (*Teruya 2009*, 11 Nov 1932, SING [SING0034100]), Holland Road (*Duistermaat 30*, 20 Feb 2002, SING [SING0059525]), Pulau Ubin (*Chua & Tan 446*, 24 Apr 1991, SINU) and Sungei Buloh (*Chua & Wee 482*, 22 May 1991, SINU).

Ecology. Open areas.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *East Indian crab grass, hairy crab grass, itchy crab grass* (English).

Notes. When the lower glume is absent it may appear as if the spikelet consists of an adaxial lower glume, an abaxial upper one (actually the sterile lemma, but its palea is extremely inconspicuous) and a fertile floret. If not immediately recognised as a *Digitaria* then identification with keys becomes even more difficult when the upper glume is virtually absent: the spikelet then seems to consist of only a single abaxial glume (the sterile lemma) and a floret.

b. var. calliblepharata (Henrard) Veldkamp

(Greek, *calli-* = beautiful, *-blepharata* = eyelashes;
alluding to the bristles on the sterile lemma)

Blumea 21(1) (1973) 36, t. 6a; Turner, Gard. Bull. Singapore 45 (1993) 95; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 60, fig. 49; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 270; Boonsuk et al., Phytotaxa 246 (2016) 267. **Basionym:** *Digitaria microbachne* (J.Presl) Henrard subsp. *calliblepharata* Henrard, Monogr. Digitaria (1950) 452, fig. 945; Gilliland, Rev. Fl. Malaya 3 (1971) 198. **Synonym:** *Digitaria microbachne* (J.Presl) Henrard var. *calliblepharata* (Henrard) Henrard ex Henty, Bot. Bull. Dept. Forests Papua New Guinea 1 (1969) 77. **Type:** *Backer 27997*, Java, Kangean, Kajoe Wasoe, 1919 (holotype L [L0044247]; isotype BO). **Fig. 25D.**

Paspalum sanguinale (L.) Lam. var. *ciliare* auct. non (Retz.) Hook.f.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 125, p.p.

Digitaria marginata Link var. *ciliaris* auct. non (Retz.): Ridl., Fl. Malay Penins. 5 (1925) 214, p.p.

Spikelets homomorphous to heteromorphous. Upper **glume** 0.3–1 mm long, 0.15–0.3 times as long as the spikelet. Lower **lemma** pubescent and bristled, bristles at most with only a few hairs in between. **Anthers** 0.9–1 mm long.

Distribution. India to Micronesia (Guam, Rota) and northern Australia. Native in Singapore and collected in Cathedral compound (*Hose 80*, Jan 1904, SING [SING0017733]), Pulau Retan Laut (*Chen et al. RL 43*, 20 Jun 1994, SINU), Robinson Road (*Wong s.n.*, 1 Aug 1959, SINU), Bishan-Ang Mo Kio Park (*Chen SING2017-705*, 16 Nov 2017, SING [SING0233532]) and Sungei Serangoon (*Tan 1215*, 17 Dec 2003, SINU).

Ecology. Open areas.

Provisional conservation assessment. Globally Least Concern (LC). Erroneously listed as Nationally Extinct in Singapore by Duistermaat (Gard. Bull. Singapore 57, Suppl. (2005) 60). The most recent collection came from a population of more than 50 plants and so it is assessed here Endangered (CR/D).

10. Digitaria violascens Link

(Latin, *violascens* = turning purplish;
referring to the colour of the mature upper floret)

Hort. Berol. 1 (1827) 229; Gilliland, Rev. Fl. Malaya 3 (1971) 191, pl. 25b, colour pl. 16; Turner, Gard. Bull. Singapore 45 (1993) 95; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 163; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 60, fig. 51; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 270; Boonsuk et al., Phytotaxa 246 (2016) 272. **Synonyms:** *Panicum violascens* (Link) Kunth, Révis. Gramin. 1 (1829) 33. – *Syntherisma violascens* (Link) Nash, Proc. Acad. Nat. Sci. Philadelphia 61 (1909) 488. – *Digitaria ischaemum* (Schreb. ex Schweigg.) Schreb. ex Muhlenb. var. *violascens* (Link) Radford in Ahles, J. Elisha Mitchell Sci. Soc. 80 (1964) 172. **Type:** *Link 93*, Brazil? (lectotype B [B100185495], designated by Henrard, Monogr. Digitaria (1950) 791; possible isoelectotypes BAA (fragment), LE [Herb. Trinius 10009.3]). **Fig. 25F.**

Paspalum chinense Nees in Hooker & Arnott, Bot. Beechey Voy., fasc. 5 (1837) 231. **Synonyms:** *Syntherisma chinensis* (Nees) Hitchc., Contr. U.S. Natl. Herb. 22 (1922) 468. – *Digitaria chinensis* (Nees) A.Camus, Notul. Syst. (Paris) 4 (1923) 48, nom. illeg. non Hornem. (1819). **Type:** *Vachell s.n.*, China, Macao, Summer 1830 (lectotype CGE [06343(CGE)], designated by Henrard, Monogr. Digitaria (1950) 122).

Digitaria pertenuis Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 41 [(Aug 1854) 381]; Ridley, Fl. Malay Penins. 5 (1925) 214; Gilliland, Rev. Fl. Malaya 3 (1971) 192, colour pl. 17. **Synonyms:** *Panicum pertenuis* (Buse) Boerl., Ann. Jard. Bot. Buitenzorg 8 (1890) 51. – *Paspalum pertenuis* (Buse) Backer, Bull. Jard. Bot. Buitenzorg, ser. 2, 12 (1913) 25. **Type:** *Junghuhn s.n.*, Sumatra, Padang (lectotype L [L0044278], designated by Veldkamp, Blumea 21(1) (1973) 63; isolectotype U).

Digitaria caespitosa Ridl., Fl. Malay Penins. 5 (1925) 215. **Type:** *Ridley s.n.*, Singapore, Botanic Gardens, November 1920 (lectotype K [K00029074], first step designated by Veldkamp, Blumea 21(1) (1973) 64, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 13).

Digitaria chinensis auct. non Hornem.: Ridley, Fl. Malay Penins. 5 (1925) 215, p.p.

Digitaria longiflora auct. non (Retz.) Pers.: Ridley, Fl. Malay Penins. 5 (1925) 214, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 820, p.p.; Turner, Gard. Bull. Singapore 45 (1993) 95, p.p.

Paspalum longiflorum auct. non Retz.: Ridl., J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184, p.p.; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 126, p.p.

Annual. **Culms** tufted, usually erect, sometimes rooting at the decumbent nodes, 0.25–0.7 m high; nodes glabrous or sparsely hairy. **Ligules** 1–3(–5) mm high. **Leaf** blades linear-lanceolate to linear, (0.5–)4–17(–25) cm by (1–)3–5(–7) mm, glabrous. **Racemes** (1–)2–7(–14), digitate, usually corymbosely paniced, longest ones (1.5–)4–12(–19) cm long; common axis 0.3–2.5(–4) cm long; rachis winged, serrate; pedicels sparsely to densely serrate, abscission discoid to cupuliform. **Spikelets** ternate, homomorphous, (1.2–)1.3–1.9(–2.5) mm long, hairs verrucose. Lower **glume** 0–0.3(–0.5) mm long; upper glume (0.75–)0.9–1 times as long as the spikelet. Lower **lemma** as long as the upper glume, inequidistantly (3–)7-nerved, apex obtuse to acute. **Fertile floret** about as long as the spikelet, chestnut-coloured to blackish in fruit. **Anthers** (0.2–)0.3–0.6 mm long.

Distribution. (Sub)tropics of Asia, Australia and the Americas. Native in Singapore and widely collected, including from Bukit Timah Road (*Wong s.n.*, 3 Aug 1959, SINU), Holland Road (*Duistermaat 32*, 26 Feb 2002, SING [SING0059520]), Lim Chu Kang Road (*Duistermaat 254*, 30 Dec 2003, SING [SING0059367]), North Buona Vista/AYE (*Chua 636*, 9 Dec 1991, SINU) and Pulau Serangoon (*Tan et al. CI 133*, 25 Sep 1998, SINU).

Ecology. Waste places, road-sides, etc.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Notes. Very similar to *Digitaria longiflora* (Retz.) Pers., but differing particularly in the dark colour of the fertile floret in fruit although this may develop rather late in development.

19. DIMERIA R.Br.

(Greek, *di-* = two, *-meria* = part; referring to the two spikes in the type)

Prodr. Fl. Nov. Holland. (1810) 204; Bor, Kew Bull. 7 (1953) 553; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 301; Veldkamp, Blumea 61 (2016) 207. **Type:** *Dimeria acinaciformis* R.Br.

Annual or perennial. **Culms** tufted, internodes hollow. **Leaf** blades linear. **Ligule** truncate, margin lacerate or fimbriate. **Inflorescence** determinate, espatheate, composed of 1–14 digitate spikes. **Spikelets** numerous, hermaphrodite, solitary, lateral to and partially embedded in the rachis, secund, biseriate, pedicellate, laterally compressed, falling as a whole, 2-flowered. **Glumes** indurate, enclosing the anthoecia, usually strongly keeled, more or less equal, 1–3-nerved. **Lemmas** less firm than the glumes. Lower **floret** reduced to the lemma, sterile, awnless, 0-nerved, similar in texture to the upper one; upper lemma incised, awnless to awned from the sinus, glabrous, 1–3-nerved; awns geniculate (when present). Rachilla process absent. Lodicules absent. Stamens 2.

Distribution. A genus of approximately 67 species from Madagascar to S. Korea, Micronesia and northern Australia. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Ischaeminae* J.Presl.

Dimeria ornithopoda Trin.

(Greek, *ornitho-* = bird, *-poda* = foot;
referring to the shape of the two spikes in the type)

Fund. Agrost. (1820) 167, t. 14; Ridley, Agric. Bull. Straits Fed. Malay States 2 (1903) 274, as '*ornithopodioides*'; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 151; Ridley, Fl. Malay Penins. 5 (1925) 192; Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 324 [incl. f. *typica* Hack. ex Honda, nom. inval.]; Bor, Kew Bull. 7 (1953) 572 (incl. var. *genuina*, nom. inval.); Henderson, Malay. Wild Fls., Monocot. (1954) 346, fig. 197a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 823; Gilliland, Rev. Fl. Malaya 3 (1971) 214, fig. 46, pl. 26a,b; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 163, fig. 266; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 61, fig. 52; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 34, 169, 227. **Synonym:** *Dimeria avenacea* (Retz.) C.E.C.Fisch. subvar. *ornithopoda* (Trin.) Roberty, Boissiera 9 (1960) 399, 401. **Type:** *Collector unknown s.n.*, India orientalis (holotype LE [Herb. Trinius 1254.1]). **Fig. 26A.**

Dimeria glabra Ridl., J. Fed. Malay States Mus. 10 (1920) 156; Ridley, Fl. Malay Penins. 5 (1925) 192. **Synonyms:** *Dimeria ornithopoda* Trin. var. *glabra* (Ridl.) Jansen, Reinwardtia 2 (1953) 266; Gilliland, Rev. Fl. Malaya 3 (1971) 216, pl. 26a; Turner, Gard. Bull. Singapore 45 (1993) 96. – *Dimeria avenacea* (Retz.) C.E.C.Fisch. subvar. *glabra* (Ridl.) Roberty, Boissiera 9 (1960) 398, 400. **Type:** *Burkill SFN 4647*, Singapore, Holland Road, edge of swampy hollow, 21 January 1919 (lectotype K [K000290039], first step designated by Roberty, Boissiera 9 (1960) 398, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 14; isoelectotypes G, K).

Dimeria ornithopoda Trin. subvar. *imperfecta* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 82; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186. **Type:** *Lobb s.n.*, Java (holotype G).

Annuals. **Culms** tufted, erect to decumbent, 0.035–0.45(–0.8) m long; nodes bearded to glabrous. **Ligules** 0.2–0.5(–1) mm long. **Leaf** blades 1–10(–13) cm by 0.75–3.25 mm, glabrous or sparsely setose. **Spikes** usually 2, sometimes 3, rarely 4, rachis filiform, terete or triquetrous, 0.7–7(–8) cm by 0.1–0.5 mm, internodes 1–2 mm long, margin minutely scaberulous or ciliate; pedicels 0.1–0.3 mm long. **Spikelets** 1–3(–4.5) mm long. **Callus** hairs 0–0.8 mm long. **Glume** keels not winged; upper glumes acute, smooth, scabrous, ciliolate, or setose. **Awns** present or absent, 0–6.5(–10) mm long, incl. 0–3.5 mm long column. **Anthems** 0.25–0.8 mm long.

Distribution. India to Japan and through continental Southeast Asia and Malasia to Australia. Native in Singapore and collected in many areas including Holland Road (*Burkill SF 4674*, 21 Jan 1916, G, K, SING [SING0017747]), MacRitchie (*Gilliland 5275*, 25 Sep 1959, SINU), Nee Soon (*Chua 686*, 8 Jan 1992, SINU), Tanah Merah (*Wong s.n.*, Aug 1959, SINU) and Upper Pierce (*Duistermaat et al. 157*, 26 Aug 2003, K, L, SING [SING0059585]).

Ecology. Sunny areas, infertile soil, grass fields, road sides and river banks.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Bird's foot grass* (English).

Notes. Forms without awns or mucronate forms (*Dimeria ornithopoda* var. *glabra* and subvar. *imperfecta*) occur within the same population (see Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 61) but we have not seen mixed collections.

20. DINEBRA Jacq.

(Latinisation of a form of Arabic *dzanaib* = little tail;
referring to the apices of the glumes)

Fragm. Bot. (1809) 77, t. 121: fig. 1; Beauvois, Ess. Agrostogr. (1812) 98, as '*Dineba*'; Phillips, Kew Bull. 28 (1973) 410; Peterson et al., Ann. Bot. (Oxford) 109 (2012) 1326; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 387. **Type:** *Dinebra arabica* Jacq., nom. illeg. superfl. (= *Dinebra retroflexa* (Vahl) Panz.).

Annuals or perennials. **Culms** tufted, solid or hollow. **Ligule** membranous, erose, never ciliolate. **Panicles** lax, composed of numerous, unilateral spikes, rachis ending in a spikelet. **Spikelets** solitary, secund, biseriate, lateral towards the rachis, sessile, laterally flattened, disarticulating above the glumes and between the anthoecia, 1–6-flowered, bisexual. Lower **glume** 1-nerved; upper glume 1- or 3-nerved. Rachilla process with a (reduced) spikelet. **Lemmas** dorsally keeled, 3-nerved, callus absent, apex acute to acuminate to shortly mucronate. **Stamens** 3. **Pericarp** adnate, glabrous, smooth, not longitudinally grooved.

Distribution. A genus of 23 species from Tropical America, Africa, Madagascar to India, China, Japan, Micronesia and northern Australia. In Singapore 2 presumed native species.

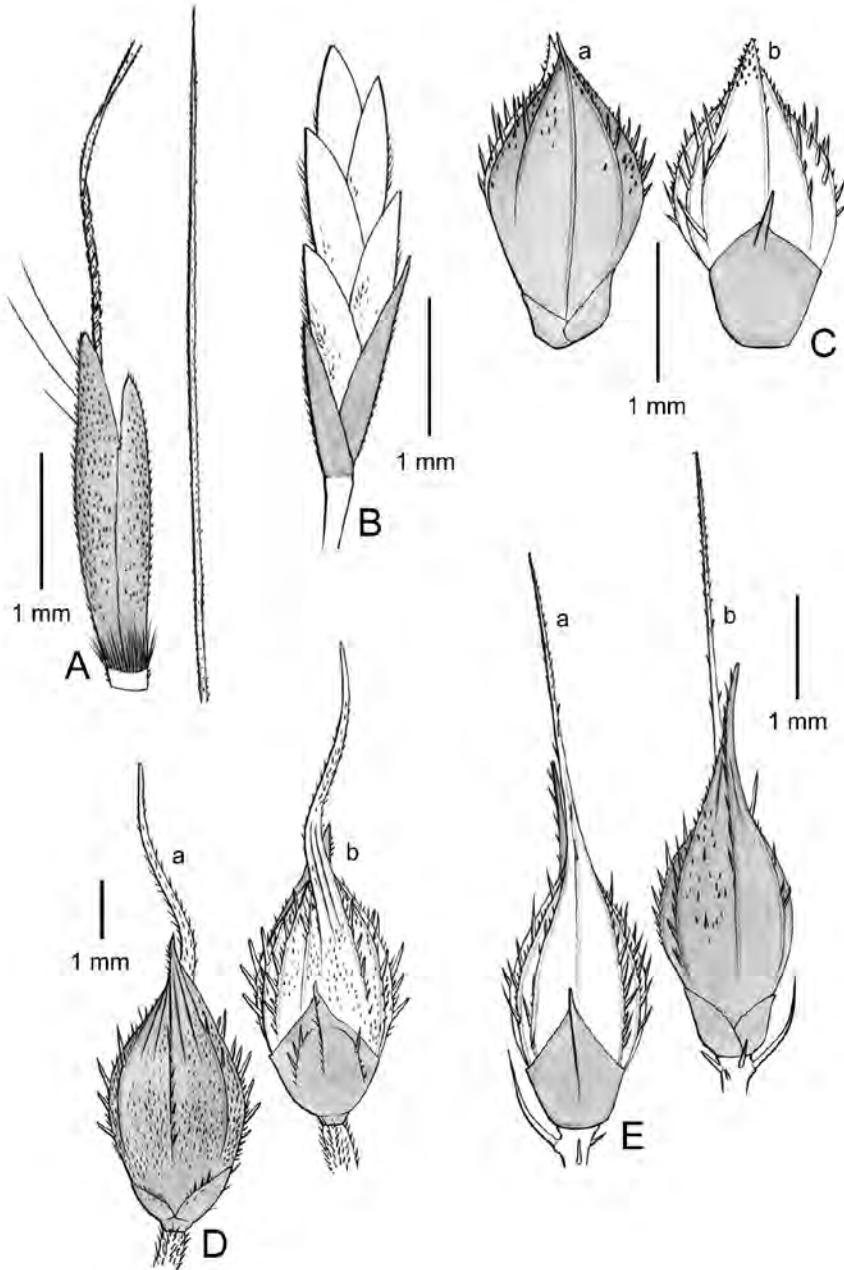


Figure 26. *Dimeria ornithopoda* Trin. **A.** Spikelet, lateral view. *Dinebra chinensis* (L.) P.M.Peterson & N.Snow. **B.** Spikelet, lateral view. *Echinochloa colona* (L.) Link. **C.** Spikelet: **a.** facing upper glume, **b.** facing lower glume. *Echinochloa crus-galli* (L.) P.Beauv. **D.** Spikelet: **a.** facing upper glume, **b.** facing lower glume. *Echinochloa picta* (J.Koenig) P.W.Michael. **E.** Spikelet: **a.** facing lower glume, **b.** facing upper glume. (Drawn by J.J. Vermeulen).

Taxonomy. This genus belongs to the *Chloridoideae* – *Chloridineae* J.Presl.

Key to *Dinebra* species

1. Aquatic or semi-aquatic, culms rooting at the decumbent nodes (if any); ligules 0.5–1.5 mm long; panicles 5–10 cm wide; spikelets 4–7-flowered, 2.1–4 mm long; glumes smooth; first lemma 1.1–1.8 mm long **1. *D. chinensis***
Terrestrial, culms not rooting at the decumbent nodes; ligules 1.5–3 mm long; panicles 1.5–4 cm wide; spikelets 1–3-flowered, 1.5–2.1 mm long; glumes minutely scaberulous; first lemma 0.8–1.2 mm long **2. *D. panicea***

1. *Dinebra chinensis* (L.) P.M.Peterson & N.Snow (of China)

Ann. Bot. (Oxford) 109 (2012) 1326. **Basionym:** *Poa chinensis* L., Sp. Pl. 1 (1753) 69. **Synonym:** *Leptochloa chinensis* (L.) Nees in Hornschuch, Syll. Pl. Nov. 1 (1822) 4; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 175; Ridley, Fl. Malay Penins. 5 (1925) 249; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1355; Gilliland, Rev. Fl. Malaya 3 (1971) 73, fig. 9, pl. 12b; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 173; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 88, fig. 86; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 169, 271. **Type:** *Osbeck s.n.*, China (lectotype LINN [Herb. Linn. no. 87.32], designated by Phillips, Fl. Trop. E. Africa, Gramineae (Pt 2) (1974) 279). **Fig. 26B, 27.**

Aquatic to semi-aquatic annual to short-lived perennial, branching intra- and extra-vaginally at base. **Culms** tufted to sprawling, geniculate to erect, 0.1–1.2 m high, rooting and sprouting at the decumbent nodes (if any). **Sheaths** glabrous, smooth to scaberulous. **Ligules** collar-shaped, 0.5–1.5 mm long, lacinate, ciliate. **Leaf** blades flat or folded, inrolled when young, 8.5–25 cm by 2.5–13 mm, glabrous, below smooth to scaberulous. **Panicles** loosely contracted to lax, 20–45 × 5–10 cm; racemes erecto-patent, persistent, numerous, 1–4 together, the longest 3–14 cm long, simple, glabrous at base, central axis 10–45 cm long. **Spikelets** laterally compressed, 2.1–4.3 mm long, 4–6(–7)-flowered. **Glumes** smooth, obtuse to mucronate; lower one 0.5–2 mm long; upper one 1.1–1.8(–2.3) mm long. First **lemma** lanceolate, 1.1–1.8 mm long, hairy on the nerves and minutely finely appressed hairy on the surface, truncate to acute. **Anthers** 0.2–0.3 mm long.

Distribution. East Africa to China and Japan and through Malesia to Australia. Presumed to be native in Singapore and distributed throughout the country such as in Kranji (*Samsuri et al. KJ 24*, 20 May 2003, SING [SING0044634]), Kusu Island (*Loo KS 20*, 3 Sep 1997, SINU), Lim Chu Kang Road (*Duistermaat 245*, 30 Dec 2003, L, SING [SING0059678]), Sungei Buloh (*Chua & Wee 474*, 22 May 1991, SINU) and Tanglin (*Luo et al. SING2015-282*, 9 Nov 2015, SING [SING0214014]).

Ecology. In wet to dry places, including old fields, disturbed places, swamp forest and along roads.



Figure 27. *Dinebra chinensis* (L.) P.M.Peterson & N.Snow. Habit with detail of inflorescence in inset. (From Singapore, Sungei Buloh. Photos: P.K.F. Leong).

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

2. *Dinebra panicea* (Retz.) P.M.Peterson & N.Snow

(Latin, *paniceus* = pertaining to *Panicum* L.; referring to a similarity to *Panicum*)

Ann. Bot. (Oxford) 109 (2012) 1326. **Basionym:** *Poa panicea* Retz., Observ. Bot. 3 (1783) 11. **Synonym:** *Leptochloa panicea* (Retz.) Ohwi, Bot. Mag. (Tokyo) 55 (1941) 311. **Type:** *Bladh s.n.*, China (holotype LD [LD1296347]; isotype BRI (fragment)).

Leptochloa polystachya auct. non Benth.: Ridley, Fl. Malay Penins. 5 (1925) 248; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1355.

Terrestrial annual to short-lived perennial, branching intra- and extra-vaginally at base. **Culms** tufted, geniculate to erect, 0.2–1 m high, not rooting at the decumbent nodes. **Sheaths** glabrous to pilose, the latter especially towards the base, (hairs bulbous-based, deciduous, 2–3 mm long), smooth. **Ligules** collar-shaped, (0.5–)1.5–3 mm long, lacinate. **Leaf** blades flat to folded, 9–30 cm by 2–15 mm, glabrous to sparsely pilose at base, below scaberulous. **Panicles** loosely contracted to lax, 10–30 × 1.5–4 cm; racemes erecto-patent, numerous, 1–8 together, the longest 5–12 cm long, glabrous to pilose at base. **Spikelets** laterally appressed and compressed, 1.5–2.1 mm long, 1–3(–5)-flowered. **Glumes** scaberulous, acute, sometimes shortly mucronate; lower one 0.5–1 mm long; upper one 0.8–1.5 mm long. **First lemma** lanceolate, 0.8–1.2 mm long, hairy on the nerves, acute. **Anthers** 0.1–0.2 mm long.

Distribution. Tropical America, Africa, Pakistan to Japan and continental Southeast Asia and Malesia to Micronesia. Presumed native in Singapore but only recently collected in Clementi Woods (*Duistermaat HDS 402*, 30 Nov 2005, L, SING [SING0072728]) and HortPark (*Chin 2017-118*, 23 Mar 2017, SING [SING0255281]).

Ecology. In disturbed places.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it has been very rarely collected and is known from extremely few plants and is therefore assessed here as Critically Endangered (CR/D).

21. *Echinochloa* P.Beauv.

(Greek, *echino-* = hedgehog, *-chloa* = grass; referring to the long awns on the type)

Ess. Agrostogr. (1812) 53, 161, pl. 11: fig. 2, nom. cons.; Michael, Proc. Conf. Weed Control Rice, 1981 (1983) 291; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 324. **Synonyms:** *Tema* Adans., Fam. Pl. 2 (1763) 496, nom. rej. – *Ornithospermum* Dumoulin in Durande, Fl. Bourgogne 1 (1782) 495, nom. rej. – *Panicum* L. sect. *Echinochloa* (P.Beauv.) Nees in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 255, as ‘*Echinochloae*’; Trinius, Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 3 (1834) 194,

213; Steudel, Syn. Pl. Glumac. 1, fasc. 1 (1853) 46, isonym; Döll in Martius, Fl. Bras. 2(2), fasc. 72 (1877) 139, isonym; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 132. – *Panicum* L. subg. *Echinochloa* (P.Beauv.) A.Gray, Manual (1848) 614. **Type:** *Echinochloa crus-galli* (L.) P.Beauv., typ. cons.

Annuals or perennials. **Culms** tufted to mat-forming and floating, branching intra-vaginally at base, sometimes rhizomatous, usually filled with pith. **Ligule** when present a row of setae. **Leaf** blades inrolled when young, linear, narrow. **Panicle** composed of racemes. **Spikelets** 2–4-seriate, paired (sometimes difficult to see in crowded glomerules), in long/short-pedicelled combinations, very shortly pedicelled, adaxial, dorso-ventrally compressed, callus obtuse, glabrous, falling as a whole. **Glumes** very unequal, setose; lower glume much shorter than the spikelet, amplexicaul, apex acuminate to mucronate, 1–5-nerved; upper glume shorter than to about as long as the spikelet, acuminate to awned, 5–7-nerved. Lower **lemma** paleate, sterile or male, 5–9-nerved, acuminate to awned; upper lemma indurate at maturity, 5-nerved, dorsally rounded, germination flap present, margins inrolled over the palea, mucronate to crested. **Stamens** 3.

Distribution. A genus of approximately 30 species in temperate and tropical regions. In Singapore 3 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Boivinellinae* Pilg.

Key to *Echinochloa* species

1. Plants annual; culms erect; ligule absent; first lemma sterile 2
Plants perennial; culms geniculate to creeping at base, rooting and branching, spongy; ligule a row of setae; first lemma male **3. E. picta**
2. Inflorescence branches setulose, rarely sparsely setose, all simple, or rarely lowermost at base with up to 0.8 cm long secondary branch; lowermost inflorescence branch short, up to 4 cm long; spikelets more or less clearly arranged in four rows, 2–3 mm long; first lemmas acuminate to mucronate, never awned; anthers purple or yellow; stigmas blackish-purple **1. E. colona**
Inflorescence branches setulose and setose, the lowermost ones usually shortly branched at base; lowermost inflorescence branch usually longer than 4 cm; spikelets usually not clearly arranged in 4 rows, longer than 3 mm; first lemmas acuminate, usually at least a few aristate; anthers yellow; stigmas white or red **2. E. crus-galli**

1. *Echinochloa colona* (L.) Link

(Latin, *colonus* = growing in the fields; referring to the habitat)

Hort. Berol. 2 (1833) 209, as ‘*colonus*’; Ridley, Fl. Malay Penins. 5 (1925) 222; Henderson, Malay. Wild Fls., Monocot. (1954) 336, fig. 192c,d; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 902; Gilliland, Rev. Fl. Malaya 3 (1971) 167, pl. 21a, colour pl. 10; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 164, fig. 267; Duistermaat, Gard. Bull.

Singapore 57, Suppl. (2005) 62, fig. 53, pl. 9; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 37, 169, 270. **Basionym:** *Panicum colonum* L., Syst. Nat., ed. 10, 2 (1759) 870; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 132. **Synonyms:** *Milium colonum* (L.) Moench, Methodus (1794) 202. – *Oplismenus colonus* (L.) Kunth in Humboldt et al., Nov. Gen. Sp. 1 (1816) 108. – *Oplismenus crus-galli* (L.) Dumort. var. *colona* (L.) Coss. & Durieu, Expl. Sci. Algérie 2 (1854) 28, as ‘*colonum*’. – *Panicum crus-galli* L. var. *colonum* (L.) Fiori, Nuov. Fl. Ital. 1(1) (1923) 79. – *Echinochloa crus-galli* (L.) P.Beauv. subsp. *colona* (L.) Honda, Bot. Mag. (Tokyo) 37 (1923) 122, as ‘*colonum*’. – *Panicum crus-galli* L. subsp. *colonum* (L.) Makino & Nemoto, Fl. Japan (1925) 1470. **Type:** *Browne s.n.* (lectotype LINN [Herb. Linn. no. 80.23], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 119). **Fig. 20C, 26C.**

Annuals. **Culms** singl tufted, erect, (0.05–)0.25–0.75(–1) m long; nodes glabrous or hairy. **Ligule** absent. **Leaf** blades linear, (2–)5–20(–30) cm by (2.5–)3.5–8(–13) mm. **Inflorescences** lax and interrupted, (1.5–)5–10(–22) × (0.5–)1–2.5 cm, axils glabrous, branches 6–30, at base simple, appressed to erecto-patent, the lowermost one (0.5–)1–4 cm long, scaberulous or setulose, rarely sparsely setose. **Spikelets** paired, more or less in 4 rows, 2–3.7 × 1–1.5 mm. **Glumes** gradually acuminate to mucronate; lower **glume** 0.8–1.6 mm long, 0.36–0.6 times as long as the spikelet, 3-nerved; upper glume 2–3.5 mm long, apically 5- or 7-nerved. Lower **lemma** sterile, acuminate to mucronate, apically 7-nerved, nerves setulose, setae 0.15–0.45 mm long, intervenium setulose; upper lemma 1.65–2.9 mm long. **Anthers** 0.6–0.9 mm long.

Distribution. Widespread in temperate and tropical areas (between 30° N and S), including in Singapore. Collected from several localities including Bishan-Ang Mo Kio Park (*Chen SING2017-707*, 16 Nov 2017, SING [SING0233534]), Jurong (*Goodenough s.n.*, 1891, SING [SING0041429]), Orchard Road (*Duistermaat 148*, 31 May 2003, L, SING [SING0059584]), Sungei Buloh (*Chua & Wee 479*, 22 May 1991, SINU) and Thomson Road (*Maxwell 80-201*, 7 Nov 1980, SING [SING0041431], SINU).

Ecology. Moist open ground, ditches and road sides.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Jungle rice* (English), *padi burung* (Malay).

2. *Echinochloa crus-galli* (L.) P.Beauv.

(Latin, *crus* = leg, *galli* = cock; presumably referring to the appearance of the panicles)

Ess. Agrostogr. (1812) 53, 161, pl. 11: fig. 2; Ridley, Fl. Malay Penins. 5 (1925) 222; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 903; Gilliland, Rev. Fl. Malaya 3 (1971) 168, fig. 33, pl. 22b; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 164; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 62, fig. 54; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 37, 169, 270. **Basionym:** *Panicum crus-galli* L., Sp. Pl. 1 (1753) 56; Ridley, J. Straits

Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 132. **Synonyms:** *Milium crus-galli* (L.) Moench, Methodus (1794) 202. – *Panicum grossum* Salisb., Prodr. Stirp. Chap. Allerton (1796) 18, nom. illeg. superfl. – *Pennisetum crus-galli* (L.) Baumg., Enum. Stirp. Transsilv. 3 (1817) 277. – *Oplismenus crus-galli* (L.) Dumort., Observ. Gramin. Belg. (1824 [‘1825’]) 138. – *Orthopogon crus-galli* (L.) Spreng., Syst. Veg. (ed. 16) 1 (1824 [‘1825’]) 307. – *Panicum crus-galli* L. var. *vulgare* Döll in Martius, Fl. Bras. 2(3), fasc. 79 (1878) 141, nom. inval. **Type:** *Collector unknown. s.n.* (Kalm?) [North America] (lectotype LINN [Herb. Linn. no. 80.18], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 117). **Fig. 26D.**

Annuals (sometimes long-living with a short rootstock?). **Culms** erect to geniculate at base, rooting at the lower nodes or not, 0.2–1.8 m long; nodes glabrous. **Ligule** absent. **Leaf** blades linear, 6–40 cm by 2–30 mm. **Panicles** contracted to lax and interrupted, 5.5–25 × 1–5 cm, axils glabrous to glabrous (nodes setose), racemes 11–18, the longer branches at base usually with distinct, short, secondary branches, erecto-patent, the lowermost one 2–8 cm long, scaberulous, setulose, setose. **Spikelets** paired to clustered, not in 4 rows, 1.9–5 × 1–3 mm. Lower **glume** 0.75–2.25 mm long, 0.25–0.6 times as long as the spikelet, gradually to abruptly acuminate, (1–)3(–5)-nerved; upper glume 2–4.5 mm long, acute to shortly awned, apically 5–7-nerved. Lower **lemma** sterile, apically 5–7-nerved, nerves scaberulous to setose, setae 0–0.75 mm long, intervenium glabrous to setulose acuminate to awned, awn 0–50 mm long; upper lemma 1.85–3.5 mm long. **Anthers** 0.45–1.3 mm long.

Distribution. Temperate and tropical areas of the world. In Singapore it is native and has been collected without locality (*Teruya* 2468, 1934, KEP, SING [SING0017748]) and in Geylang (*Teruya* 2396, Jun 1933, SING [SING0017749]) and Telok Bahru (*Sinclair SF* 40525, 14 Feb 1955, SING [SING0017750]).

Ecology. Open places, sandy shores, gardens, abandoned fields, road sides.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it is presumed Nationally Extinct.

Uses. Formerly widely cultivated for forage.

Vernacular names. *Barnyard millet* (English), *padi burung* (Malay).

Notes. This is an extremely variable species in which many authors have distinguished (micro) species, subspecies, varieties and forms, but no classification has turned out to be satisfactory. Like Hooker (Fl. Brit. India 7, fasc. 21 (1896) 31) we too find no sharp boundaries between the various forms in the herbarium where our accounts by necessity had to be made. A traditional division was based on the development of the apex of the first lemma, a rather striking feature, ranging from acute to acuminate [var. *mitis* (Pursh) Peterm.] through short-awned [var. *brevisetata* (Döll) Neilr.] to long-awned [var. *longisetata* (Döll) Neilr.].

In temperate regions it is considered to be a serious agricultural weed.

3. *Echinochloa picta* (J.Koenig) P.W.Michael

(Latin, *pictus* = painted; application uncertain)

Philipp. J. Weed Sci. 5 (1978) 18; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 62, fig. 55; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 37, 169, 191. **Basionym:** *Panicum pictum* J.Koenig, Naturforscher (Halle) 23 (1788) 204. **Synonym:** *Oplismenus pictus* (J.Koenig) Kunth, Enum. Pl. 1 (1833) 144. **Type:** *König s.n.* (lectotype LD [1220586], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 29). **Fig. 26E.**

Echinochloa stagnina auct. non (Retz.) P.Beauv.: Gilliland, Rev. Fl. Malaya 3 (1971) 166; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 164, fig. 268.

Panicum crus-galli L. var. *stagninum* auct. non (Retz.) Kuntze: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 132, in nota.

Perennial. **Culms** creeping at base, rooting and branching, spongy, floating, 1.3–1.5 m long. **Ligule** a row of 1.5–2.5 mm long setae. **Sheaths** glabrous, upper margin often setulose or setose. **Leaf** blades 16–46 cm by 6–19 mm, base cuneate to rounded. **Inflorescences** lax and interrupted, 9–32 × 3–6 cm, axils glabrous (nodes setose), branches at base simple, sometimes with short, secondary branches, erecto-patent to patent, the lowermost one 3–7.5 cm long, otherwise scaberulous, setulose, or sparsely setose. **Spikelets** paired to clustered, 3–4.5 × 1.5–2.55 mm. Lower **glume** 1.2–2.25 mm long, 0.36–0.6 times as long as the spikelet, abruptly acuminate, inconspicuously 3–5-nerved; upper glume 3.4–5.2 mm long, mucronate to shortly awned, apically 5–7-nerved. Lower **lemma** male, 3–4.5 mm long, apically 7-nerved, nerves setose, setae 0.3–0.8 mm long, intervenium glabrous to setulose, apex mucronate to awned, awn 0.5–4(–7) mm long; upper lemma 2.6–4.1 mm long. **Anthers** 1.5–1.8 mm long.

Distribution. East Africa, India, Sri Lanka, through continental Southeast Asia and Malesia to northern Queensland. Introduced in Hawai'i and Guyana. In Singapore likely to be native but only known from one unlocalised specimen (*Hullett 46*, Oct 1883, SING [SING0035053]).

Ecology. Throughout its range it is said to grow in marshes, rice fields, ponds and on river banks.

Provisional conservation assessment. Globally Least Concern (LC) as it is widespread and said to be locally abundant. In Singapore, however, it appears to be presumed Nationally Extinct.

22. ELEUSINE Gaertn.

(Greek, from Eleusis, a town where Demeter,
Greek goddess of agriculture, was worshipped)

Fruct. Sem. Pl. 1 (1788) 7, t. 1: fig. [11]; Phillips, Kew Bull. 27 (1972) 251; Hilu & Johnson, Ann. Missouri Bot. Gard. 84 (1997) 841; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 392. **Type:** *Eleusine coracana* (L.) Gaertn., lectotype designated by Nash in Britton & Brown, Ill. Fl. N. U.S., ed. 2, 1 (1913) 228.

Perennial. **Culms** tufted, solid; nodes glabrous. **Ligule** either membranous and ciliolate, or a row of hairs. **Leaf** blades folded when young. **Spikes** lax, unilateral, (sub)digitate (rarely solitary), rachis ending in a spikelet. **Spikelets** solitary, secund, biseriate, lateral to the rachis, subsessile, laterally compressed, disarticulating or not above the glumes and between the anthoecia, 3–9-flowered, muticous. **Glumes** subequal to unequal, shorter than the spikelet, dorsally keeled; lower glume shorter than first lemma, 1–3-nerved; upper glume muticous, 3–7-nerved. Rachilla terminated by a reduced floret. **Lemmas** dorsally keeled, glabrous, obtuse to acute, 3(or 5)-nerved; callus obtuse, glabrous. **Stamens** 3. **Pericarp** thin, free from the seed. **Seeds** ridged or granular.

Distribution. A genus of 9 species in the tropics and subtropics. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Chloridoideae* – *Eleusininae* Dumort.

Notes. *Eleusine coracana* (L.) Gaertn. (Fig. 28A) is currently only known from old records of plants in cultivation in Singapore and it has not been suggested in the literature that it is native or naturalised in Singapore. However, it is known to naturalise elsewhere in Southeast Asia and may do so in the future in Singapore. It is, therefore, included in the key in italics but is not otherwise discussed.

Key to *Eleusine* species

1. Spikes 8–17 mm wide, rachis 1.5–2 mm wide; spikelets tardily disarticulating; lower glume c. 2.4 mm long, truncate; upper glume c. 3 mm long, obtuse; anthers 0.85–1 mm long; seed subglobose, 1.25–1.75 × 1–1.75 mm, smooth, granular, or weakly obliquely ridged (remove pericarp), usually exposed when ripe *E. coracana*
Spikes 3–6 mm wide, rachis 0.7–1.2 mm wide; spikelets readily disarticulating; lower glume 1.8–2.0 mm long, obtuse to acute; upper glume 2.4–2.6 mm long, acute; anthers 0.35–0.5 mm long; seed elliptic to oblong, 1–1.25 × 0.5–0.75 mm, obliquely ridged, furrowed on the hilar side (remove pericarp), not exposed when ripe ***E. indica***

***Eleusine indica* (L.) Gaertn.**

(from the Indies)

Fruct. Sem. Pl. 1 (1788) 8; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 174; Ridley, Fl. Malay Penins. 5 (1925) 250; Henderson, Malay. Wild Fls., Monocot. (1954) 313, fig. 180a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 932; Gilliland, Rev. Fl. Malaya 3 (1971) 78, fig. 10, pl. 14a; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 165, fig. 269; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 64, fig. 57; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 38, 169, 266. **Basionym:** *Cynosurus indicus* L., Sp. Pl. 1 (1753) 72. **Synonyms:** *Eleusine distans* Moench, Methodus (1794) 210, nom. illeg. superfl. – *Eleusine gracilis* Salisb., Prodr. Stirp. Chap. Allerton (1796) 19, nom. illeg. superfl. – *Cynodon indicus* (L.) Raspail, Ann. Sci. Nat. (Paris), 5 (1825) 303. – *Eleusine indica* (L.) Gaertn. var. *typica* Fiori,

Nuov. Fl. Italia 1(1) (1923) 114, nom. inval. **Type:** [Published illustration] Burman, Thes. Zeylan. (1736) t. 47: fig. 1, lectotype designated by Phillips in Cafferty et al. (ed.), Taxon 49 (2000) 249. **Epitype:** Clayton 5330, Sri Lanka, Kandy, 5 miles south of Matele on Kandy road, 16 January 2970 (epitype K [K000245128], designated by Phillips in Cafferty et al. (ed.), Taxon 49 (2000) 249; isopitypes CANB, PDA, US). **Fig. 28B, 29.**

Culms 0.05–0.85 m long. **Ligules** 0.35–1 mm long. **Leaf** blades 4.5–40 cm by 3–9 mm, shorter than to overtopping the panicle. **Spikes** straight, (1–)2–7(–11), lowermost 1–3 usually solitary, (1.5–)3–15 cm by 3.5–6 mm, rachis 0.7–1.2 mm wide. **Spikelets** disarticulating, (2–)3–9-flowered, (3.25–)4.25–6 mm long. Lower **glume** 1.5–2.85 mm long, 1-nerved; upper glume 2.25–3.5 mm long, 3–5(–9)-nerved. First **lemma** 2.7–3.5 mm long, narrowly crested, acute, 3–7-nerved. **Anthers** 0.35–0.5 mm long. **Seed** elliptic to oblong, 1–1.25 × 0.5–0.75 mm, ridged, sulcate on hilar side, dark brown to blackish (remove pericarp), not exposed when ripe.

Distribution. From the Old World (sub)tropics, now widely introduced and naturalised elsewhere. Native in Singapore and very widely collected, including from Government House (*Holtum SF 35775*, Sep 1938, SING [SING0000040]), Holland Road (*Duistermaat 009*, 8 Jan 2002, L, SING [SING0059329]), Kranji (*Tan et al. KZOO 56*, Jul–Aug 2001, SINU), Pulau Ubin (*Duistermaat et al. 181*, 23 Sep 2002, SING [SING0059580]) and the Western Catchment (*Samsuri et al. WC 31*, 20 Apr 2004, SING [SING0054291]).

Ecology. Waste places, road-sides and fields. It is drought resistant.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Goose grass* (English), *rumput sambau* (Malay).

Notes. Sometimes only a single spike is developed but this reduction is part of the range in variability and does not warrant a special status.

23. ERAGROSTIS Wolf

(Greek, *eros*, *er-* = love, *agrostis* = of the field;
love grass, a vernacular name for some species)

Gen. Pl. (1776) 23; Host, Icon. Descr. Gram. Austriac. 4 (1809) 14, t. 24, isonym; Beauvois, Ess. Agrostogr. (1812) 70, 162, isonym; Veldkamp, Blumea 47 (2002) 157; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 366. **Synonyms:** *Eragrostis* Wolf sect. *Pteroessa* Döll in Martius, Fl. Bras. 2(3), fasc. 79 (1878) 136, nom. inval. – *Eragrostis* Wolf sect. *Eu-eragrostis* Boiss., Fl. Orient. 5 (1884) 580, nom. inval. – *Erosion* Lunell, Amer. Midl. Naturalist 4 (1915) 221, nom. illeg. superfl. **Type:** *Eragrostis minor* Host, lectotype designated by Ross, Acta Bot. Neerl. 15 (1966) 157.

Eragrostis Wolf sect. *Cataclastos* Döll in Martius, Fl. Bras. 2(3), fasc. 79 (1878) 137, 155; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 176. **Type:** *Eragrostis ciliaris* (L.) R.Br., lectotype designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 15.

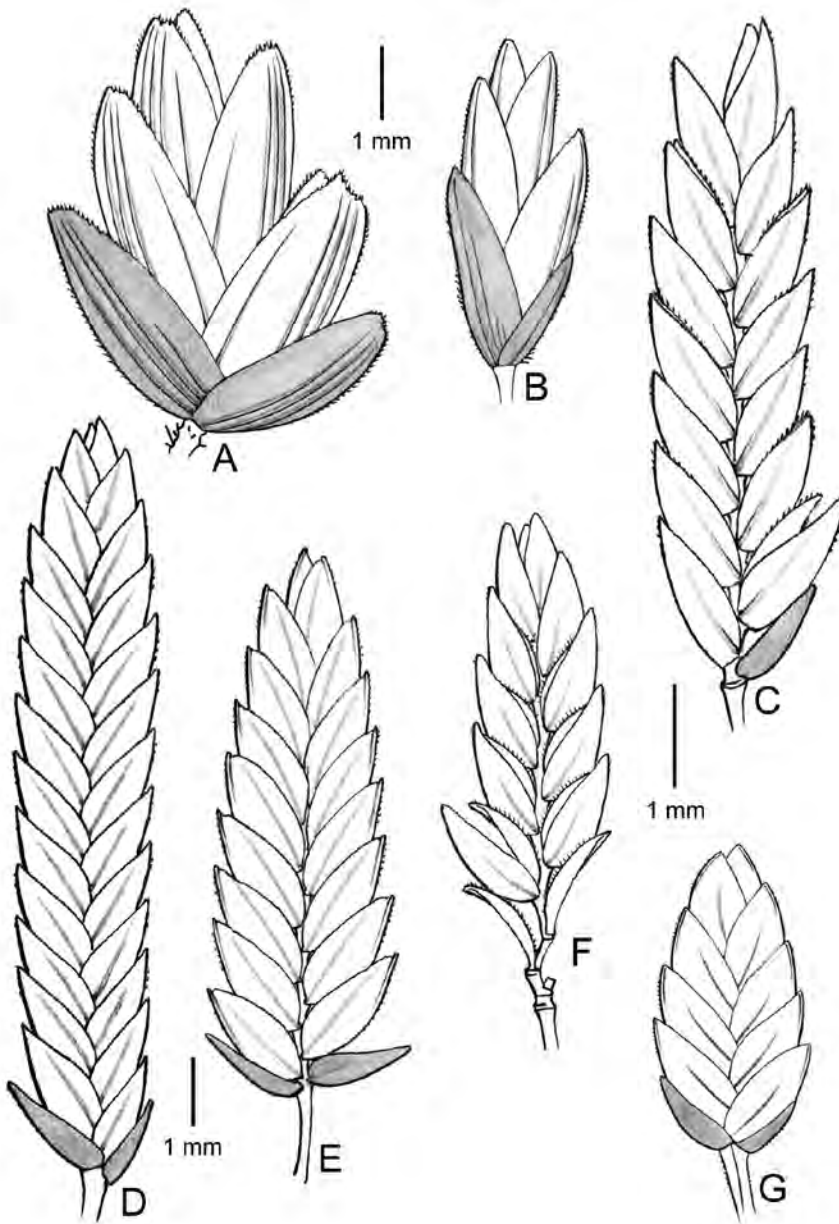


Figure 28. *Eleusine coracana* (L.) Gaertn. **A.** Spikelet, lateral view. *Eleusine indica* (L.) Gaertn. **B.** Spikelet, lateral view. *Eragrostis atrovirens* (Desf.) Trin. ex Steud. **C.** Spikelet, lateral view. *Eragrostis brownii* (Kunth) Nees. **D.** Spikelet, lateral view. *Eragrostis cumingii* Steud. **E.** Spikelet, lateral view. *Eragrostis gangetica* (Roxb.) Steud. **F.** Spikelet, lateral view. *Eragrostis montana* Balansa. **G.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).



Figure 29. *Eleusine indica* (L.) Gaertn. Habit and two separate inflorescences with detail of inflorescence in inset. (From Singapore, Kranji. Photos: P.K.F. Leong).

Annuals or perennials which branch intra- and extra-vaginally at base, rhizomes and stolons absent. **Culms** hollow; nodes glabrous. **Ligules** usually a line of hairs. **Leaf** blades inrolled when young. **Panicle branches** ending in a spikelet. **Spikelets** pedicelled, solitary, more or less laterally compressed, muticous, 2–many-flowered, disarticulating above the glumes. **Glumes** early deciduous, unequal to subequal, shorter than to subequal to the adjacent lemmas, acute to mucronate; lower glumes 0- or 1-nerved; upper glumes 0–3-nerved. **Rachilla** persistent or not, ending in a more or less reduced floret. **Lemmas** without a distinct callus, keeled or rounded on the back, 3-nerved, acute to mucronate. **Stamens** 2 or 3. **Pericarp** adnate (in Singapore).

Distribution. A genus of approximately 400 species mainly in the (sub)tropics. In Singapore 9 species of which 7 presumed native and 2 naturalised.

Taxonomy. The genus belongs to the *Chloridoideae – Eragrostidinae* J.Presl.

Key to *Eragrostis* species

1. Palea keels glabrous to ciliate 2
Palea keels long-setose **7. E. tenella**
2. Paleas early caducous; rachilla persistent, not articulated (Fig. 33B) 3
Paleas persistent; rachilla persistent or articulated (Fig. 33B) and breaking up from the top down 6
3. Culm 0.1–0.55(–0.8) m long, *if* longer than 55 cm *then* spikelet rachilla with 13–16 nodes per 3 mm length; anthers 0.1–0.5 mm long; caryopsis ellipsoid, laterally somewhat flattened, pericarp smooth or finely reticulate 4
Culm (0.6–)0.8–2 m long; spikelet rachilla with 7 or 8 nodes per 3 mm length; anthers 0.6–1 mm long; caryopsis fusiform, terete, pericarp finely striate **1. E. atrovirens**
4. Annuals; culms not rooting at lower nodes; spikelet rachilla with 7–10 nodes per 3 mm length; lemmas not microscopically punctate; keels of palea scaberulous to ciliate 5
Perennials; culms rooting at lower nodes; spikelet rachilla with 13–16 nodes per 3 mm length; lemmas microscopically punctate; keels of palea ciliate **9. E. unioloides**
5. Ligule a ciliate rim; axils of the panicle branches glabrous, lowermost panicle branches solitary; spikelets 1.5–1.75 mm wide; glumes subequal, lower glume 0.5–0.6 times as long as first lemma, 1-nerved; anthers 2, 0.15–0.27 times as long as the lemma; pericarp minutely finely reticulate **4. E. gangetica**
Ligule a row of hairs; axils of the panicle branches bearded, lowermost panicle branches whorled; spikelets 0.65–1.25 mm wide; glumes unequal, lower glume 0.27–0.38 times as long as first lemma, 0-nerved; anthers 3, 0.1–0.12 times as long as the lemma; pericarp smooth **6. E. pilosa**
6. Rachilla articulated, ultimately breaking up from the top down 7
Rachilla persistent, not articulated, breaking up from the base up 8

7. Culms branching intra- and extravaginally at base; anthers 0.3–0.4 mm long, 0.15–0.26 times as long as the lemma; pericarp usually dark tea-coloured **2. *E. brownii***
 Culms branching intra-vaginally at base; anthers 0.1–0.25 mm long, 0.06–0.13 times as long as the lemma; pericarp cinnamon-coloured **3. *E. cumingii***
8. Panicle 4–7.5 × 0.5–2.5 cm, the lower axils of the panicle branches glabrous to puberulous, lowermost longest branch 1.2–2.5 cm long; pedicels 0.5–3.25 mm long, shorter than the spikelets; spikelets 2.75–4.5 mm long; glumes 1-nerved; lower glume 0.4–0.65 times as long as first lemma; first lemma 1.1–1.5 mm long; anthers 0.2–0.35 mm long; caryopsis laterally somewhat flattened, not grooved, 0.55–0.6 mm long **5. *E. montana***
 Panicle 10.5–20 × 4.5–9 cm, the lower axils of the panicle branches bearded, lowermost longest branch 5–8 cm long; pedicels 3.5–12 mm long, longer than the spikelets; spikelets 6.5–12 mm long; glumes 0-nerved; lower glume 0.2–0.3 times as long as first lemma; first lemma 2.2–2.5 mm long; anthers 0.4–0.6 mm long; caryopsis laterally very flat, grooved, 1.15–1.25 mm long **8. *E. tenuifolia***

1. *Eragrostis atrovirens* (Desf.) Trin. ex Steud.

(Latin, *atro-* = dark or black, *-virens* = green; dull-blackish green, misleadingly referring to the colour of the plants)

Nomencl. Bot., ed. 2, 1 (1840) 562; Steudel, Nomencl. Bot., ed. 2, 2, fasc. 10 (1841) 358; Nees, Fl. Afr. Austral. Ill. (1841) 400, isonym; Gilliland, Rev. Fl. Malaya 3 (1971) 68, pl. 11g, colour pl. 1; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 1654, fig. 271; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 66, fig. 60; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 227. **Basionym:** *Poa atrovirens* Desf., Fl. Atlant. 1 (1798) 73, t. 14. **Synonym:** *Eragrostis atroviridis* Maire, Bull. Soc. Hist. Nat. Afrique N. 28 (1937) 385. **Type:** *Desfontaines s.n.*, Algeria (lectotype LE (right-hand plant only), designated by Jain, J. Indian Bot. Soc. 50 (1971) 129; isolectotypes C, FI, P). **Fig. 28C, 30.**

Poa chariis Schult., Mant. 2 (1824) 314. **Synonyms:** *Poa elegans* Roxb., [Hort. Bengal. (1814) 82, nom. nud.] Fl. Ind. 1 (1820) 339, nom. illeg. non Poir. (1804) nec R.Br. (1810). – *Poa elegantula* Kunth, Révis. Gramin. 1 (1829) 114, nom. illeg. superfl. – *Eragrostis elegantula* (Kunth) Steud., Syn. Pl. Glumac. 1, fasc. 3 (1854) 266, nom. illeg. non Miq. (1851); Ridley, Mat. Fl. Malay. Penins. 3 (1907) 179, p.p.; Ridley, Fl. Malay Penins. 5 (1925) 248, p.p.; Henderson, Malay. Wild Fls., Monocot. (1954) 312, fig. 179e–g; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 948. – *Eragrostis chariis* (Schult.) Hitchc., Lingnan Sci. J. 7 (1931) 193. **Type:** [Unpublished illustration] Icones Roxburghianae no. 841 (lectotype K, designated by Turner et al., Gard. Bull. Singapore 71 (2019) 35).

Eragrostis elongata auct. non (Willd.) J.Jacq.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187, p.p.; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 179, p.p.; Ridley, Fl. Malay Penins. 5 (1925) 248, p.p.; Henderson, Malay. Wild Fls., Monocot. (1954) 313, fig. 179h, p.p.; Turner, Gard. Bull. Singapore 45 (1993) 96, p.p.

Eragrostis nutans auct. non (Retz.) Nees ex Steud.: Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 166.



Figure 30. *Eragrostis atrovirens* (Desf.) Trin. ex Steud. **A.** Habit. **B.** Detail of inflorescence. **C.** Detail of culm with node. (From Singapore, Bishan Park, *Chen SING2017-766*. Photos: L.M.J. Chen).

Perennials. **Culms** tufted, erect to geniculate at base, rarely rooting at the nodes, branching extra- and intra-vaginally at base, 0.5–1.35(–2) m long, eglandular. **Sheath** collar subglabrous to pilose on the edges. **Ligule** a ciliolate rim, 0.2–0.3 mm long. **Leaf** blades 10–26 cm by 1.25–5 mm. **Panicles** at first contracted, later lax, 11.5–25 × 6–9 cm, axils glabrous, branches erecto-patent, 1(–2) together, the lowermost longest 6.5–11 cm long, naked in the lower 0.35–0.4 of its length, scaberulous; pedicels 0.25–4 mm long, shorter than the spikelets. **Spikelets** disarticulating from the base upward, rachilla persistent, 5.5–12(–20) × 1.5–2.5 mm. **Glumes** unequal, acute, 1-nerved; lower glume 1–1.8 mm long, 0.53–0.74 times as long as first lemma; upper glume 1.3–1.6(–2) mm long. **Lemmas** 1.75–2 mm long, acuminate. **Paleas** soon deciduous, keels scaberulous. **Anthers** 3, 0.6–1 mm long, 0.33–0.45 times as long as the lemma. **Caryopsis** spindle-shaped, 0.6–0.9 mm long, pericarp finely striate, dark tea-coloured.

Distribution. Africa, India to Japan and throughout Malesia. Native and widespread in Singapore including Pasir Panjang (*Chen SING2017-726*, 06 Dec 2017, SING [SING0255901]), Clementi Road (*Duistermaat 283*, 21 Mar 2004, L, SING [SING0059578]), Cluny Road (*Jumali 614*, 18 Dec 1961, SINU), Lower Peirce (*Holtum s.n.*, 7 Aug 1925, SING [SING0035060]) and Tuas (*Chua 1045*, 5 Oct 1994, SINU).

Ecology. Hard, stony soil, along paths, fields, moist to wet soil, usually unshaded.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Notes. Spikelets are occasionally infected with a *Bipolaris* sp. smut fungus. The epithet is misleading because, as noted by Henderson and Duistermaat, the plants are tall and bluish in the field.

2. *Eragrostis brownii* (Kunth) Nees

(Robert Brown, 1773–1858, Scottish botanist and pioneering cell biologist)

in Wight, *Cat. Indian Pl.* (1834) 105; Nees in Hooker & Arnott, *Bot. Beechey Voy.*, fasc. 6 (1838) 253, as '*brownei*'; Duistermaat, *Gard. Bull. Singapore* 57, Suppl. (2005) 68, fig. 61, pl. 11, p.p.; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 39, 169, 271. **Basionym:** *Poa brownii* Kunth, Révis. Gramin. 1 (1829) 112, as '*brownei*'. **Synonyms:** *Poa polymorpha* R.Br., *Prodr. Fl. Nov. Holland.* (1810) 180, nom. illeg. non Wibel (1799). – *Megastachya polymorpha* P.Beauv., *Ess. Agrostogr.* (1812) 74, 167, 175. – *Eragrostis atrovirens* (Desf.) Steud. f. *brownii* (Kunth) Hack. in Kneucker, *Allg. Bot. Z. Syst.* 21 (1915) 38. – *Eragrostis polymorpha* (P.Beauv.) Jedwabn., *Bot. Arch.* 5 (1924) 188, nom. illeg. non Roem. & Schult. (1817). **Type:** *Brown 6284*, Australia, Shoalwater Bay, 3 September 1802 (BM [BM000991612], designated by Lazarides, *Austral. Syst. Bot.* 10 (1997) 101; isoelectotypes E [E00381774], K, US (fragment)). **Fig. 28D, 31A.**

Eragrostis elegantula auct. non (Kunth) Steud.: Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 179, p.p.; Ridley, *Fl. Malay Penins.* 5 (1925) 248, p.p.

Eragrostis elongata auct. non (Willd.) J.Jacq.: Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 179, p.p.; Ridley, *Fl. Malay Penins.* 5 (1925) 248, p.p.; Henderson, *Malay. Wild Fls., Monocot.* (1954) 313, fig 179e–g,



Figure 31. *Eragrostis brownii* (Kunth) Nees. **A.** Inflorescence. *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult. **B.** Inflorescence. (From Singapore, exact localities uncertain. Photos: H. Duistermaat).

p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 948; Turner, Gard. Bull. Singapore 45 (1993) 96, p.p.

Perennials. **Culms** tufted, erect, branching extra- and intra-vaginally at base, 0.1–1.1 m long, eglandular. **Sheath** collar glabrous to sparsely pilose on the edges. **Ligule** a ciliolate rim, 0.2–0.3 mm high. **Leaf** blades 3–8(–25) cm by 0.5–3 mm. **Panicles** lax, interrupted, or dense, 3.5–20 × 1.5–9 cm, axils glabrous, branches more or less appressed to patent, the lowermost solitary, 0.5–6.5 cm long, naked in the lower 0.1–0.25 on its length, scaberulous to setulose; pedicels 0.5–2.75 mm long, shorter than the spikelets. **Spikelets** disarticulating from the base upward, rachilla fragile from the top down, 4.25–15(–40) × 1.5–2.5 mm. **Glumes** unequal, acute, 1-nerved; lower glume 1–1.45 mm long, 0.48–0.77(–0.9) times as long as first lemma; upper glume 1.25–1.7 mm long. **Lemmas** 1.4–2.8 mm long, acute to acuminate. **Paleas** persistent, keels ciliolate. **Anthers** 3, (0.25–)0.3–0.4(–0.6) mm long, 0.15–0.26 times as long as the lemma. **Caryopsis** ellipsoid, laterally slightly flattened, 0.45–0.65 mm long; pericarp finely striate, dark tea-coloured, rarely cinnamon.

Distribution. Sri Lanka and India to southern China, Taiwan, Japan and to New Zealand and Pacific islands. Probably native in Singapore but rarely collected: Kent Ridge Road (*Firdaus* 22, 28 Nov 2000, SINU), Pulau Salu (*Tan et al. 1303*, 2 Aug 2004, SINU), South Buona Vista Road (*Enoch 2730*, 11 Feb 1958, SINU) and Tanah Merah (*Teo TM 30*, 2000, SINU).

Ecology. On stony, shallow soil, sandy beaches, roadsides.

Provisional conservation assessment. Globally Least Concern (LC). With the low number of collections but widespread collection localities it could have fewer than 1000 individuals and therefore be treated as Vulnerable (VU/D) but surveys are needed to see if it has rather been overlooked.

Notes. Spikelets are occasionally infected with a *Bipolaris* sp. smut fungus.

3. *Eragrostis cumingii* Steud.

(Hugh Cuming, 1791–1865, collector of over 130,000 botanical specimens in South America and Malesia)

Syn. Pl. Glumac. 1, fasc. 3 (1854) 266; Gilliland, Rev. Fl. Malaya 3 (1971) 65, pl. 11c; Veldkamp, Blumea 47 (2002) 172. **Type:** *Cuming 1104*, Philippines (lectotype P [P00622472], designated by Lazarides, Austral. Syst. Bot. 10 (1997) 109; isolectotypes BRI, CGE, G, E, GOET, K [$\times 2$], L, MO, P, W). **Fig. 28E.**

Eragrostis brownii auct. non (Kunth) Nees: Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 68, p.p.

Eragrostis cilianensis auct. non (All.) Janch.: Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 68, fig. 62.

Eragrostis elegantula auct. non (Kunth) Steud.: Ridl., Mat. Fl. Malay. Penins. 3 (1907) 179, p.p.; Ridley, Fl. Malay Penins. 5 (1925) 248, p.p.

Eragrostis elongata auct. non (Willd.) J.Jacq.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 179, p.p.; Ridley, Fl. Malay Penins. 5 (1925) 248, p.p.; Henderson, Malay. Wild Fls., Monocot. (1954) 313, fig. 17h, p.p.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 948; Turner, Gard. Bull. Singapore 45 (1993) 96, p.p.; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 166.

Annuals, sometimes perennial. **Culms** tufted, erect or geniculate at base, not rooting at the nodes, branching intra-vaginally at base, 0.1–0.85 m long, eglandular. **Sheath** collar glabrous or with some hairs on the edges. **Ligule** a ciliolate rim. **Leaf** blades 4–8(–19) cm by 0.5–1.75(–5) mm. **Panicles** lax, 5.5–26 \times 2–8 cm, axils glabrous to sparsely pilose, branches erecto-patent, solitary, nearly smooth to scaberulous, sometimes sparsely pilose, the lowermost 1.5–5.5 cm long, naked in the lower 0.13–0.4 of its length; pedicels 0.25–2.75 mm long, much shorter than the spikelets. **Spikelets** disarticulating from the base upward, rachilla persistent, ultimately breaking up from the top down or not, 4.5–20 \times 1.25–3 mm. **Glumes** subequal, acute; lower glume 0.75–1.5 mm long, 0.6–0.87 times as long as first lemma; upper glume 1–1.9 mm long. **Lemmas** 1.25–1.7(–2) mm long, acute to acuminate. **Paleas** persistent, keels ciliolate. **Anthers** 3, 0.1–0.25 mm long, 0.06–0.13 times as long as the lemma. **Caryopsis** subglobose to ellipsoid, laterally flattened, 0.35–0.55 mm long, pericarp finely reticulate, cinnamon.

Distribution. Bhutan and Myanmar to northern Vietnam and through continental Southeast Asia and Malesia to northern Australia. Native in Singapore and collected from Freshwater Isle [Pulau Bukom] (*Ridley s.n.*, Jan 1889, SING [SING0035067]), Gallop Road (*Duistermaat*

213, 14 Oct 2003, SING [SING0059571]), MacRitchie (*Gilliland 5273*, 25 Sep 1959, SINU), Pasir Ris (*Sinclair s.n.*, 1949, L) and Pulau Ubin (*Duistermaat et al. 185*, 23 Sep 2003, SING [SING0059572]).

Ecology. Open or slightly shaded, less fertile soil, roadsides, lawns, fields, and under shrubbery.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Notes. Further field observations are needed to clarify the differences between *Eragrostis cumingii* and *E. brownii*.

4. *Eragrostis gangetica* (Roxb.) Steud.

(from the Ganges, the sacred river of India)

Syn. Pl. Glumac. 1, fasc. 3 (1854) 266; Gilliland, Rev. Fl. Malaya 3 (1971) 68; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 166; Turner, Gard. Bull. Singapore 45 (1993) 96; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 70, fig. 63. **Basionym:** *Poa gangetica* Roxb., [Hort. Bengal. (1814) 8, nom. nud.] Fl. Ind. 1 (1820) 341. **Synonym:** *Eragrostis willdenowii* Nees ex Steud., Nomencl. Bot., ed. 2, 1 (1840) 565, nom. illeg. superfl. **Type:** *Roxburgh s.n.*, India orientalis, 1813 (lectotype BM [BM000578754], designated by Clayton, Fl. Trop. E. Africa, Gramineae (Pt 2) (1974) 217). **Fig. 28F.**

Eragrostis cambessediana (Kunth) Steud., Syn. Pl. Glum. 1, fasc. 3 (1854) 269; Sinclair, Gard. Bull. Singapore 14(1) (1953) 36; Turner, Gard. Bull. Singapore 45 (1993) 96. **Basionym:** *Poa cambessediana* Kunth, Révis. Gramin. 2 (1831) 469. **Type:** *Lelièvre s.n.*, Senegal, Richard Tol (isotype K).

Annuals. **Culms** tufted, geniculate at base, not rooting at the nodes, branching intra-vaginally at base, 0.25–0.45 m long, eglandular. **Sheath** collar bearded on the edges. **Ligule** a ciliolate rim, 0.1–0.2 mm high. **Leaf** blades 6–15 cm by 1–2.5(–4) mm. **Panicles** lax to contracted, 12–20 × 5.5 cm, axils glabrous, branches solitary, erecto-patent, scaberulous, the lowermost 4–5 cm long, naked in the lower 0.16–0.2 of its length; pedicels 1.75–6 mm long, shorter than to as long as the spikelet. **Spikelets** disarticulating from the base upward, rachilla persistent, 4–5.5 × 1.5–1.75 mm. **Glumes** subequal, acute, 1-nerved; lower glumes 0.75–1 mm long, 0.5–0.6 times as long as the first lemma; upper glumes 1–1.5 mm long. **Lemmas** 1–1.5 mm long, obtuse to acuminate. **Paleas** caducous, keels scaberulous. **Anthers** 2, 0.2–0.4 mm long, 0.15–0.27 times as long as the lemma. **Caryopsis** ellipsoid, laterally slightly flattened, 0.4–0.5 mm long, pericarp finely reticulate, dark tea-coloured.

Distribution. Tropical Africa to Northern Vietnam and Malesia. Introduced and formerly casual in Singapore near Upper Seletar (*Sinclair 6892*, 15 Sep 1951, L, SING [SING0035074]).

Ecology. Disturbed places, grasslands.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

5. *Eragrostis montana* Balansa

(Latin, *montanus* = montane, pertaining to mountains)

J. Bot. (Morot) 4 (1890) 168; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 166; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 70, fig. 64; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 227. **Type:** *Godefroy 487*, Cambodia, Mont de Pursat, 18 June 1875 (lectotype L [L0044358], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 15; isolectotype P [P02279651]). **Fig. 28G, 32.**

Eragrostis malayana Stapf in Hooker, Fl. Brit. India 7, fasc. 22 (1896) 317; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 178; Ridley, Fl. Malay Penins. 5 (1925) 247; Gilliland, Rev. Fl. Malaya 3 (1971) 65; Turner, Gard. Bull. Singapore 45 (1993) 96. **Type:** *Wray 773*, [Malaysia], Perak, Thaiping (lectotype K [K000290370], designated by Veldkamp, Blumea 47 (2002) 180).

Perennials. **Culms** tufted, erect to geniculate, with new tufts at the nodes, but not rooting, branching intra- and extra-vaginally at base, 0.2–0.4(–0.6) m long, eglandular. **Sheath** collar pilose on the edges. **Ligule** a row of 0.2–0.3 mm long hairs. **Leaf** blades 3.5–11.5 cm by 0.5–1.3 mm. **Panicles** contracted to lax, 4–10 × 0.5–2.5 cm, axils glabrous or with a few long hairs, branches solitary, erect to erecto-patent, the lowermost one 1–2.5 cm long, naked in the lower 0.2–0.35 of its length, scaberulous; pedicels 0.5–3.25 mm long, distinctly to slightly shorter than the spikelet. **Spikelets** disarticulating from the base upward, rachilla persistent, 2–4.5 × 1.2–2.25 mm. **Glumes** unequal, acute, 1-nerved; lower glumes 0.5–1 mm long, 0.4–0.65 times as long as the first lemma; upper glumes 0.75–1.35 mm long. **Lemmas** 1.1–1.5 mm long, acutish. **Paleas** long-persistent, keels ciliolate. **Anthers** 3, 0.2–0.35 mm long, 0.13–0.23 times as long as the lemma. **Caryopsis** ellipsoid, slightly laterally compressed, 0.55–0.6 mm long, pericarp smooth, dark tea-coloured.

Distribution. Andaman & Nicobar Islands, Myanmar to southern Vietnam and through Malesia. Presumably native in Singapore but infrequently collected, including from Ballestier Plain (*Collector unknown 76*, Jan 1904, SING [SING0035075]), Freshwater Isle [Pulau Bukom] (*Ridley 453*, Jan 1889, SING [SING0035077]), MacRitchie (*Gilliland s.n.*, 17 Nov 1963, SINU) and Punggol Way (*Boo SING2011-180*, 31 Mar 2011, L, SING [SING0170118]).

Ecology. Sunny areas, stony soil, often water-logged, along roads, ditches, banks.

Provisional conservation assessment. Globally Least Concern (LC). Listed as common in Singapore by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 227) and as Nationally Extinct by Duistermaat (Gard. Bull. Singapore 57, Suppl. (2005) 70). As there has only been one collection in the last few decades it is assessed here as Critically Endangered (CR/D).

Notes. Recognisable in the field by its bluish leaves and spikelets and the lemmas with a small purple blotch. These features, along with ovate glumes with a fairly wide rounded base, distinguish it from the otherwise similar *Eragrostis unioloides*.



Figure 32. *Eragrostis montana* Balansa. **A.** Habit. **B.** Detail of inflorescence. **C.** Detail of leaf sheath and blade. (From Singapore, Pasir Panjang, *Chen SING2017-726*. Photos: L.M.J. Chen).

6. *Eragrostis pilosa* (L.) P.Beauv.

(Latin, *pilosus* = pilose; referring to the ligule of hairs)

Ess. Agrostogr. (1812) 71, 162, 175; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 179; Ridley, Fl. Malay Penins. 5 (1925) 247; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 949; Gilliland, Rev. Fl. Malaya 3 (1971) 69, pl. 11f; Turner, Gard. Bull. Singapore 45 (1993) 96; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 167; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 70, fig. 65; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 271. **Basionym:** *Poa pilosa* L., Sp. Pl. 1 (1753) 68. **Type:** [Published illustration] Scheuchzer, Agrostographia (1719) t. 4: fig. 3, lectotype designated by Koch, Illinois Biol. Monogr. 48 (1974) 24. **Epitype:** *Kneucker Gram. exsicc. XII, no. 344*, Italy, Piemonte, Alluvium der Sesia bei Vercelli und an den Wegen zwischen den Reisfeldern von Oldenico unweit Vercelli in Oberitalien, 9–10 August 1902 (epitype B, designated by Scholz in Cafferty et al. (ed.), Taxon 49 (2000) 256; possible isoeotypes L, W). **Fig. 33A.**

Annuals. **Culms** tufted, erect to geniculate, not rooting at the nodes, branching intra-vaginally at base, (0.05–)0.15–0.5 m long, glandular or not (check under the nodes, midrib of sheath, blade, apex peduncle, base main axis and/or branches of the panicle). **Sheath** collar bearded on the edges. **Ligule** a row of 0.25–0.4 mm long hairs. **Leaf** blades 3.5–18 cm by 0.35–3 mm. **Panicles** lax, 6–28 × 3.5–14 cm, at least the lower axils bearded, lowermost branches usually whorled, 3–10 together, the upper solitary, erecto-patent to patent, smooth to scaberulous, the lowermost longest 2.5–8.5 cm long, naked in the lower 0.16–0.46 of its length; pedicels 1–8 mm long, longer than to subequal to the spikelet. **Spikelets** disarticulating from the base upward, rachilla persistent, 2.75–5.5 × 0.65–1.25 mm. **Glumes** unequal, acute; lower glumes 0.35–0.75 mm long, 0.27–0.38 times as long as the first lemma, 0-nerved; upper glumes 0.75–1.2 mm long, 1-nerved. **Lemmas** 1–1.75 mm long, somewhat acuminate. **Paleas** shortly persistent, keels sparsely scaberulous. **Anthers** 3, 0.15–0.2 mm long, 0.1–0.12 times as long as the lemma. **Caryopsis** ellipsoid, laterally flattened, 0.5–1 mm long, pericarp smooth, dark tea-coloured.

Distribution. Temperate to tropical areas in the Old World, introduced in the New. Native in Singapore but infrequently collected, including from Singapore Botanic Gardens (*Ridley s.n.*, Mar 1904, SING [SING0035079]; *Sinclair s.n.*, 2 Jan 1950, L), Bukit Timah Campus (*Duistermaat 222*, 3 Nov 2003, L, SING [SING0059568]), Clementi Road (*Wong & Kassim s.n.*, 17 Jul 1959, SINU) and Farrer Road (*Duistermaat 263*, 4 Feb 2004, SING [SING0059569]).

Ecology. Weed in waste places, near the shore, along roads, railroads, drought resistant; rather rare.

Provisional conservation assessment. Globally Least Concern (LC). With the low number of collections but various collection localities it could have fewer than 1000 individuals and therefore be treated as Vulnerable (VU/D) but surveys are needed to see if it has rather been overlooked.

Vernacular name. *Indian love grass* (English).

Notes. Anthoecia are often cleistogamous: spikelets remain closed even during anthesis resulting in self-pollination; anthers remain on top of the fruit and are later pushed out by it.

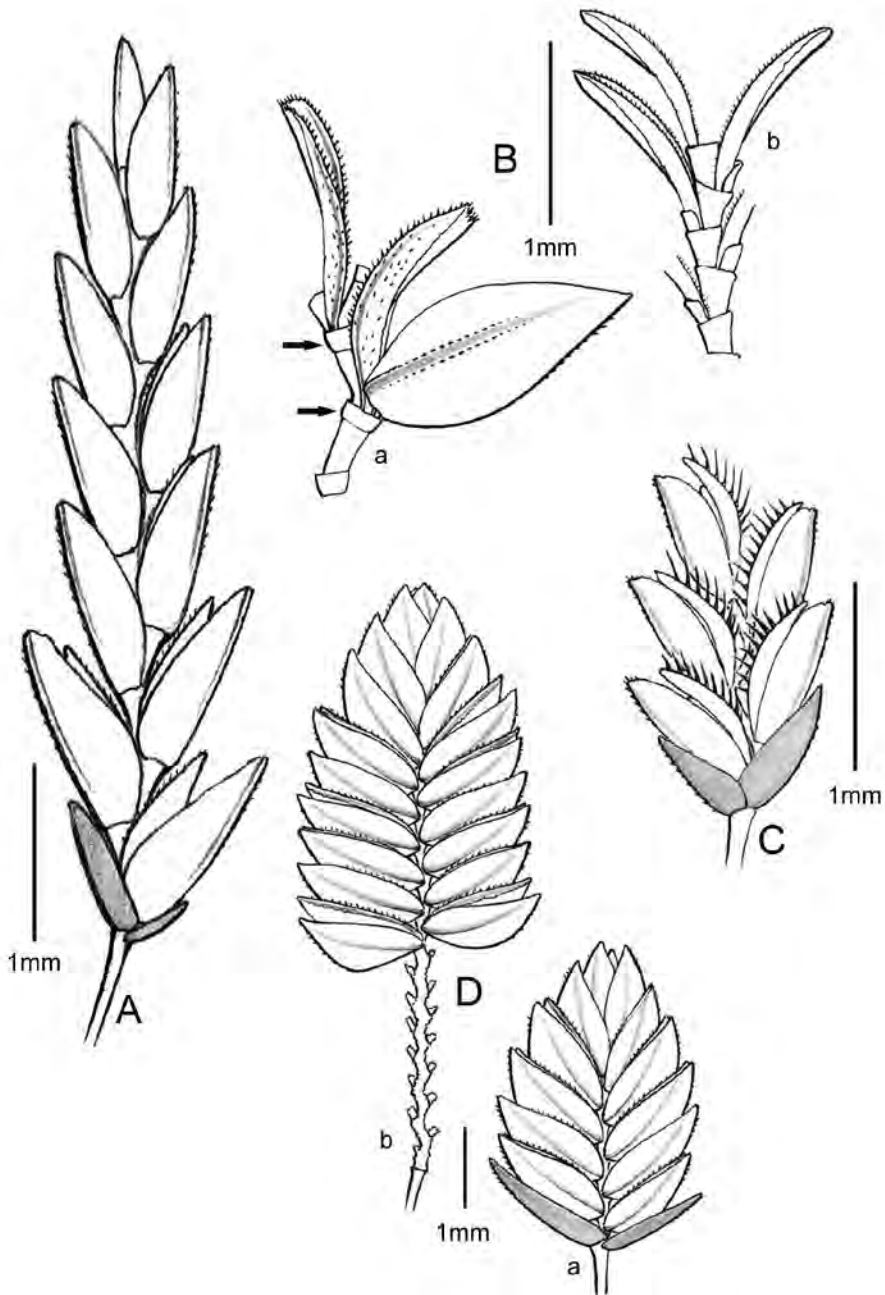


Figure 33. *Eragrostis pilosa* (L.) P.Beauv. **A.** Spikelet, lateral view. *Eragrostis*. **B.** Rachilla: **a.** articulated, **b.** not articulated. *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult. **C.** Spikelet, lateral view. *Eragrostis uniolooides* (Retz.) Nees ex Steud. **D.** Spikelet, lateral view: **a.** young spikelet, **b.** maturing spikelet. (Drawn by J.J. Vermeulen).

7. *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.

(Latin, *tenellus* = delicate; referring to the stature of the plant)

Syst. Veg., ed. 15 bis, 2 (1817) 576; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 177; Ridley, Fl. Malay Penins. 5 (1925) 245; Gilliland, Rev. Fl. Malaya 3 (1971) 71, fig. 7, pl. 11b; Turner, Gard. Bull. Singapore 45 (1993) 97; Veldkamp, Blumea 47 (2002) 164. **Basionym:** *Poa tenella* L., Sp. Pl. 1 (1753) 69. **Synonyms:** *Megastachya tenella* (L.) Bojer, Hortus Maurit. (1837) 369. – *Eragrostis amabilis* Nees var. *tenella* (L.) A.Camus, Fl. Indo-Chine 7, fasc. 5 (1923) 557. **Type:** *Collector unknown s.n.*, India (lectotype LINN [Herb. Linn. no. 87.33], designated by Mitra & Jain in Manilal, Bot. Hist. Hort. Malabaricus. (1980) 151). **Fig. 31B, 33C.**

Eragrostis amabilis auct. non (L.) Wight & Arn.: Henderson, Malay. Wild Fls., Monocot. (1954) 312, fig. 179c,d; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 948; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 165, fig. 270; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 66, fig. 59, pl. 10; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 270. Based on *Poa amabilis* L., Sp. Pl. 1 (1753) 68, which is a dubious name. A formal proposal to reject this name has been published (Taxon 67 (2018) 644–645).

Eragrostis viscosa auct. non (Retz.) Trin.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 177; Ridley, Fl. Malay Penins. 5 (1925) 246; Turner, Gard. Bull. Singapore 45 (1993) 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 167.

Annual to perennial. **Culms** tufted, erect, not rooting at the nodes, branching intra- and extra-vaginally at base, (0.03–)0.3–0.7 m long, glands absent or with glandular patches in the inflorescence ('*viscosa*'). **Sheath** collar long-ciliate. **Ligule** rim-like, 0.1–0.2 mm high, with 0.3–0.4 mm long hairs. **Leaf** blades (1–)3.5–13 cm by (1–)2.5–5 mm. **Panicles** rather lax, 3–15 × 1–5 cm, axils glabrous to pilose, branches erecto-patent, solitary, approximate and pseudo-whorled, stiff to wavy, (sub)smooth, sometimes somewhat sticky, the lowermost 1–3.5 cm long, naked in the lower 0.1–0.3 of its length; pedicels 0.5–3 mm long, shorter to longer than the spikelet, inconspicuously glandular or not. **Spikelets** disarticulating from the top down, rachilla fragile, anthoecia fragmenting, 1.25–4.25 × 1–1.25 mm. **Glumes** subequal, 0.4–1.25 mm long, acute, 1-nerved; lower glume 0.7–0.8 times as long as the first lemma. **Lemmas** 0.7–1.25 mm long, acute to obtuse. **Paleas** caducous, keels setose (setae up to 0.6 mm long). **Anthers** 3, 0.2–0.25 mm long, 0.15–0.2 times as long as the lemma. **Caryopsis** ellipsoid, 0.4–0.5 mm long, pericarp smooth, cinnamon to dark tea-coloured.

Distribution. Tropics of the Old World and widely introduced in the New. Native and very widespread in Singapore including in Changi (*Ridley 5763*, 1893, SING [SING0035054]), Dunearn Road (*Kassim 87*, 18 Oct 1955, SINU), Holland Road (*Duistermaat 11*, 8 Jan 2002, SING [SING0059369]), Pulau Ubin (*Ali Ibrahim & Veldkamp SING2017-089*, Mar 2017, SING [SING0231216]) and Tanah Merah (*Teo TR Plot 4*, 2000, SINU).

Ecology. Open waste places, road-sides, between stones, near beaches, locally abundant.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Feathery eragrostis* (English), *rumpit telur kutu* (Malay).

Notes. In the literature there is mention of some but not all plants being glandular and sticky. We have not seen this but further field observations might clarify whether there really are two forms of this species, or whether it was confused with *Eragrostis viscosa*.

8. *Eragrostis tenuifolia* (A.Rich.) Hochst. ex Steud.

(Latin, *tenui*- = slender, *-folia* = leaves; with slender leaves)

Syn. Pl. Glumac. 1, fasc. 3 (1854) 268; Veldkamp, Blumea 47 (2002) 187. **Basionym:** *Poa tenuifolia* A.Rich., Tent. Fl. Abyss. 2 (1851) 425. **Type:** *Schimper, Iter Abyssinicum. Sectio prima: plantae Adoënses* 92, Ethiopia, locis incultis vallium prope Adoam, 18 September 1837 (lectotype P [P00439420], first step designated by Phillips, Fl. Ethiopia Eritrea 7 (1995) 122, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 36; isoelectotypes B, BR, FR, G [×4], GOET, K, L, MPU, P [P00439421, P00439422], TUB [×2], US (fragment), W [×2], WAG).

Long-lived annuals. **Culms** tufted, erect or geniculate, then with shoots and roots at the lower nodes, branching intra-vaginally at base, 0.5–0.8 m long, eglandular. **Sheath** collar pilose. **Ligule** a row of c. 0.25 mm long hairs. **Leaf** blades 6–22 cm by 0.5–2 mm. **Panicles** lax, 10.5–20 × 4.5–9 cm, axils pilose, branches erecto-patent, solitary, stiff, scaberulous, the lowermost 5–8 cm long, naked in the lower 0.25–0.3 of its length; pedicels 3.5–12 mm long, longer than the spikelets. **Spikelets** disarticulating from the base upward, rachilla persistent, 6.5–12 × 2.25–2.75 mm. **Glumes** unequal, acute, 0-nerved; lower glume 0.5–0.75 mm long, 0.2–0.3 times as long as first lemma; upper glume 0.75–1.25 mm long. **Lemmas** 2.2–2.5 mm long, acuminate. **Paleas** persistent, keels scaberulous. **Anthers** 3, 0.4–0.6 mm long, 0.19–0.27 times as long as the lemma. **Caryopsis** ellipsoid, strongly laterally flattened, dorsally grooved, 1–1.25 mm long, pericarp smooth, dark tea-coloured.

Distribution. Tropical Africa and Madagascar. Introduced in Singapore but only once collected with no precise locality (*Jumali s.n.*, Nov 1963, SINU).

Ecology. Over its range it occurs on roadsides, in disturbed places, abandoned gardens, etc.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Elastic grass* (English).

9. *Eragrostis unioides* (Retz.) Nees ex Steud.

(Latin, *uniol*- = pertaining to *Uniola* L., *-oides* = like, resembling;
similar to the grass genus *Uniola* L.)

Syn. Pl. Glumac. 1, fasc. 3 (1854) 264; Henderson, Malay. Wild Fls., Monocot. (1954) 318, fig. 179g; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 949; Gilliland, Rev. Fl. Malaya 3 (1971) 66, fig. 7, pl. 11a; Turner, Gard. Bull. Singapore 45 (1993) 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 167, fig. 273; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 71, fig. 66; Chong

et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 227. **Basionym:** *Poa uniolooides* Retz., Observ. Bot. 5 (1788 [‘1789’]) 19. **Synonym:** *Uniola indica* Spreng., Syst. Veg. (ed. 16) 1 (1824 [‘1825’]) 349, nom. illeg. superfl. **Type:** *König s.n.*, India (lectotype LD [LD1289627], designated by Fischer, Bull. Misc. Inform. Kew 1932 (1932) 74; possible isolectotypes BM [$\times 2$], C [$\times 3$], LE). **Fig. 33D, 34.**

Eragrostis amabilis auct. non (L.) Wight & Arn.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 178; Ridley, Fl. Malay Penins. 5 (1925) 246, t. 224.

Perennials. **Culms** tufted, geniculate, rooting at the decumbent nodes sending up new tufts, branching intra-vaginally at base, 0.1–0.6(–0.8) m long, eglandular. **Sheath** collar pilose on the edges. **Ligule** a ciliolate rim, c. 0.2 mm high. **Leaf** blades (1.5–)3–12(–20) cm by 2–8 mm. **Panicles** very variable, usually lax, sometimes contracted and interrupted, 5–17 \times 2–6.5 cm, axils glabrous, branches solitary, erecto-patent to patent, stiff, smooth to scaberulous, the lowermost 1.5–6.5 cm long, naked in the lower 0.05–0.14 of its length; pedicels 0.5–9 mm long, much shorter to longer than the spikelet. **Spikelets** strongly laterally compressed, disarticulating from the base upward, **rachilla** persistent, 2–7.8(–16) \times 1.25–4 mm. **Glumes** unequal, acute, 1-nerved; lower glumes 0.75–1.3 mm long, 0.45–0.72 times as long as the first lemma; upper glumes 1.25–1.7 mm long. **Lemmas** 1.25–1.7 mm long (see notes), acutish, strongly 3-nerved, granular, often pinkish. **Palea** soon caducous, keels ciliolate. **Anthers** 2, ellipsoid, 0.3–0.45 mm long, 0.2–0.3 times as long as the lemma. **Caryopsis** ellipsoid, laterally compressed, 0.6–1 mm long, pericarp smooth, dark tea-coloured.

Distribution. Originally probably from Southeast Asia, now pantropical. Presumably native in Singapore and widely collected, including from Singapore Botanic Gardens (*Duistermaat* 137, 18 May 2003, L, SING [SING0059623]), Bishan-Ang Mo Kio Park (*Chen* SING2017-709, 16 Nov 2017, SING [SING0233536]), Pasir Panjang (*Chen* SING2017-727, 6 Dec 2017, SING [SING0255902]), Changi (*Ridley s.n.*, 1890, SING [SING0041441]) and Sungei Buloh (*Duistermaat et al.* 59, 19 Mar 2002, SING [SING0059625]).

Ecology. Moderately shaded to moist places, road sides and fields.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Pink eragrostis* (English), *rumput kolam padang* (Malay).

Notes. Sometimes some lemmas are much enlarged due to an infection by the gall midge *Contarinia eragrostidis* Felt. (Docters van Leeuwen, Ned. Kruidk. Arch. 51 (1941) 127).

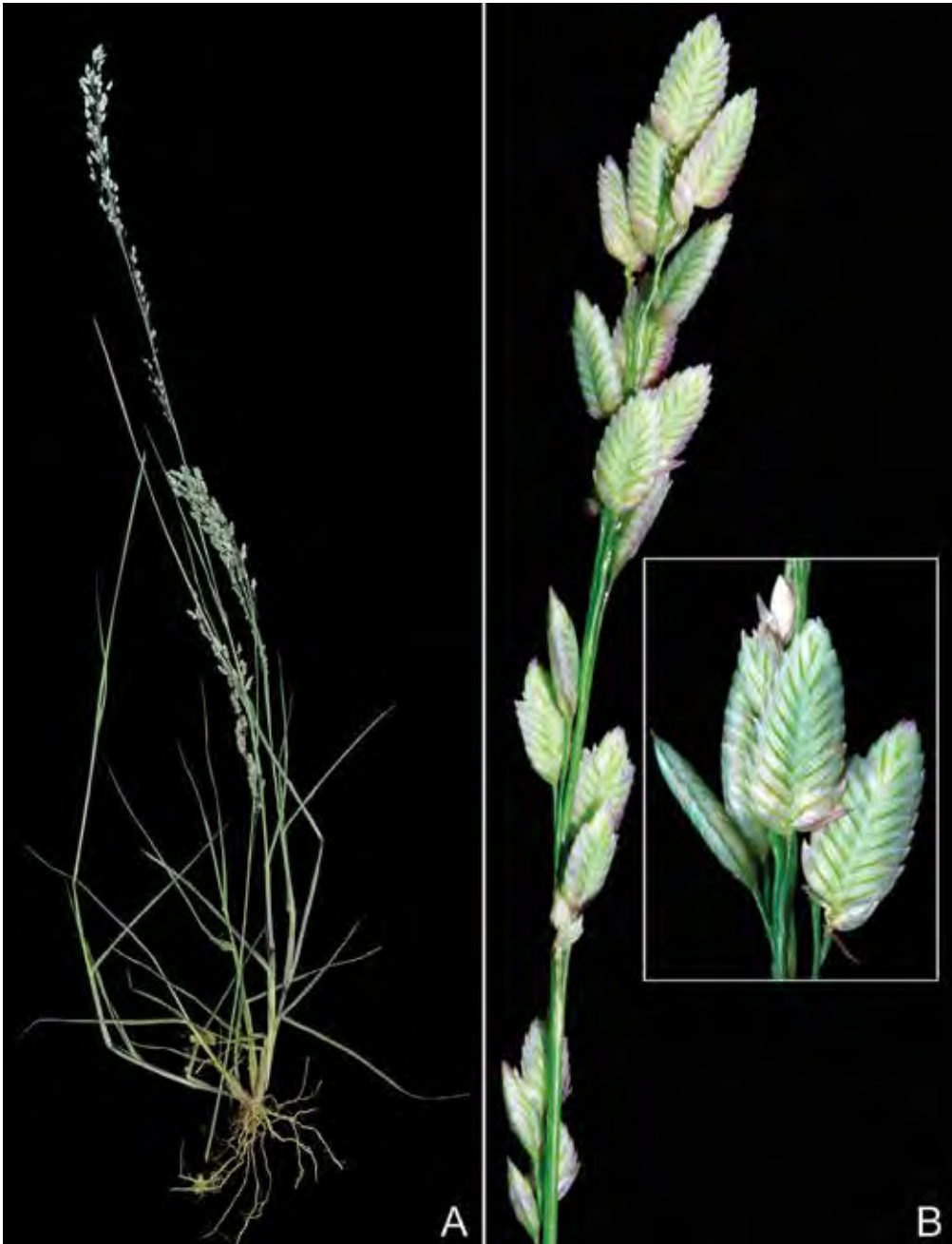


Figure 34. *Eragrostis unioloides* (Retz.) Nees ex Steud. **A.** Habit. **B.** Inflorescence with detail of spikelets in inset. (From Singapore, A from Kranji; B from Pasir Panjang, *Chen SING2017-727*. Photos: A, P.K.F. Leong; B, L.M.J.Chen).

24. ERIACHNE R.Br.

(Greek, *eri* = woolly, *-achne* = scale;
referring to the hairs in the inflorescence)

Prodr. Fl. Nov. Holland. (1810) 183; Eck-Borsboom, *Blumea* 26 (1980) 127; Lazarides, *Austral. Syst. Bot.* 8 (1995) 355; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 400. **Type:** *Eriachne squarrosa* R.Br., lectotype designated by Eck-Borsboom, *Blumea* 26 (1980) 127.

Massia Balansa, *J. Bot. (Morot)* 4 (1890) 165. **Type:** *Massia trisetata* (Nees ex Steud.) Balansa (= *Eriachne trisetata* Nees ex Steud.).

Perennials. **Culms** tufted, branching intra- and extra-vaginally at base, hollow; nodes glabrous. **Ligule** a row of hairs. **Leaf** blades setaceous when young, linear. **Panicles** very lax to densely contracted, composed of racemes. **Spikelets** 2-flowered, quaquaversal, abaxial, solitary, disarticulating above the glumes, laterally compressed, callus absent. **Glumes** subequal, shorter than to as long as the spikelet, acuminate, 9–11-nerved. **Rachilla** process absent. **Lemmas** indurate at maturity, 5–9-nerved, dorsally rounded, callus obtuse to pungent, short-hairy, germination flap absent, puberulous to hairy, margins inrolled over the palea, apex usually awned. **Awn** 1, apical, straight to recurved. **Palea** acute to 2-awned. **Stamens** 2.

Distribution. A genus of 48 taxa from India to southern China, continental Southeast Asia and Malesia to Australia. In Singapore 2 species, one of which is casual.

Uses. Inferior fodder.

Taxonomy. The genus belongs to the *Micrairoideae* – *Eriachneae* Eck-Borsboom.

Notes. Anthoecia in Singapore species cleistogamous.

Key to *Eriachne* species

1. Spikelets 2-awned; glumes (2.5–)3–5.5(–6.5) mm long; lemmas hairy all over; awns (1–)1.9–5.6(–6.6) mm long; paleas bilobed to shortly 2-aristulate **1. E. pallescens**
Spikelets 6-awned; glumes 7.4–12 mm long; lemma short-hairy all over; awns 7–19 mm long; palea 2-awned **2. E. trisetata**

1. *Eriachne pallescens* R.Br.

(Latin, *pallescens* = fading in colour;
presumably referring to the inflorescence)

Prodr. Fl. Nov. Holland. (1810) 184; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 187; Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 172; Ridley, *Fl. Malay Penins.* 5 (1925) 240; Henderson, *Malay. Wild Fls., Monocot.* (1954) 316, fig. 182a,b; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 1 (1966) 951; Gilliland, *Rev. Fl. Malaya* 3 (1971) 94, fig. 15, pl. 10d; Turner, *Gard. Bull. Singapore* 45 (1993) 97; Keng

et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 167; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 71, fig. 67; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 221. **Synonym:** *Aira effusa* Spreng., Syst. Veg. (ed. 16) 1 (1824 [‘1825’]) 278. **Type:** *Banks & Solander s.n.*, New Holland [Australia], Endeavour River, 1770 (lectotype BM [BM000645842], designated by van Eck-Borsboom, Blumea 26 (1980) 134, 135; possible isoelectotypes BM [$\times 4$]). **Fig. 35A.**

Culms 0.2–0.9(–1.05) m high. **Ligules** 0.4–0.6(–1) mm long. **Leaf** blades 2.3–16.6(–21) cm by (0.4–)0.8–3(–4) mm. **Panicle** very lax, 2–15.4 \times (0.5–)1–7(–19) cm, lowest longest branch (1.7–)3–10.5(–12.2) cm long. **Spikelets** 4–10.3(–11.4) mm long (excl. awns). Lower **glumes** (2.5–)3–5.5(–6.5) mm long; upper glumes (2.25–)4–4.9(–5.5) mm long. **Lemmas** (1.2–)3–4.6(–5.5) mm long (excl. awns), hairy all over. **Awns** (1–)1.9–5.6(–6.6) mm long. **Paleas** hairy all over, bilobed to shortly 2-aristulate. **Anthers** 0.25–0.8 mm long.

Distribution. Northeastern India to southern China and continental Southeast Asia and Malesia to Australia and the Caroline Islands. In Singapore it is native and has been collected all over Singapore such as in Choa Chu Kang (*Sinclair SF 38593*, 18 Aug 1949, SING [SING0041448]), Geylang (*Ridley s.n.*, 1893, SING [SING0041456]), Kent Ridge Park (*Duistermaat 286*, 20 Mar 2004, SING [SING0059618]), Mount Faber (*Deshmukh SF 4897*, 23 Aug 1929, SING [SING0072377]) and the Western Catchment (*Samsuri et al. WC 51*, Apr 2004, SING [SING0072377]). It has also been collected on several of the offshore islands.

Ecology. Rocky or sandy areas, coastal dunes, waste places, fire resistant.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 221) but it is highly likely there are more than 1000 mature plants in Singapore and so it is assessed here as Least Concern (LC).

Vernacular name. *Slender eriachne* (English).

2. *Eriachne trisetata* Nees ex Steud.

(Latin, *tri-* = three, *-seta* = awns; with three awns)

Syn. Pl. Glumac. 1, fasc. 3 (1854) 237; Burkill, Diet. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 951, as ‘*tincta*’, Gilliland, Rev. Fl. Malaya 3 (1971) 94, pl. 10c; Turner, Gard. Bull. Singapore 45 (1993) 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 168; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 72, fig. 68. **Synonym:** *Massia trisetata* (Nees ex Steud.) Balansa, J. Bot. (Morot) 4 (1890) 165; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 172; Ridley, Fl. Malay Penins. 5 (1925) 240. **Type:** *Macrae s.n.* [Herb. Wight propr. 2047], Ceylon [Sri Lanka] (lectotype B [B100272753], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 15; isoelectotype LE [Herb. Trinius 1844.1] (fragment)). **Fig. 35B.**

Culms (0.25–)0.35–0.8 m high. **Ligules** 0.25–0.65 mm long. **Leaf** blades 6.3–18.5 cm by 0.7–2 mm. **Panicle** very lax, 4–14(–18) \times 1–4(–7) cm, lowest longest branch 4–8.5 cm long. **Spikelets** 7.4–12 mm long (excl. awns). **Glumes** 7.4–12 mm long. **Lemma** (3.7–)3.9–5(–5.4)

mm long (excl. awns), short-hairy all over. **Awns** 7–19 mm long. **Palea** hairy all over, awns (5.9–)6.8–14.5 mm long. **Anthers** 0.25–0.5 mm long.

Distribution. Sri Lanka, Myanmar and Vietnam through Malesia to Australia. Probably not native in Singapore and only once collected as an escaped plant in Pasir Panjang Nursery (*Maxwell* 83-27, 22 Mar 1983, SING [SING0017752, SING0017753]).

Ecology. Elsewhere in its distribution in sandy heaths, dry exposed rocky places, savannah forest, sandy sea shores, and wet depressions on river flats.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

25. ERIOCHLOA Kunth

(Greek, *erio-* = woolly, *-chloa* = grass; referring to the pubescence of the pedicel and glumes)

in Humboldt et al., *Nov. Gen. Sp.* 1 (1816) 94; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 338. **Type:** *Eriochloa distachya* Kunth, lectotype designated by Nash in Britton, *N. Amer. Fl.* 17 (1912) 157.

Annuals or perennials. **Culms** tufted, sometimes rhizomatous hollow, branching intra-vaginally at base; nodes more or less hairy. **Ligule** a membranous rim, margin hairy. **Leaf** blades linear, inrolled when young. **Panicle** lax to contracted, composed of bilaterally alternating racemes, rachis terminating in a spikelet. **Spikelets** solitary, paired, or clustered, biseriate, secund, adaxial, dorso-ventrally flattened, 2-flowered. Lower **glume** absent, fused with the stipe to a basal ‘bead’, rarely slightly developed (up to 0.2–0.4 mm long) above this ‘bead’; upper glume as long as the spikelet, acute to acuminate, sometimes mucronate, 5–7-nerved. Lower **lemma** epaleate to paleate, sterile or male, acute or mucronate, 5-nerved; upper lemma dorsally compressed, coriaceous, smooth to rugulose, dull, germination flap present, margins inrolled over the palea, apiculate to mucronate.

Distribution. Pantropical with approximately 30 species. In Singapore 1 native and 1 naturalised species.

Taxonomy. The genus belongs to the *Panicoideae* – *Melinidinae* Stapf.

Notes. Davidse in Soderstrom et al. (ed.) (*Grass Syst. Evol.* (1987) 149–150, 153) has observed that the ‘bead’ contains lipids to attract ants although experiments to verify this are lacking.

There is a specimen of *Eriochloa villosa* (Thunb.) Kunth, collected by D’Alleizette (Jul 1909, L), said to have been collected from Singapore Botanic Garden, but with doubtful provenance (see comments by Veldkamp, *Blumea* 48 (2003) 498). Without any other collections it is consequently omitted from the account.

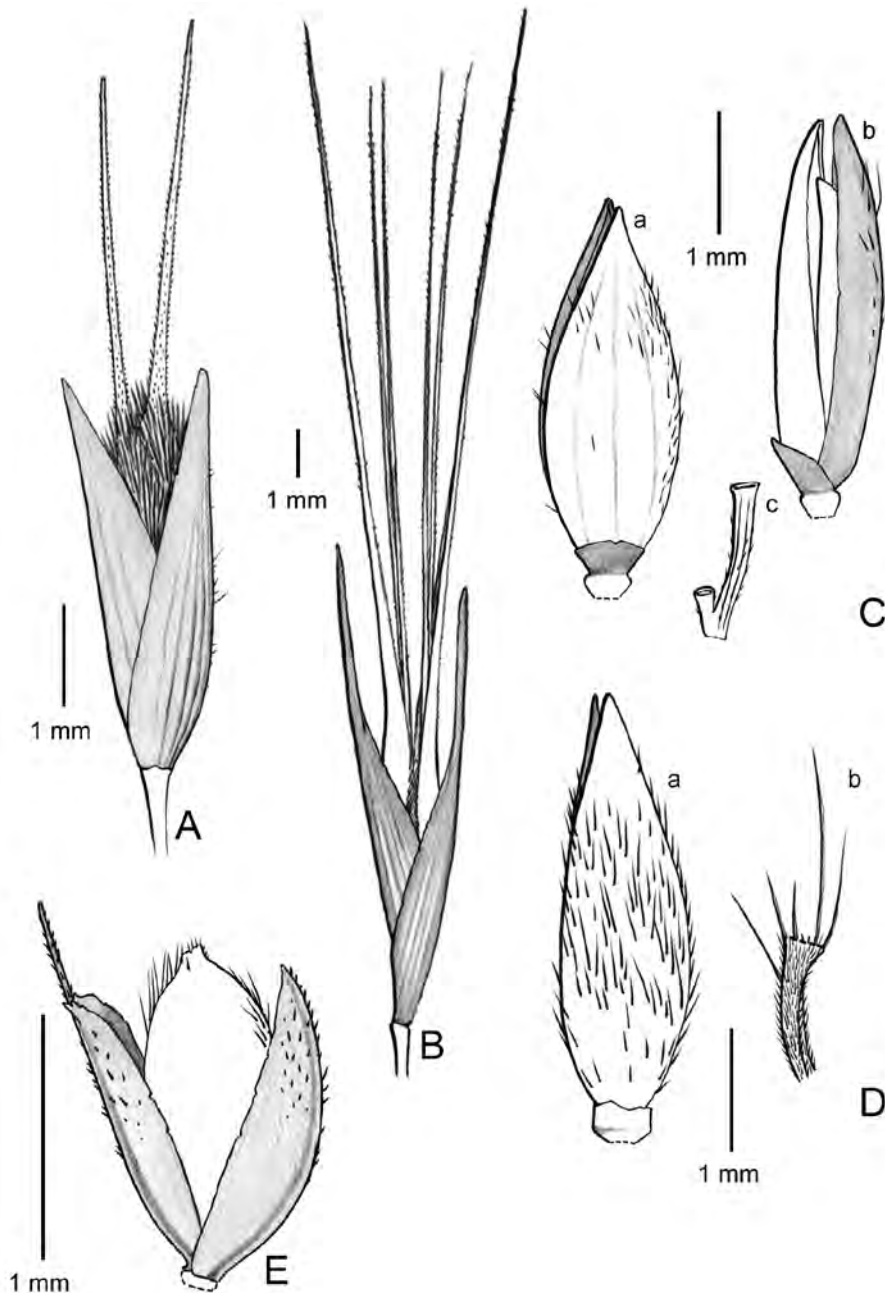


Figure 35. *Eriachne pallescens* R.Br. **A.** Spikelet, lateral view. *Eriachne trisetata* Nees ex Steud. **B.** Spikelet, lateral view. *Eriochloa meyeriana* (Nees) Pilg. **C.** Spikelets: **a.** facing 1st lemma, **b.** lateral view, **c.** pair of pedicels. *Eriochloa procera* (Retz.) C.E.Hubb. **D.** Spikelets: **a.** facing 1st lemma, **b.** pedicel. *Eustachys tenera* (J.Presl) A.Camus. **E.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

Key to *Eriochloa* species

1. Perennial; lower glume slightly developed, 0.2–0.4(–0.8) mm long, c. 0.1(–0.2) times as long as the spikelet; upper glume obtuse to acuminate; lower lemma paleate, male; upper lemma 2–2.3 mm long, smooth, apiculate, mucro less than 1 mm long; anthers 1.4–1.65 mm long **1. *E. meyeriana***
 Annuals (sometimes perennial?); lower glume absent; upper glume mucro 0.1–0.3 mm long; lower lemma epaleate, sterile, acuminate to apiculate, pilose; upper lemma 1.8–2 mm long, rugulose, mucronate, mucro 0.2–0.6 mm long; anthers 0.9–1.1 mm long
 **2. *E. procera***

1. *Eriochloa meyeriana* (Nees) Pilg.

(Ernst Heinrich Friedrich Meyer, 1791–1858, co-author of a work on the Drège collections)

in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 14e (1940) 56; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 168; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 74, fig. 70. **Basionym:** *Panicum meyerianum* Nees, Fl. Afr. Austral. Ill. (1841) 32. **Type:** *Drège s.n.*, CBSP [Capitis Bonae Spei Promontorium = Cape of Good Hope] (lectotype LE [Herb. Trinius 825.2], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 26; possible isoelectotypes G [×3], HAL, K, P, S, TUB, W). **Fig. 35C.**

Perennial. **Culms** erect to geniculate, rooting at the decumbent nodes (often scrambling), 0.3–2 m long. **Ligules** 0.7–0.8 mm long. **Leaf** blades flat, 4–25 cm by 3–15 mm. **Panicle** common axis 8–14.5 cm long, longest branches 6–8 cm by 0.4–0.6 mm, glabrous to puberulous (at base); pedicels pilose, the longer one of the pair 1.5–2.0 mm long, scaberulous. **Spikelets** paired to clustered, 2.5–3.6 × 1.1–1.3 mm (incl. callus). Lower **glume** slightly developed, 0.2–0.4(–0.8) mm long, c. 0.1(–0.2) times as long as the spikelet; upper glume 2.8–2.9 mm long, glabrous or sparsely hairy at base and along margins, obtuse to acuminate, 5-nerved. Lower **lemma** paleate, male, acute to acuminate, sparsely pilose; upper lemma 2–2.3 mm long, smooth, apiculate, mucro less than 1 mm long. **Anthers** 1.4–1.65 mm long.

Distribution. South and tropical Africa, introduced elsewhere. Formerly naturalising in Singapore on Bukit Timah Road (*Wong s.n.*, 6 Aug 1959, SINU), Dunearn Road (*Wong s.n.*, Aug 1959, SINU), Farrer Road (*Jumali 3454*, 19 Mar 1965, SINU) and the University Campus (*Jumali s.n.*, 28 Nov 1966, SINU). It now appears to be extinct in Singapore.

Ecology. Elsewhere in its distribution it is found in swampy places, along river banks, ditches and on coralline sand.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore and appearing to also now no longer be in the country.

2. *Eriochloa procera* (Retz.) C.E.Hubb.

(Latin, *procera* = very tall, high; referring to the size of the plant)

Bull. Misc. Inform. Kew 1930 (1930) 256; Gilliland, Rev. Fl. Malaya 3 (1971) 202, fig. 43, pl. 23c; Turner, Gard. Bull. Singapore 45 (1993) 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 168; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 74, fig. 71, pl. 12; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 39, 169, 271. **Basionym:** *Agrostis procera* Retz., Observ. Bot. 4 (1786) 19. **Synonym:** *Thysanolaena procera* (Retz.) Mez ex Janowski, Bot. Arch. 1 (1922) 27. **Type:** *König s.n.*, India (lectotype LD [LD1215977], designated by Fischer, Bull. Misc. Inform. Kew 1932 (1932) 71; isolectotype BRI (fragment), K (fragment) [K000958820]). **Fig. 35D, 36A.**

Milium ramosum Retz., Observ. Bot. 6 (1791) 22. **Synonyms:** *Agrostis ramosa* (Retz.) Poir. in Lamarck, Encycl., Suppl. 1, fasc. 1 (1810) 257. – *Helopus pilosus* Trin., Fund. Agrost. (1820) 104, nom. illeg. superfl. – *Eriochloa ramosa* (Retz.) Kuntze, Revis. Gen. Pl. 2 (1891) 775; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 953. **Type:** *Collector unknown s.n.*, India (lectotype LD [LD1222805], designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 571).

Eriochloa ramosa (Retz.) Kuntze var. *involucrata* Hack. ex Merr., Philipp. J. Sci. 1, Suppl. 5 (1906) 349. **Synonym:** *Eriochloa procera* C.E.Hubb. var. *involucrata* (Hack.) Jansen, Reinwardtia 2 (1953) 276. **Type:** *Merrill 3333*, Philippines, Mindoro, Puerta Galera, October 1903 (lectotype W [1916-0020483], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 16; isolectotypes BM, K, NY, US).

Eriochloa annulata auct. non (Flüggé) Kunth: Ridley, Fl. Malay Penins. 5 (1925) 223; Henderson, Malay. Wild Fls., Monocot. (1954) 325, fig. 187a,b.

Eriochloa polystachya auct. non Kunth: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 127.

Perennial. **Culms** erect, 0.5–1.2) m long, nodes puberulous. **Ligules** 0.7 mm long. **Leaf** blades flat to involute, 5–24.5 cm by 3–10 mm. **Panicle** common axis 12.5–19 cm long, branches more or less appressed to patent, 3.5–7 cm by 0.2–0.4 mm, glabrous or short-hairy in the axils; pedicels glabrous to pilose or with an apical corona under the spikelet, the longer one 2–3 mm long. **Spikelets** paired, 2.7–4.3 × c. 1 mm long (incl. callus). Lower **glume** absent; upper glume acute to acuminate, faintly 5-nerved; upper glume 2.7–3.1 mm long, (sparsely) hairy, mucro 0.1–0.3 mm long. Lower **lemma** epaleate, sterile, acuminate to apiculate, pilose. Lower **palea** 0–0.5 mm long. Upper lemma 1.8–2 mm long, rugulose, mucronate, mucro 0.2–0.6 mm long. **Anthers** 0.9–1.1 mm long.

Distribution. Tropical Africa to Malesia and Australia. Native and widespread in Singapore including in Singapore Botanic Gardens (*Teruya 2457*, 14 Mar 1934, KEP, SING [SING0034102]), Geylang (*Teruya s.n.*, 23 Jun 1933, SING [SING0041125]), Pasir Panjang-HortPark (*Chen SING2017-742*, 06 Dec 2017, SING [SING0255907]), Punggol (*Ridley 12235*, 1903, SING [SING0041127]) and Kusu Island (*Loo KS21*, 3 Sep 1997, SINU).

Ecology. Open, humid grasslands, roadsides and in ditches.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).



Figure 36. *Eriochloa procera* (Retz.) C.E.Hubb. **A.** Two inflorescences. *Lepturus repens* (G.Forst.) R.Br. **B.** Inflorescence. *Melinis repens* (Willd.) Zizka. **C.** Inflorescence. (From Singapore, A, C exact localities uncertain, B from Pulau Ubin, *Duistermaat 123*. Photos: H. Duistermaat).

26. EUSTACHYS Desv.

(Greek, *eu-* = well, *-stachys* = spike;
referring to the well-developed racemes)

Nouv. Bull. Sci. Soc. Philom. Paris 2 (1810) 188; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 389. **Synonyms:** *Schultesia* Spreng., *Pl. Min. Cogn. Pug.* 2 (1815) 17, nom. illeg. superfl. – *Chloris* Sw. sect. *Eustachys* (Desv.) Rchb., *Consp. Regn. Veg.* (1828) 49; Bentham in Bentham & Hooker, *Gen. Pl.* 3(2) (1883) 1166, isonym. – *Chloris* Sw. subg. *Eustachys* (Desv.) Döll in Martius, *Fl. Bras.* 2(3), fasc. 79 (1878) 63. **Type:** *Eustachys petraea* (Sw.) Desv.

Annuals. **Culms** tufted, solid. **Ligule** a row of hairs. **Inflorescence** more or less lax, racemes digitate, 2–7, rachis ending in a spikelet. **Spikelets** solitary, secund, very shortly pedicelled, biseriate, laterally towards the rachis, with 1 fertile and distally with 1 empty, muticous lemma, disarticulating above the glumes, laterally strongly flattened. **Glumes** subequal, membranous, shorter than the lemma, 1-nerved; the upper glume bilobed with a short subapical awn. **Callus** absent. Fertile **lemma** keeled, chartaceous, dark brown, 3-nerved, midrib and margins sparsely hairy, apex rounded, muticous. **Stamens** 3. **Caryopsis** smooth, not longitudinally grooved. **Pericarp** tardily free.

Distribution. About 10 species in the tropics, mainly in the New World. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Chloridoideae – Eleusininae* Dumort.

Eustachys tenera (J.Presl) A.Camus

(Latin, *tener* = delicate; perhaps referring to the overall appearance of the plant)

Rev. Int. Bot. Appl. Agric. Trop. 5 (1925) 208, as '*tener*'; Hubbard, Bull. Misc. Inform. Kew 1941 (1941) 25, isonym; Gilliland, Rev. Fl. Malaya 3 (1971) 88, pl. 21c (excl. fig. 13 = *Chloris barbata*); Turner, Gard. Bull. Singapore 45 (1993) 97, as '*tener*'; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 168; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 74, fig. 69; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 41, 169, 192. **Basionym:** *Cynodon tener* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 291. **Synonym:** *Chloris tenera* (J.Presl) Scribn., Rep. (Annual) Missouri Bot. Gard. 10 (1899) 41, pl. 40: fig. 2, as '*tener*'. **Type:** *Haenke s.n.*, Philippines (lectotype MO [MO-144078], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 41; isolectotypes B, BM, HAL, LE [Herb. Trinius 2052.01], PR [sheet no. 495766], PRC, US (fragment), W [x2]). **Fig. 35E.**

Culms geniculate, with short stolons, compressed in the lower parts, 0.1–0.5 m long; nodes glabrous. **Sheaths** (sub)glabrous, loose. **Ligule** 0.05–0.1 mm long. **Leaf** blades folded when young, flat, linear, distichously crowded at the nodes, 1–10 cm by 2–5 mm, obtuse to (sub)acute, scabrous, obtuse to (sub)acute. **Racemes** 2–7, erecto-patent, 2.5–5 cm by 1–4 mm; rachis scabrous, 0.03–0.05 mm wide. **Spikelets** 1.1–1.5 mm long. Lower **glumes** 1–1.2 mm long; upper glumes 1.1–1.4 mm long. **Lemma** broadly ovate, 1.1–1.5 mm long, nerves puberulous, dark brown at maturity. **Anthers** 0.3–0.4 mm long. **Sterile lemma** (sometimes enclosed by fertile lemma), 0.5–0.7 mm long, truncate.

Distribution. Thailand to southeastern China, Taiwan, and throughout Malaysia. In Singapore it has been collected in Changi (*Ridley 9580*, 1898, K) and Telok Paku (*Sinclair 10766*, 23 Dec 1964, E, K, L, SING [SING0017754]).

Ecology. Elsewhere a weed in maize and rice fields, along roads and in disturbed places, close to rivers on sandy soil.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

27. HETEROPOGON Pers.

(Greek, *hetero-* = different, *-pogon* = beard; referring to the spikelets with or without awns)

Syn. Pl. 2(2) (1807) 533; Deshpande, Bull. Bot. Surv. India 30 (1990 [‘1988’]) 120; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 310. **Synonyms:** *Andropogon* L. sect. *Heteropogon* (Pers.) Endl., Gen. Pl., fasc. 2 (1836) 108. – *Andropogon* L. subg. *Heteropogon* (Pers.) Hack. in Engler & Prantl, Nat. Pflanzenfam. 2(2) (1887) 29. – *Heteropogon* Pers. sect. *Macropogon* Roberty, Boissiera 9 (1960) 136, nom. inval. **Type:** *Heteropogon glaber* Pers., nom. illeg. superfl., lectotype designated by Nash in Britton, N. Amer. Fl. 17 (1912) 127 (= *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.).

Annuals or perennials. **Ligule** membranous. **Racemes** espatheate, usually single, terminal. **Joints and pedicels** linear, disarticulating obliquely. Lower **spikelets** paired, homogamous, muticous, male or sterile. **Spikelets** paired. **Sessile spikelet** subterete, female, sometimes bisexual. **Callus** pungent. **Glumes** coriaceous; lower glume dorsally rounded, not keeled, rarely grooved. Lower **floret** reduced to the lemma. Upper **lemma** basal part very narrow and hyaline, widening upwards and somewhat indurate passing into the awn. **Pedicelled spikelets** male or sterile, muticous, clasping the sessile one.

Distribution. A genus of about 6 species in the (sub)tropics of which there is 1 native species in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoninae* J.Presl.

Notes. The plants are nearly monoecious.

Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.

(Latin, *contortus* = contorted, twisted; referring to the entwined awns)

Syst. Veg., ed. 15 bis, 2 (1817) 836; Gilliland, Rev. Fl. Malaya 3 (1971) 292, fig 63, pl. 36a; Turner, Gard. Bull. Singapore 45 (1993) 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 169; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 76, fig. 72; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 48, 169, 228. **Basionym:** *Andropogon contortus* L., Sp. Pl. 2 (1753) 1045, as ‘*contortum*’; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 167. **Synonyms:** *Heteropogon hirtus* Pers., Syn. Pl. 2(2) (1807) 533, nom. illeg. superfl. – *Andropogon contortus* L. var. *genuinus* Hack. & subvar. *typicus* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 586, nom. inval. – *Sorghum contortum* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 791. – *Holcus contortus* (L.) Kuntze ex Stuck., Anales Mus. Nac. Buenos Aires 11 (1904) 48, nom. inval. (not accepted by author, see p. 49). – *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult. subvar. *glaber* Roberty, Boissiera 9 (1960) 138, nom. inval. **Type:** [Published illustration] ‘Gram. Secalinum, Indicum, spica gracili, tomentoso, aristas longioribus, ad se invicem intortis’, Plukenet, Phytogr. 4: t. 191: fig. 5 (1692), lectotype designated by Cope, Fl. Pakistan 143 (1982) 312. **Fig. 37A.**

Perennials. **Culms** tufted, erect, 0.3–1.5 m long, uppermost branches fascicled; nodes glabrous. **Ligules** collar-shaped, 1–2 mm long, ciliate. **Leaf** blades flat, folded when young, 10–20 cm by 2–7 mm, upper surface often finely hairy. **Racemes** solitary, 3–10 cm long (excl. awns). **Joints** glabrous. **Homogamous pairs** of spikelets in 8 or 9 pairs, male, unawned, 6–7 × 1 mm. Lower **glume** almost glabrous at base, upwards with golden bulbous-based hairs increasing in length up to 2 mm long, 13-nerved; upper glume 3-nerved, sparsely hairy on midrib and margins only. **Heterogamous spikelets** in 5–8 pairs. **Sessile spikelets** 4–10 mm long (incl. the 2–3 mm long callus), dark brown, setose, hairs with small bulbous bases. **Callus** c. 2.5 mm long. Lower **glume** 9-nerved; upper glume 3-nerved. **Awns** 5–12 cm long. **Pedicelled spikelets** 5–15 mm long. **Glumes** glabrous to pilose along the margins. **Floret** male or sterile. **Anthers** c. 3 mm long.

Distribution. Tropical America, Africa, India to southern China and Japan (Ryukyus) and through Malesia and the Pacific to the Marianas Islands and Australia. Presumably native

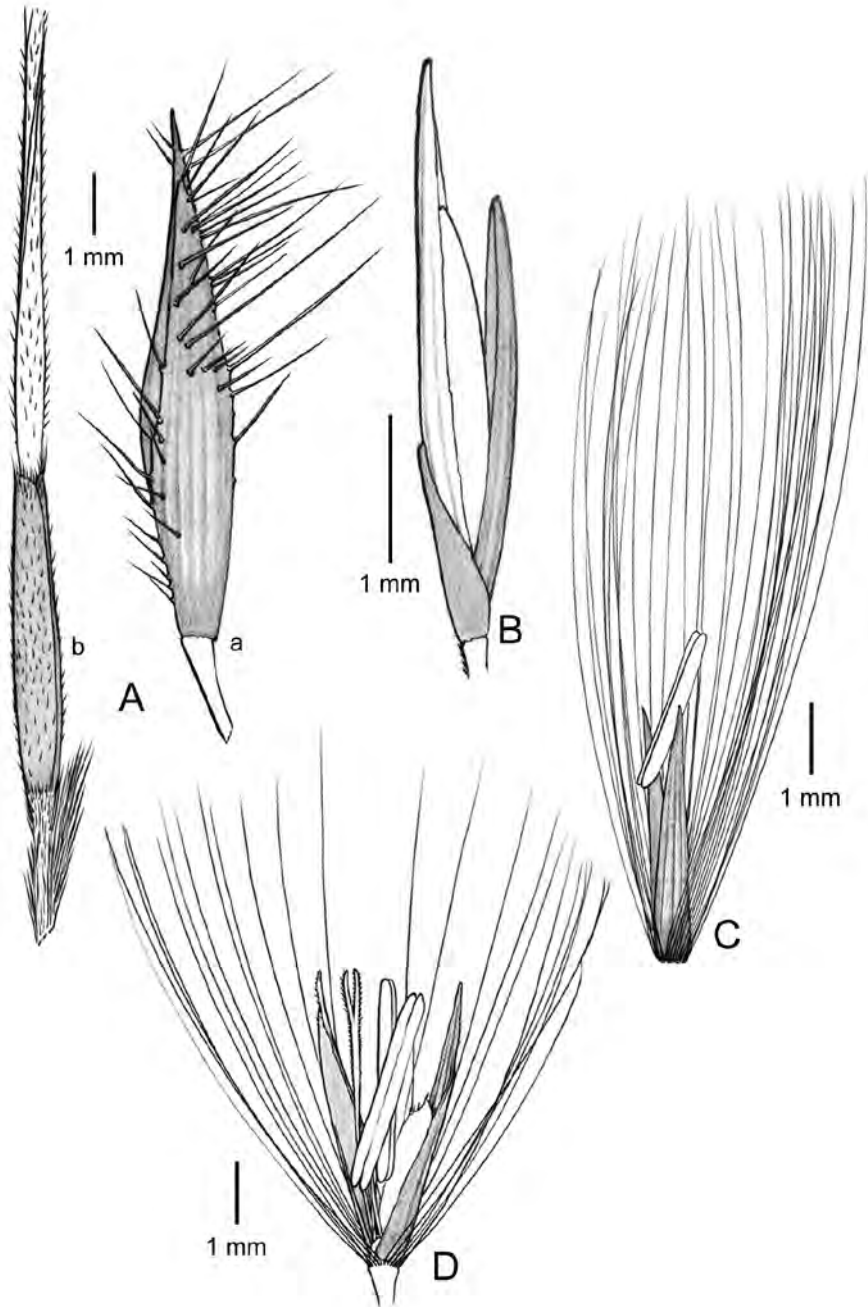


Figure 37. *Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult. **A.** Spikelets: **a.** male spikelet, **b.** female spikelet. *Hymenachne amplexicaulis* (Rudge) Nees. **B.** Spikelet, lateral view: *Imperata conferta* (J.Presl) Ohwi. **C.** Spikelet, lateral view. *Imperata cylindrica* (L.) Rausch. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

in Singapore but only infrequently collected: without locality (*Teruya* 2803, 1936, SING [SING0017755]) and in Changi (*Teruya* 2855, 1 Jan 1937, SING [SING0017758]; Corner *s.n.*, 20 Jul 1941, SING [SING0017757]; *Kassim s.n.*, 28 May 1954, SINU; *Burkill* 1121, 9 Jan 1957, SING [SING0017756]).

Ecology. Elsewhere on lightly shaded and periodically dry soils and sandy coasts. It is salt and drought resistant.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Vernacular name. *Tangle-head* (English).

Notes. Merrill (Sp. Blancoan. (1918) 61) implied that this species was introduced to Asia from the Americas but given its very widespread distribution even from early collections in Asia this seems unlikely.

28. HYMENACHNE P.Beauv.

(Greek, *hymen-* = membrane, *-achne* = scale; referring to the thin glumes)

Ess. Agrostogr. (1812) 48, pl. 10: fig. 8; Chase, Proc. Biol. Soc. Wash. 21 (1908) 1, fig. 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 318. **Synonyms:** *Panicum* L. [sect.] *Hymenachne* (P.Beauv.) J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 311; Bentham in Bentham & Hooker, Gen. Pl. 3(2) (1883) 1102, isonym; Hack. in Engler & Prantl, Nat. Pflanzenfam. 2(2) (1887) 35, isonym, as '*Hymenachnae*'; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 134. **Type:** *Agrostis monostachya* Poir., lectotype designated by Chase, Proc. Biol. Soc. Wash. 21 (1908) 1 (= *Hymenachne amplexicaulis* (Rudge) Nees).

(Semi-)aquatic perennials. **Culms** with aerenchyma. **Ligule** collar-shaped, glabrous, membranous. **Leaf** blades inrolled when young, broad, base moderately to strongly cordate. **Panicle** composed of racemes. **Pedicel** apices truncate to discoid. **Spikelets** solitary, abaxial, distichous, secund, 2-flowered, terete. **Glumes** unequal, with a developed rachilla internode, acute to mucronate; lower glume c. 0.33 times as long as the spikelet, 1–5-nerved; upper glume inserted shortly above the lower one, 3–5-nerved. Lower **lemma** epaleate, sterile, acute to mucronate, 5-nerved; upper lemma scarious, dorsally rounded, glabrous, germination flap absent, white in fruit margins lying flat on the palea, mucicous. **Stamens** 3.

Distribution. A genus of about 5 species in the tropics of which 1 is possibly native in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Otachyriinae* Butzin.

Hymenachne amplexicaulis (Rudge) Nees

(Latin, *amplexi-* = embracing, *-caulis* = the culm; referring to the base of the leaf blades)

in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 267; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 170; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 76, fig. 73; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 50, 169, 228. **Basionym:** *Panicum amplexicaule* Rudge, Pl. Guian. 1, fasc. 3 (1805) 21, t. 27; Henderson, Malay. Wild Fls., Monocot. (1954) 329, fig. 188d–f. **Synonyms:** *Panicum hymenachne* Desv., Mém. Soc. Agric. Angers 1 (1831) 183, nom. illeg. superfl. – *Panicum myuros* Lam. var. *amplexicaule* (Rudge) Kuntze, Revis. Gen. Pl. 2 (1891) 784. **Type:** *Martin s.n.*, Guiana [French Guiana] (holotype BM [BM000938736]). **Fig. 37B.**

Panicum acutiglumum Steud., Syn. Pl. Glumac. 1, fasc. 1 (1853) 66. **Synonyms:** *Hymenachne serrulata* Nees in Hooker's J. Bot. Kew Gard. Misc. 2 (1850) 98, nom. nud. – *Hymenachne acutigluma* (Steud.) Gilliland, Gard. Bull. Singapore 20(4) (1964) 314; Gilliland, Rev. Fl. Malaya 3 (1971) 155, pl. 19a; Turner, Gard. Bull. Singapore 45 (1993) 97. **Type:** *Cuming 2287*, [Malaysia], Malacca (lectotype K [K000290317], designated by Gilliland, Gard. Bull. Singapore 20(4) (1964) 314; isolectotypes A, E, GH, L, MO, P, W [$\times 3$])

Panicum myuros auct. non Lam.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 135, as '*myurus*'.

Hymenachne myuros auct. non (Lam.) P.Beauv.: Ridley, Fl. Malay Penins. 5 (1925) 230; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1975, as '*myurus*'.

Sacciolepis interrupta auct. non (Willd.) Stapf: Gilliland, Rev. Fl. Malaya 3 (1971) 151.

Culms 0.8–2.5 m long, erect to ascending, sometimes forming large mats or tufts, branching intra-vaginally at base; nodes glabrous. **Sheaths** with transverse nerves, glabrous or margins with a row of bulbous-based bristles. **Ligule** 1–2 mm long. **Leaf** blades flat, linear, 10–45 cm by 6–35 mm, base rounded to more or less amplexicaul, margin usually with bulbous-based bristles, glabrescent, scabrid, rarely with a few hairs on the upper surface. **Panicle** densely contracted, spike-like, often lobed at base, 10–40(–55) \times 0.6–1.2(–3.5) cm; racemes more or less appressed, smooth or distally scaberulous, the lowermost solitary, 5–10 cm long, spikelets dense and many; pedicels shorter than the spikelets, 0.2–0.5 mm long, with hair-like spicules. **Spikelets** yawning at anthesis, 3–6 mm long. **Glume internode** 0.3–0.5 mm long; lower glume ovate-oblong, 1–1.75(–2.5) mm long, mucro up to c. 0.4 mm long; upper glume ovate-oblong, 2.5–5 mm long. Lower **lemma** ovate-oblong, 3.4–6 mm long, 5-nerved, mucro up to 0.8 mm long, glabrous; upper lemma ovate, 2.25–3.3(–4.5) mm long, obtuse. **Anthers** 0.8–1.2 mm long.

Distribution. New World (sub)tropics, India to southern China, Taiwan, and through Malesia to northern Australia. Possibly native in Singapore but infrequently collected: without locality (*Keng et al. 4065*, 18 Nov 1965, SINU), Clementi Road (*Wong s.n.*, 10 Jul 1959, SINU) and Serangoon Road (*Sinclair s.n.*, 19 Dec 1948, L). Collections from Singapore Botanic Gardens (*Duistermaat 261*, 3 Feb 2004, SING [SING0059610]) and Sungei Buloh (*Duistermaat et al. 77*, 19 Mar 2002, SING [SING0059611]) would appear to be of cultivated plants only.

Ecology. Elsewhere in swamps in water up to 3 m deep, margins of ponds, rice fields, and rivers with slowly flowing fresh water.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct as all collections within the last 30 years would appear to have been of cultivated plants.

Vernacular names. *Swamp panic grass* (English), *rumput kumpai* (Malay).

29. IMPERATA Cirillo

(Ferrante Imperato, 1525?–1615?, pharmacist in Naples, Italy,
author of a work on natural history)

Pl. Rar. Neapol. 2 (1792) 26; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 304. **Synonyms:** *Saccharum* L. subg. *Imperata* (Cirillo) Pers., *Syn. Pl.* 1 (1805) 103. – *Imperata* Cirillo sect. *Imperatella* Hack. in Martius, *Fl. Bras.* 2(3), fasc. 90 (1883) 250, nom. inval. – *Saccharum* L. sect. *Imperata* (Cirillo) Roberty, *Boissiera* 9 (1960) 375. **Type:** *Imperata arundinacea* Cirillo, nom. illeg. superfl. (= *Imperata cylindrica* (L.) Raeusch.).

Perennials. **Culms** rhizomatous, solid to hollow. **Leaves** before flowering clustered at the base of the culm. **Ligule** a membranous collar, margin ciliate. **Leaf** blades inrolled when young. **Panicles** racemose, espatheate, common axis tenacious, branches solitary, slender, persistent, silky. **Spikelets** paired, homomorphous, 2-flowered, unequally pedicelled, easily deciduous, more or less dorsoventrally compressed. **Callus** long-hairy. **Glumes** subequal, awnless, long-bearded; lower glume dorsally convex. **Lemmas** glabrous, 0-nerved; lower lemma epaleate, sterile; upper lemma entire, mucicous. Lower **palea** absent, upper one 0-nerved. **Lodicules** absent. **Stamens** 1 or 2 (sometimes Y-shaped). **Styles** fused.

Distribution. A pantropical genus of 8 species of which 2 are native in Singapore (but see notes below).

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoneae* Dumort., subtribe uncertain.

Notes. There is some doubt as to whether the two species recognised here really are distinct from each other. Further studies are necessary but here we follow the traditional usage.

Key to *Imperata* species

1. Culms glabrous just below the nodes; peduncle hollow; panicle thyrsiform, secund, 25–52 cm long, lowermost branches 5–15 cm long, spreading; stamens 1; anthers 1.4–2.2(–2.7) mm long **1. I. conferta**
Culms with long bulbous-based hairs just below the nodes; peduncle more or less solid; panicle narrow, spiciform, erect, 4–28 cm long, lowermost branches 1.2–5 cm long, appressed; stamens 2; anthers 2.5–3.5 mm long **2. I. cylindrica**

1. *Imperata conferta* (J.Presl) Ohwi

(Latin, *confertus* = crowded; perhaps alluding to the dense stands in which it grows)

Bot. Mag. (Tokyo) 55 (1941) 549; Gilliland, Rev. Fl. Malaya 3 (1971) 222; Turner, Gard. Bull. Singapore 45 (1993) 97; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 170; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 78, fig. 74; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 50, 169, 228. **Basionym:** *Saccharum confertum* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 346. **Synonym:** *Imperata ramosa* Andersson, Öfvers. Kongl. Vetensk.-Akad. Förh. 12 (1855) 158, nom. illeg. superfl. **Type:** *Haenke s.n.*, Philippines, Luzon, Sorsogon (lectotype PR [sheet no. 612328], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 38; isolectotype PR [sheet nos. 612329, 612330], US (fragment)). **Fig. 37C.**

Saccharum macilentum Chauv. ex Steud., Syn. Pl. Glumac. 1, fasc. 6 (1854) 406. **Synonyms:** *Imperata macilentata* (Chauv. ex Steud.) Ohwi, Acta Phytotax. Geobot. 11 (1942) 146. – *Imperata exaltata* (Roxb.) Brongn. var. *genuina* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 99, nom. inval. **Type:** *Dumont d'Urville s.n.*, [Indonesai], Ins. Waigiou [Waigeo] (lectotype P [P03639080], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 39).

Imperata exaltata auct. non (Roxb.) Brongn.: Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 107; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 152; Ridley, Fl. Malay Penins. 5 (1925) 193.

Imperata contracta auct. non Hitchc.: Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1248.

Culms 0.5–1.8 m tall, hollow under the panicle; nodes glabrous or with a few long white hairs. **Sheaths** glabrous, auricles distinct. **Ligules** 0.7–2.5 mm long. **Leaf** blades 30–110 cm by 7–22 mm, with a few long hairs at base, otherwise glabrous. **Peduncle** hollow. **Panicle** thyriform, spreading, 25–52 × 5–8 cm; lowermost branches drooping, 6–15 cm long; pedicels 1–2 and 2–3.5 mm long, respectively; callus hairs 7–12 mm long. **Spikelets** 2.9–4 mm long. Lower **glume** 3- or 4-nerved in lower half, smooth to scabrid in upper half, longest nerve ending at most 0.25 mm below the ciliate apex; upper glume as the lower. Lower **lemma** 1.75–2.25 mm long, 0- or 1-nerved at base; second lemma oblong, 1.75–2.75 mm long, acute, 0- or 1-nerved at base. **Stamens** 1. **Anthers** 1.4–2.2(–2.7) mm long.

Distribution. Southeast Asia and throughout Malesia to New Guinea. In Singapore collected in Lengkok Saga (*Tan 39*, 3 Apr 1999, SINU), Lorong Lada Hitam (*Tan 13*, 24 Feb 1999, SINU) and Tanglin Halt Road (*Morgany & Tan M 130A*, 23 Apr 1998, SINU).

Ecology. Road sides, recently abandoned fields. Formerly common according to Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186).

Provisional conservation assessment. Not assessed due to uncertainty over the status of the species.

2. *Imperata cylindrica* (L.) Raeusch.

(Latin, *cylindricus* = cylindrical; referring to the shape of the inflorescence)

Nomencl. Bot. 3 (1797) 10; Beauvois, Ess. Agrostogr. (1812) 7, 165, 177, pl. 5: fig. 1, isonym; Henderson, Malay. Wild Fls., Monocot. (1954) 343, fig. 195a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1249; Turner, Gard. Bull. Singapore 45 (1993) 98; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 78, fig. 75; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 50, 169, 271. **Basionym:** *Lagurus cylindricus* L., Syst. Nat., ed. 10, 2 (1759) 878. **Synonyms:** *Saccharum cylindricum* (L.) Lam., Encycl. 1, fasc. 2 (1785) 594; Willd., Sp. Pl., ed. 4, 1(1) (1797) 323, isonym. – *Imperata arundinacea* Cirillo, Pl. Rar. Neapol. 2 (1792) 27, t. 11, nom. illeg. superfl. – *Calamagrostis lagurus* Koeler, Descr. Gram. (1802) 112, nom. illeg. superfl. – *Imperata cylindrica* (L.) Raeusch. var. *genuina* A.Camus, Fl. Indo-Chine 7, fasc. 3 (1922) 232, nom. inval. – *Imperata cylindrica* (L.) Raeusch. f. *typica* Honda, Bot. Mag. (Tokyo) 39 (1925) 38, nom. inval. **Type:** *Gérard s.n.*, ‘Monspelii, Creta, Smyrnae’ (lectotype LINN [Herb. Linn. no. 96.2]), designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 700. **Fig. 37D, 38.**

Imperata koenigii (Retz.) P.Beauv. var. *major* Arn. & Nees in Nees, Fl. Afr. Austral. Ill. (1841) 90, as ‘*maior*’. **Synonym:** *Imperata cylindrica* (L.) Raeusch. var. *major* (Arn. & Nees) C.E.Hubb. in Hubbard & Vaughan, Grasses Mauritius (1940) 96; Gilliland, Rev. Fl. Malaya 3 (1971) 220, fig. 48; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 170, fig. 274. **Type:** *Drège 4253*, South Africa, Facoskraal, 1900–2000 ft, 10 February 1832 (lectotype P [P00443973]), designated by Turner et al., Gard. Bull. Singapore 71 (2019) 17; isoelectotypes K, L, TUB, W [$\times 2$]).

Saccharum alopecurus Nees in Hooker’s J. Bot. Kew Gard. Misc. 2 (1850) 100. **Synonyms:** *Saccharum negrosense* Steud., Syn. Pl. Glumac 1, fasc. 6 (1854) 407, nom. illeg. superfl. **Type:** *Cuming 1801*, Philippines, Island of Negros (lectotype CGE (ex Herb. Lindl.)), designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 38; isoelectotypes CGE (ex Mus. Henslow), E [E00393731], GOET [$\times 2$], K, P, W).

Imperata arundinacea auct. non Cirillo: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 152; Ridley, Fl. Malay Penins. 5 (1925) 193.

Culms 0.2–1.5(–2.3) m tall, more or less solid under the panicle, nodes bearded with long white hairs, beard sometimes much reduced and absent, especially in old specimens. **Sheaths** glabrous to pilose, auricles absent to minute. **Ligules** (0.5–)2 mm long. **Leaf** blades 12–80 cm by 5–18 mm, long-hairy at base, otherwise glabrous. **Panicle** narrow, spiciform, 4–28 \times 0.6–2 cm; lowermost branches appressed, 1.2–5 cm long; pedicels 0.5–2 and 1–3 mm long, respectively; callus hairs 7–15 mm long. **Spikelets** 3.25–4.5 mm long. Lower **glume** 2–6-nerved in lower half, scabrid in upper half, longest nerve ending 0.75 or more mm below the ciliate apex; upper glume as the lower, somewhat longer. Lower **lemma** 1.5–3 mm long, 0- or 1-nerved at base; second lemma oblong, 0.5–2.75 mm long, acute, 0-nerved. **Stamens** 2. **Anthers** 2–3.5 mm long.

Distribution. Native in the Old World and widely introduced in the (sub)tropics and warm temperate regions (up to 45° N and S). In Singapore it is extremely widespread with examples being of an early but unlocalised collection (*Cuming 2411*, 1839/1840, CGE), Bukit Brown Cemetery (*Tan 34, 35*, 18 Mar 1999, SINU), Bukit Timah Road (*Sew & Wee s.n.*, 10 Jul 1961, SINU), Clementi Road (*Duistermaat 282*, 21 Mar 2004, L, SING [SING0059808]) and Holland Road (*Duistermaat 17*, 6 Feb 2002, K, L, SING [SING0059806]).



Figure 38. *Imperata cylindrica* (L.) Raeusch. **A.** Habit. **B.** Inflorescence detail with anthers and stigmas. **C.** Rhizomatous stem. **D.** Leaf blade and stem with hairy node. (From Singapore, Bishan Park. Photos: L.M.J. Chen).

Ecology. Sunny to moderately shaded fields, road sides, cultivated fields, gardens, etc. When frequently mown, plants get smaller and produce smaller inflorescences or stop flowering altogether. It can be a pernicious weed.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Lalang* (English, Malay).

30. ISACHNE R.Br.

(Greek, *isa-* = equal, *-achne* = scale; referring to the equal glumes)

Prodr. Fl. Nov. Holland. (1810) 196; Prakash & Jain, Fasc. Fl. India 14 (1984) 7; Iskandar & Veldkamp, Reinwardtia 12 (2004) 159; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 401. **Synonyms:** *Panicum* L. sect. *Isachne* (R.Br.) Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 3 (1834) 195, 328; R.Br. ex Steud., Syn. Pl. Glumac 1, fasc. 1 (1853) 38, isonym. – *Isachne* R.Br. sect. *Euisachne* Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 278, nom. inval. **Type:** *Isachne australis* R.Br. (= *Isachne globosa* (Thunb.) Kuntze).

Isachne R.Br. sect. *Albentes* V.Prakash & S.K.Jain, Fasc. Fl. India 14 (1984) 8. **Synonym:** *Isachne* R.Br. sect. *Pseudoisachne* Ohwi ex Jansen, Reinwardtia 2 (1953) 290, nom. inval. **Type:** *Isachne albens* Trin.

Annuals or perennials. **Culms** tufted, mat- or cushion-forming, or subscandent, branching intra- and/or extra-vaginally at base, sometimes rhizomatous, hollow. **Ligule** absent or a row of hairs. **Leaf** blades inrolled when young. **Inflorescences** of panicles. **Spikelets** 2-flowered, quaquaversal to secund, abaxial, paired, disarticulating above the glumes, and between the lemmas, sex very variable (anthoecia sterile to bisexual), callus absent. Lower **glume** 3–9-nerved; upper glume 5–9-nerved. **Rachilla** process absent. **Lemmas** 5–11-nerved, apex obtuse to rounded, entire, muticous; first lemma similar in texture to the second one, or much less indurate, sometimes very different from it, upper lemma callus obtuse, glabrous, dorsally rounded to grooved, margins involute over the palea, germination flap present. **Stamens** 3.

Distribution. A pantropical genus of approximately 100 species of which 4 are native in Singapore.

Taxonomy. The genus belongs to the *Micrairoideae* – *Isachneae* Benth.

Key to *Isachne* species

1. Lemmas not differing in texture, subequal to equal, chartaceous to coriaceous, not dorsally depressed 2
- Lemmas differing in texture and (usually) in size, the lower one herbaceous to membranous, usually longer than the chartaceous upper one, usually dorsally depressed 3

Culms tufted, rather stiffly erect; blade bases subcordate to cordate, clasping, 1.5–3.5 cm wide, margins pectinate, below with 11–13 main nerves; panicle branches stiffly patent; spikelets 1–1.3 mm long; glumes shorter than the lemmas to subequal to the lemmas, apex rounded; lower glume 3–5-nerved, acuminate, apex rounded; upper glume setose; first lemma 0.8–1 mm long **1. I. confusa**

Culms geniculate, rooting at decumbent nodes; blade bases nearly pseudo-petiolate to cuneate, 0.3–0.8 cm wide, margins minutely scaberulous, below with 5–9 main nerves; panicle branches appressed to erecto-patent; spikelets 2.4–3.5 mm long; glumes longer than the lemmas, apex acuminate; lower glume 7–9-nerved; upper glume glabrous or puberulous; first lemma 1.5–1.8 mm long **4. I. schmidtii**

3. Culm nodes glabrous; blades 7–9-nerved; spikelets globular to ellipsoid **2. I. globosa**
Culm nodes usually pubescent; blades 5-nerved; spikelets obovoid **3. I. minutula**

1. *Isachne confusa* Ohwi

(Latin, *confusus* = confused; for its confused recognition as a distinct species)

Bull. Tokyo Sci. Mus. 18 (1947) 14; Gilliland, Rev. Fl. Malaya 3 (1971) 121, pl. 16f. **Type:** *Binnemeijer 1577*, Indonesia, Banka, Muntok, 18 October 1917 (lectotype BO, designated by Jansen, Reinwardtia 2 (1953) 282; isolectotypes B, CAL, L [$\times 2$], US). **Fig. 39A.**

Isachne rigida auct. non Miq.: Ridley, Fl. Malay Penins. 5 (1925) 238; Henderson, Malay. Wild Fls., Monocot. (1954) 326, fig. 187e,f; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1273.

Isachne pulchella auct. non Roth: Turner, Gard. Bull. Singapore 45 (1993) 98; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 82, fig. 79; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 271.

Perennials or annuals (seemingly). **Culms** tufted and stiffly erect, 0.15–0.7 m long, nodes glabrous, with or without annular glands below the nodes. **Sheaths** glabrous or hairy at least along the margins with hairs with a bulbous base. **Ligule** absent. **Leaf** blades ovate to linear-lanceolate, 0.9–3 cm by 2–4.5(–10) mm, base subcordate to cordate, clasping, above minutely scaberulous, glabrous, below smooth, glabrous, with 11–13 main nerves, margins white cartilaginous or not, not undulate, pectinate. **Panicle** lax, 1.5–4 \times 1.5–3.5 cm, branches stiffly patent, many, eglandular or with annular glands, terete, smooth, lowermost branch 0.5–2 cm long, unbranched, with 2–4 spikelets; pedicels eglandular, shorter to longer than the spikelet, smooth. **Spikelets** subglobose, yawning, 1–1.3 \times 1–1.5 mm. **Glumes** shorter than to subequal to the lemmas, herbaceous. **Rachilla** between glumes present (when viewed with a 30 \times lens). **Glumes** elliptic, apex rounded, setose, smooth; lower glume 0.8–1 \times 0.7–1 mm, obscurely 3–5-nerved; upper glume 0.9–1 mm long and wide, obscurely nerved, 5-nerved. **Rachilla** between anthoecia developed, terete. **Anthoecia** not differing in texture, subequal to equal; lower floret hemi-orbicular, bisexual. **First lemma** not longitudinally depressed, 0.8–1 mm long, chartaceous, obscurely nerved, glabrous. **Anthers** c. 0.5 mm long. **Upper floret** hemi-orbicular, bisexual. **Second lemma** 0.6–1 mm long, 0.9–1 times as long as the first lemma, chartaceous, glabrous. **Anthers** c. 0.5 mm long.

2.

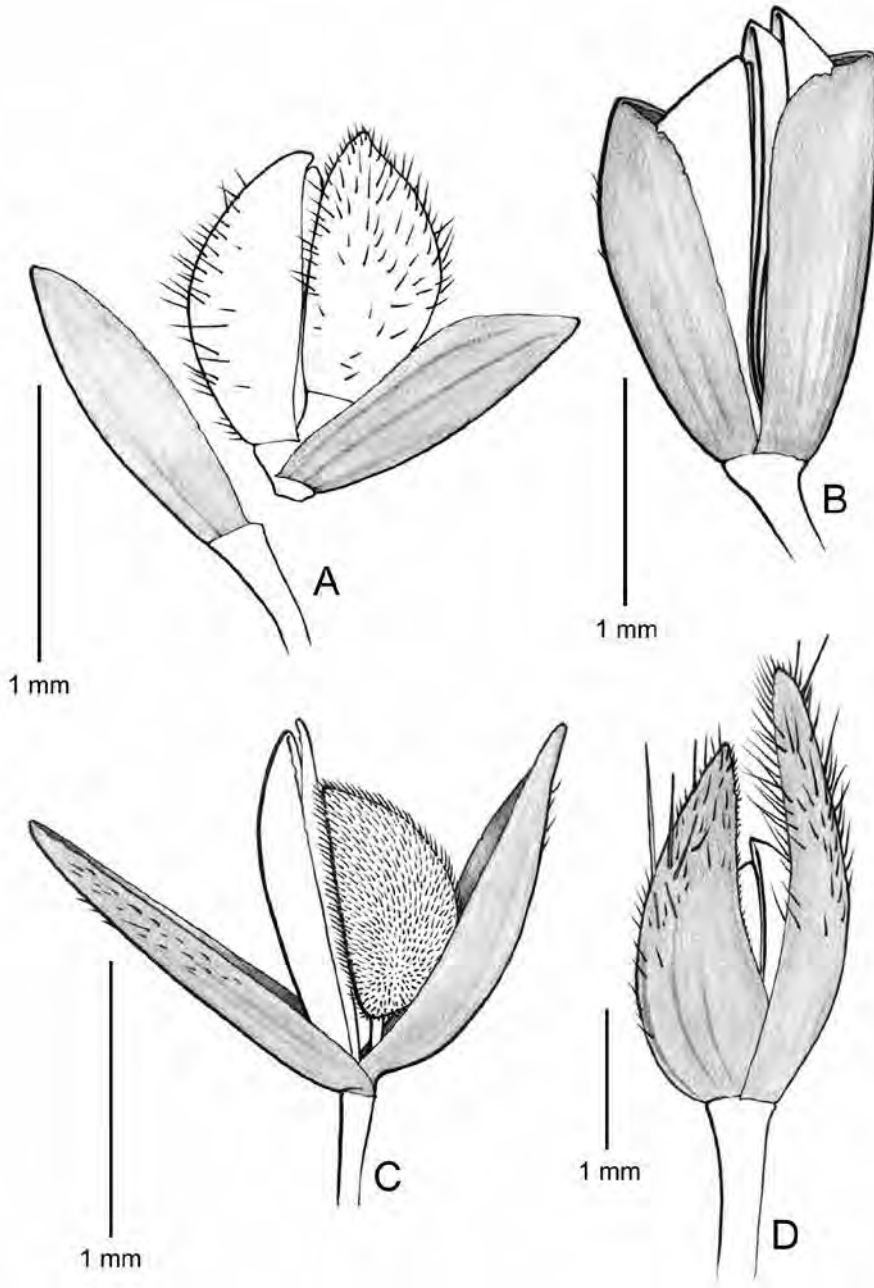


Figure 39. *Isachne confusa* Ohwi. **A.** Spikelet, lateral view. *Isachne globosa* (Thunb.) Kuntze. **B.** Spikelet, lateral view. *Isachne minutula* (Gaudich.) Kunth. **C.** Spikelet, lateral view. *Isachne schmidtii* Hack. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

Distribution. Nicobar Islands, southern Myanmar, Peninsular Thailand, Cambodia, Vietnam, southern China and through Malesia to the Caroline Islands and northern Australia. In Singapore it has been collected on Bukit Timah (*Ridley 12200*, 1905, SING [SING0041463]) and in the Western Catchment (*Leong WC 117*, 1 May 2004, SING [SING0057370]).

Ecology. In humid, shaded places.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore there is only one relatively recent collection and as it is not a particularly weedy species it could be represented in Singapore by fewer than 50 plants justifying a national assessment of Critically Endangered (CR/D).

2. *Isachne globosa* (Thunb.) Kuntze

(Latin, *globosus* = spherical; presumably referring to the spikelets)

Revis. Gen. Pl. 2 (1891) 778; Henderson, Malay. Wild Fls., Monocot. (1954) 327, fig. 187h–j; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1273; Gilliland, Rev. Fl. Malaya 3 (1971) 123, fig. 22, pl. 16c; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 170, fig. 275; Iskandar & Veldkamp, Reinwardtia 12 (2004) 165; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 80, fig. 76; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 271. **Basionym:** *Milium globosum* Thunb. in Murray, Syst. Veg., ed. 14 (May–Jun 1784) 109; Thunberg, Fl. Jap. (Aug 1784) 49. **Synonym:** *Agrostis globosa* (Thunb.) Poir. in Lamarck, Encycl., Suppl. 1, fasc. 1 (1810) 257. **Type:** *Thunberg s.n.*, Japan (lectotype, UPS-THUNB [V-002041], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 22). **Fig. 39B.**

Isachne australis auct. non R.Br.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 129; Ridley, Fl. Malay Penins. 5 (1925) 239.

Perennial or annual. **Culms** erect and geniculate, rooting at decumbent nodes, 0.15–0.75 m long; nodes glabrous, without annular glands below the nodes, internodes 1.4–13 cm long. **Sheaths** 1–6.5 cm long, glabrous to distally pubescent, margin glabrous to pubescent with bulbous hairs. **Ligule** hairs 1.25–4 mm long. **Leaf** blades linear, 1.5–9.5 cm by 2.5–6 mm, base abruptly narrowed and pectinate, scaberulous, glabrous to pubescent with bulbous hairs, underneath (5–)9-nerved; margins white cartilaginous or not, not undulate, scaberulous, pectinate or not. **Panicle** loosely contracted, 2.5–14 × 1–7 cm; branches 5–17, glandular or not, smooth to scaberulous; lowermost branch 1.3–6.2 cm long, naked in the lowermost 0.1–0.3 of its length, with 2–5 branches and 6–25 spikelets; pedicels smooth to scaberulous, pedicels of the lower spikelet eglandular, shorter than the spikelet (rarely longer), pedicels of the upper spikelet glandular or not, longer than the spikelet (rarely shorter). **Spikelets** not secund, paired to distally solitary, not yawning, globose to ellipsoid, 1.75–2.7 × 1–1.85 mm. **Rachilla** between glumes not distinctly developed, between anthoecia obdeltooid. **Glumes** elliptic to obovate, membranous, glabrous or sparsely hairy, smooth to scaberulous, apex obtuse; lower glume 1.6–2.7 × 0.85–1.4 mm, 7-nerved; upper glume 1.6–2.7 × 0.9–1.5 mm, 7(–9)-nerved. **Anthoecia** differing in texture and (usually) in size, the lower one herbaceous to membranous, usually longer than the chartaceous upper one; lower floret flattened ellipsoid,

male. First **lemma** oblong, at anthesis longitudinally grooved or not, 1.75–2.55 × 0.8–1.25 mm, at anthesis membranous to chartaceous, 5-nerved, glabrous, apex obtuse. First **palea** oblong, 1.65–2.3 × 0.7–1.15 mm, membranous to chartaceous, 0-nerved, glabrous, apex obtuse. **Anthers** 3, 0.8–1.8 mm long. **Upper floret** plano-convex, female, rarely bisexual. Second lemma elliptic, 1.25–1.85 × 0.75–1.3 mm, 0.5–1.05 times as long as the first lemma, at anthesis chartaceous, inconspicuously 5-nerved, glabrous to puberulous, apex obtuse. Second palea elliptic, 1.2–1.55 × 0.7–1.2 mm, chartaceous, 0-nerved, glabrous to puberulous, apex obtuse. **Anthers** 3, 0.5–1 mm long.

Distribution. Oman, India and Sri Lanka to Japan, China and Taiwan, through continental Southeast Asia and Malesia to the Pacific islands. Native in Singapore and widely but infrequently collected, including from Changi (*Ridley* 75, 6 Apr 1889, SING [SING0041464]), MacRitchie (*Maxwell* 77-28, 18 Jan 1977, SINU), Nee Soon (*Kassim* 85, 12 Oct 1955, SINU), Pierce (*Duistermaat et al.* 158, 26 Aug 2003, K, L, SING [SING0059788]) and Tanglin (*Ridley* 64, 22 Jan 1889, SING [SING0041461]).

Ecology. Marshy places, watersides and river banks in sun.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore likely also to be Least Concern (LC) even though it has not been commonly collected.

Vernacular names. *Rounded isachne* (English), *rumpit minyak* (Malay).

3. *Isachne minutula* (Gaudich.) Kunth

(Latin, *minutus* = smallish; presumably referring to the spikelets)

Révis. Gramin. 2 (1831) 407, t. 117; Iskandar & Veldkamp, Reinwardtia 12 (2004) 167; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 82, fig. 78; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 228. **Basionym:** *Panicum minutulum* Gaudich., Voy. Uranie, fasc. 10 (1829) 410. **Synonyms:** *Isachne miliacea* Roth var. *minutula* (Gaudich.) Fosberg & Sachet, Micronesica 18 (1984) 55. **Type:** *Gaudichaud-Beaupré s.n.*, Mariana Islands (lectotype P [P01934348], first step designated by Fosberg & Sachet, Micronesica 18 (1984) 55, second step designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 27; possible isoelectotypes B, P [P01934347]). **Fig. 39C.**

Isachne miliacea auct. non Roth: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 130; Ridley, Fl. Malay Penins. 5 (1925) 239; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1273.

Perennial. **Culms** loosely tufted or erect or geniculate, rooting at decumbent nodes, 0.05–0.45 m long; nodes pubescent (rarely glabrous in Singapore), without annular glands below the nodes, internodes 0.6–6.5 cm long. **Sheaths** 0.4–2.2 cm long, glabrous to pubescent with bulbous hairs, margin pubescent. **Ligule** hairs 0.7–1.6 mm long. **Leaf** blades ovate-lanceolate to linear, 0.9–3.5 cm by 2–6 mm, base narrowed and pectinate, underneath (3 or)5(or 7)-nerved; margins not white, not undulate, scaberulous, not pectinate. **Panicle** loosely contracted, 2–4.5 × 1–3 cm; branches 3–12, glandular or not, smooth to scaberulous; lowermost branch 0.6–2 cm long,

naked in the lowermost 0.05–0.17 of its length, with 2–5 branches and 6–17 spikelets; pedicels of lower spikelet glandular or not, shorter to longer than the spikelet, smooth to scaberulous, pedicels of upper spikelet glandular, longer than the spikelet, smooth to scaberulous. **Spikelets** not secund, paired, not yawning, obovoid, 1.3–2 × 0.8–2 mm. **Rachilla** between glumes not distinctly developed, between anthoecia obdeltoid. **Glumes** 1.2–1.9 mm long, membranous, glabrous, distally scaberulous, apex obtuse; lower glume elliptic, 0.7–0.9 mm wide, 7-nerved; upper glume obovate to elliptic (rarely), 0.75–1.3 mm wide, 7(–9)-nerved. **Anthoecia** differing in texture and (usually) in size, the lower one herbaceous to membranous, usually longer than the chartaceous upper one; lower floret flattened ellipsoid, male. First **lemma** oblong, at anthesis longitudinally grooved, 1.2–2 × 0.8–0.85 mm, at anthesis membranous, 5-nerved, glabrous, apex obtuse. First **palea** oblong, 1.2–1.85 × 0.5–0.75 mm, membranous, 0-nerved, glabrous, apex obtuse. **Anthers** 3, 0.45–1.05 mm long. **Upper floret** plano-convex, female. Second lemma elliptic, 0.8–1.4 × 0.65–1.05 mm wide, 0.45–1.1 times as long as the first lemma, at anthesis chartaceous, inconspicuously 5-nerved, puberulous, apex obtuse. Second palea elliptic, 0.75–1.3 × 0.6–0.95 mm, chartaceous, 0-nerved, puberulous, apex obtuse.

Distribution. India and Sri Lanka to Vietnam and through Malesia to northern Australia and western Pacific. Native in Singapore and collected on Bukit Timah Road (*Ridley 5768*, 25 Aug 1892, SING [0017772]), Chua Chu Kang (*Ridley 8037*, Feb 1896, SING [SING0017770]), Galang (*Ridley 9168*, 1898, SING [SING0017774]), Seletar (*Ridley 6952*, Apr 1894, SING [SING0017763]) and Tanglin (*Ridley 5771*, 1893, SING [SING0017771]).

Ecology. Damp to wet places, usually in forest.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

4. *Isachne schmidtii* Hack.

(Ernst Johannes Schmidt, 1877–1933, Danish plant collector)

Bot. Tidsskr. 24 (1901) 97. **Type:** *Schmidt s.n.*, Siam [Thailand], Koh Chang Island, 1889–1900 (lectotype W [1916-0021689], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 17; isolectotype US (fragment)). **Fig. 39D, 40.**

Isachne semitalis Ridl., Fl. Malay Penins. 5 (1925) 237. **Type:** *Ridley 6110*, Singapore, Tanglin, March 1894 (lectotype SING [SING0017766], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 17; isolectotype K [K000290172]).

Isachne kunthiana auct. non (Wight & Arn. ex Steud.) Miq.: Hooker, Fl. Brit. India 7, fasc. 21 (1896) 21; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 128; Gilliland, Rev. Fl. Malaya 3 (1971) 122, colour pl. 3; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 171; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 82, fig. 77; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 228.

Perennial, mat-forming. **Culms** geniculate, rooting at decumbent nodes, 0.06–0.3 m long, without annular glands below the glabrous or puberulous nodes. **Sheaths** 1.2–2 cm long,

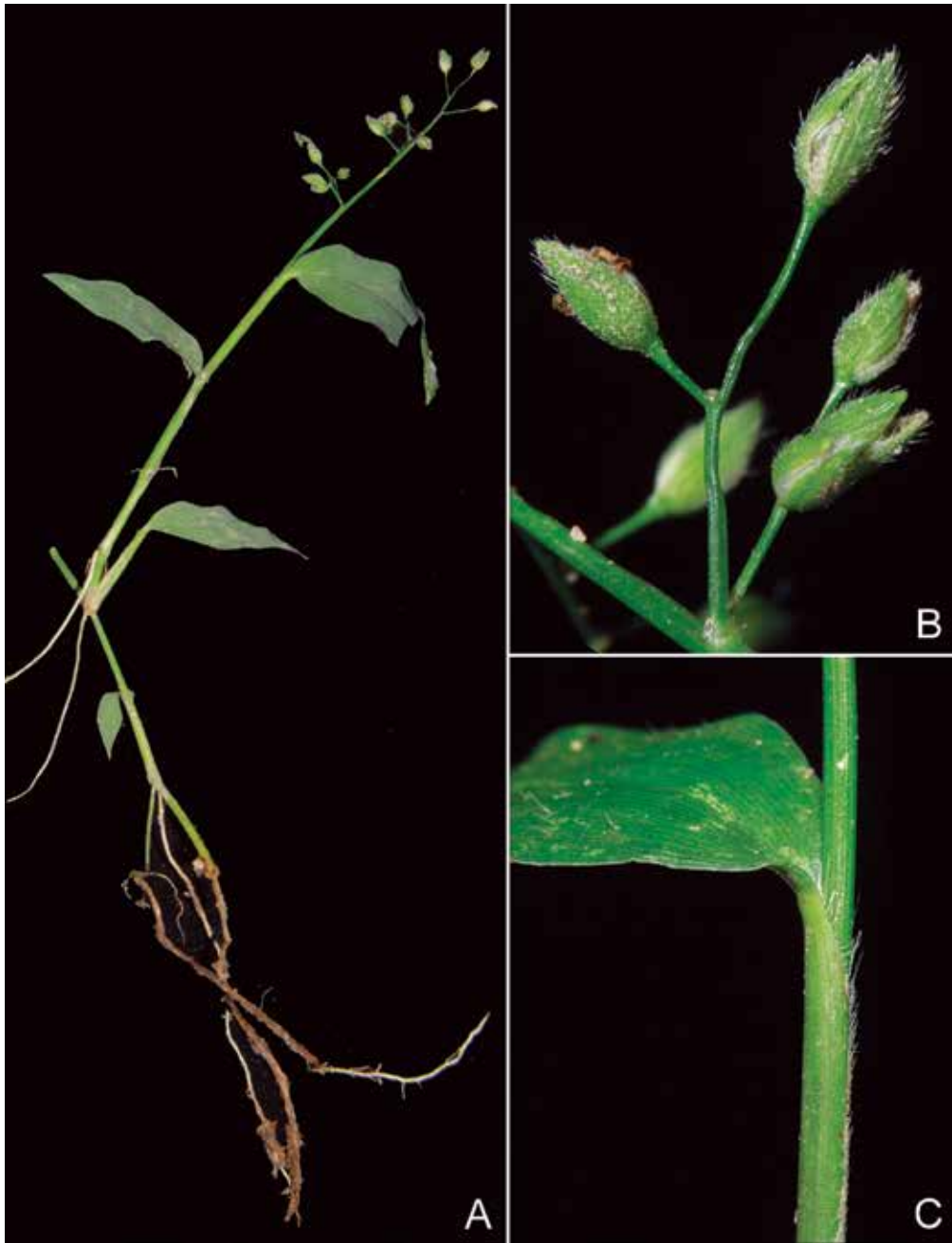


Figure 40. *Isachne schmidtii* Hack. **A.** Habit. **B.** Inflorescence detail with spikelets. **C.** Detail of leaf sheath and blade. (From Singapore, Nee Soon, *Ho et al. SING2017-690*. Photos: L.M.J. Chen).

hairy along the margins. **Ligule** hairs 1–1.6 mm long. **Leaf** blades ovate-oblong, 2–7 cm by 6–12 mm, base cuneate to nearly pseudo-petiolate, scaberulous erecto-patent, glabrous, with 5–9 main nerves, margins white cartilaginous, not undulate, scaberulous erecto-patent. **Panicle** contracted to lax, 1–5 × 0.3–0.8 cm, branches appressed to erecto-patent, 0–6, angular, eglandular, smooth to scaberulous erecto-patent, lowermost branch 0.6–2 cm long, with 0 or 1 branch, with 2–7 spikelets; pedicels eglandular (very rarely glandular), shorter to longer than the spikelet, smooth to scaberulous. **Spikelets** ellipsoid, yawning at maturity or not, 2–3(–3.5) × 1.5–3 mm. **Glumes** distinctly longer than the lemmas, oblong, apex acuminate, puberulous and distally setose, smooth erecto-patent; lower glume 1.8–3 × 1–1.3 mm, 7- or 9-nerved; upper glume 1.9–3 × c. 1 mm, 5–11-nerved. **Rachilla** between glumes erecto-patent, between anthoecia terete. **Anthoecia** not differing in texture, subequal to equal, plano-convex; lower floret bisexual. First **lemma** not longitudinally depressed, 1.5–1.8 mm long, chartaceous, obscurely nerved, puberulous near the margin. Upper **floret** bisexual or female. Second lemma 1.4–1.6 mm long, 0.9–1 times as long as the first lemma, chartaceous, puberulous along the margin erecto-patent. **Anthers** 0.9–1 mm long.

Distribution. India to Vietnam and through Malesia to Australia, New Zealand and Pacific islands. Native in Singapore and widely collected, including from Bukit Mandai (*Ridley* 5770, 1892, SING [SING0017761]), MacRitchie (*Duistermaat et al.* 194, 27 Sep 2003, SING [SING0059790]), Pierce (*Duistermaat et al.* 165, 26 Aug 2003, K, L, SING [SING0059789]) and Nee Soon (*Ho et al.* SING2017-690, 28 Nov 2017, SING [SING0233528]).

Ecology. Damp shaded places in forest.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

31. ISCHAEMUM L.

(Greek, *ischaemos* = to stop bleeding; referring to the supposed medicinal properties of some species)

Sp. Pl. 2 (1753) 1049; Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 200; Sur, J. Econ. Taxon. Bot. 25 (2001) 407; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 302. **Synonyms:** *Schoenanthus* Mesuë [‘Mefues’] ex Adans., Fam. Pl. 2 (1763) 9, as ‘*Schoinantos*’, 38, 567, as ‘*Schoinantos*’, 602, as ‘*Schoenantus*’, nom. illeg. superfl. **Synonyms:** *Ischaemum* L. sect. *Distachya* Brongn. in Duperrey, Voy. Monde, Phan., fasc. 8 (1831) 68, nom. illeg. superfl. – *Ischaemum* L. subg. *Eu-ischaemum* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 201, nom. inval. – *Ischaemum* L. sect. *Eu-ischaemum* Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 126, nom. inval. – *Ischaemum* L. sect. *Autischaemum* Pilg. in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 14e (1940) 126, nom. inval. – *Ischaemum* L. ser. *Mutica* Ohwi, Acta Phytotax. Geobot. 11 (1942) 171, nom. inval. **Type:** *Ischaemum muticum* L., lectotype designated by Nash in Britton, N. Amer. Fl. 17 (1909) 94.

Annuals or perennials. **Ligule** membranous. **Leaf** blades inrolled when young, auriculate, fused with the ligule. **Racemes** digitate, usually paired and closely appressed, rarely 3 or

4, one sessile, the other(s) shortly pedunculate, joints inflated, disarticulating, edges usually hairy. **Pore** (space between joint and pedicel, seen from the adaxial side) very narrow and linear to tear-, U-, or pawn-shaped. **Spikelets** secund, paired, dorsoventrally compressed, heteromorphous, 2-flowered. **Sessile spikelet** dorso-ventrally flattened, callus collapsing on drying. Lower **glume** indurate, smooth to variously sculptured, 2-keeled, apex acute to winged, usually more or less bifid; upper glume boat-shaped, more or less keeled. Lower **lemma** paleate, male. Upper **lemma** bifid, usually awned from the sinus. **Stamens** 3. **Pedicelled spikelet** similar to the sessile or more or less reduced, male to neuter, awned or not.

Distribution. A genus of approximately 68 (sub)tropical species, mainly in the Old World, especially in India, of which 6 species native in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Ischaeminae* J.Presl.

Key to *Ischaemum* species

1. Lower glume of sessile spikelet apex entire; upper glume unawned 2
 Lower glume of sessile spikelet apex bifid; upper glume with a 0.5–2 mm long awn 5
2. Lower glume of sessile spikelet transversely rugose or nodular at the margins; pedicel and joint of rachis inflated compared to rachis below 3
 Lower glume of sessile spikelet not transversely rugose or nodular; pedicel and joint of rachis subequal to rachis below **4. I. muticum**
3. Perennial; lower glume with up to 4 transverse rugosities or marginal nodules 4
 Annual; lower glume with about 6 transverse rugosities **5. I. rugosum**
4. Leaf blades at base attenuate or slightly rounded, not deeply cordate **1. I. barbatum**
 Leaf blades at base deeply cordate **3. I. feildingianum**
5. Sessile spikelet subsessile, pore U-shaped; lower glume obovate, apically clearly winged, wings 0.4–1.0 mm wide. – Generally rather coarse, long-leaved, racemes long
 **2. I. ciliare**
 Pedicel of sessile spikelet often curved, pore pawn-shaped; lower glume ovate-lanceolate, apically narrowed, rarely somewhat winged, wings 0–0.4 mm wide. – Generally rather weak, short-leaved, racemes short **6. I. timorense**

1. *Ischaemum barbatum* Retz.

(Latin, *barbatus* = bearded; referring to the hairy bases of the spikelets)

Observ. Bot. 6 (1791) 35; Bor, Kew Bull. 15 (1962) 411; Gilliland, Rev. Fl. Malaya 3 (1971) 260, pl. 31c; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 171; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 271. **Synonyms:** *Meoschium barbatum*

(Retz.) P.Beauv. [Ess. Agrostogr. (1812) 111, nom. inval.] ex Roem. & Schult., Syst. Veg., ed. 15 bis, 2 (1817) 789. – *Andropogon barbigerus* Steud., Nomencl. Bot. 1 (1821) 440, nom. nov., non *Andropogon barbatus* L. (1759); Steudel, Syn. Pl. Glumac. 1, fasc. 4–5 (1854) 376. – *Ischaemum aristatum* L. subsp. *barbatum* (Retz.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 204. – *Ischaemum aristatum* L. subvar. (Retz.) *barbatum* (Retz.) Roberty, Boissiera 9 (1960) 332. **Type:** *Collector unknown s.n.* (Wennerberg?), Java (holotype LD [1229226]). **Fig. 41A, 42A.**

Ischaemum aristatum L. var. *imbricatum* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 203. **Synonyms:** *Meoschium imbricatum* Munro ex Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 127, nom. inval. – *Ischaemum imbricatum* (Hack.) Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 200. – *Ischaemum barbatum* Retz. var. *imbricatum* (Hack.) Jansen, Reinwardtia 2 (1953) 294. **Type:** *Hooker & Thomson s.n.*, India, Khasia, Churra, June 1850 (lectotype K [K000245675], designated by Traiperm et al., Kew Bull. 67 (2012) 78; isoelectotypes L, W).

Ischaemum magnum Rendle, J. Bot. 32 (1894) 102; Hooker, Fl. Brit. India 7, fasc. 21 (1896) 128; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 158; Ridley, Fl. Malay Penins. 5 (1925) 200; Gilliland, Rev. Fl. Malaya 3 (1971) 261, pl. 31f; Turner, Gard. Bull. Singapore 45 (1993) 98; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 84, fig. 81, pl. 14; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 228. **Synonym:** *Ischaemum aristatum* L. subvar. *magnum* (Rendle) Roberty, Boissiera 9 (1960) 334. **Type:** *Feilding s.n.*, Singapore, Blakan Mati [Pulau Sentosa], October 1892 (lectotype BM [BM000959779], designated by Traiperm et al., Kew Bull. 67 (2012) 78; isoelectotypes E, G, K).

Ischaemum laeve Ridl., J. Straits Branch Roy. Asiat. Soc. 44 (1905) 207; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 158; Ridley, Fl. Malay Penins. 5 (1925) 201. **Synonym:** *Ischaemum aristatum* L. f. *laeve* (Ridl.) Roberty, Boissiera 9 (1960) 334. **Type:** *Ridley 9143*, Singapore, Galang (lectotype SING [SING0054936], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 18; isoelectotypes G, K [K000290075]).

Perennial. **Culms** single to tufted, erect or geniculate at base, 0.55–1.65(–2) m tall. **Stolons** absent; nodes glabrous to bearded. **Sheaths** glabrous to pilose, auricled or not, auricles 0–10 mm long. **Ligules** collar-shaped or trapezoid, 1–10 mm high, outside glabrous to pilose. **Leaf** blades linear, 8–35 cm by 6.5–10(–25) mm, greenish, pseudopetiole absent or when present up to 70 mm long, base gradually narrowed to obtuse, rarely cordate, both sides glabrous to densely pilose, underneath 9–17-nerved. **Inflorescence** clearly exserted from the supporting sheath; racemes 2, rarely 3, closely appressed to slightly divergent, 4–18 cm long. **Joints** triangular in cross section, 3.5–6 mm long, 0.65–0.77 times as long as the sessile spikelet, outer edges glabrous, ciliate, or setose, hairs 1–3 mm long, inner edges glabrous to pilose. **Pore** between joint and pedicel tear-shaped. **Sessile spikelets** subsessile, articulation pilose, hairs 1–2 mm long. Lower **glume** (4–)5–8 × 1.5–2 mm, smooth, keels not winged, minutely scaberulous, apex not wrinkled, not auricled, acumen minutely truncate, acuminate, retuse, or bidentate (teeth to 0.3 mm long), dorsally convex, with 2 or 3(–6) nodules near the margins sometimes connected into transverse ridges, glabrous to densely long-pilose all over, with 7 inconspicuous intercarinal nerves, distally anastomosing or not; upper glume 3-nerved, distally not anastomosing, apex acuminate to mucronate, mucro or awn to 1 mm long, glabrous, keel smooth, not winged. Lower **floret** male, female, or bisexual. **Awns** exserted, 10–17 mm long, column twisted, 5–8 mm long. **Anthers** 2–3.5 mm long. **Pedicels** of pedicelled spikelets 0.4–2 mm long, 0.05–0.25 times as long as the sessile spikelet, 0.08–0.3 times as long as the joint, edge pilose. **Pedicelled spikelets** 1- or 2-flowered, neuter or upper floret male or bisexual, 6–8

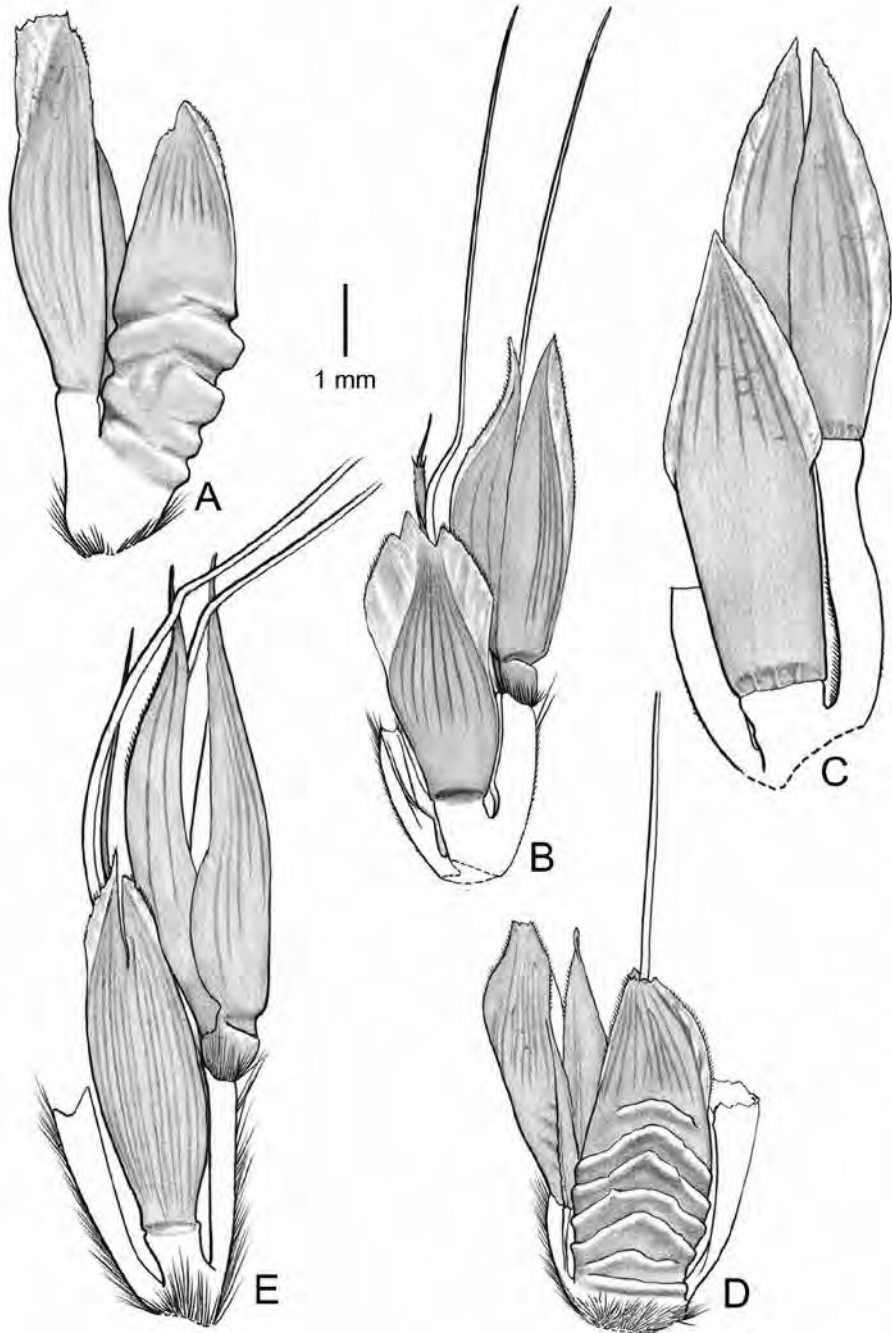


Figure 41. *Ischaemum barbatum* Retz. **A.** Pair of spikelets. *Ischaemum ciliare* Retz. **B.** Pair of spikelets. *Ischaemum muticum* L. **C.** Pair of spikelets. *Ischaemum rugosum* Salisb. **D.** Pair of spikelets. *Ischaemum timorense* Kunth. **E.** Pair of spikelets. (Drawn by J.J. Vermeulen).

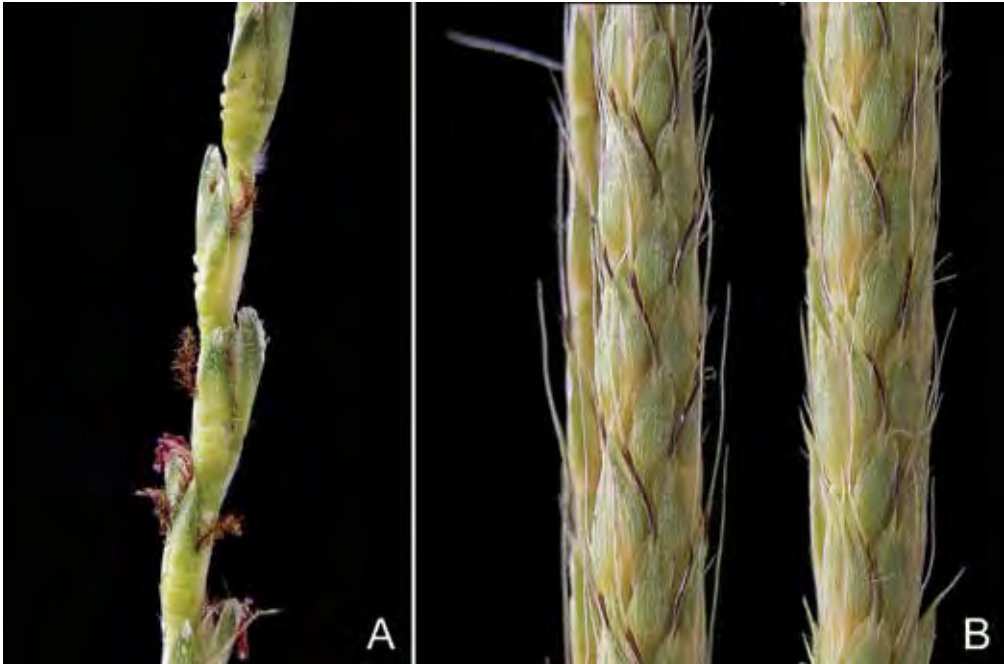


Figure 42. *Ischaemum barbatum* Retz. **A.** Detail of a raceme. *Ischaemum ciliare* Retz. **B.** Detail of two racemes. (From Singapore, A exact locality uncertain; B from Gallop Road, *Duistermaat 215*. Photos: H. Duistermaat).

mm long. Lower **glume** not winged or winged on one side, acute, rarely with nodules, keels minutely scaberulous. Upper **lemma** acute.

Distribution. Sri Lanka and India to China and through continental Southeast Asia and Malesia to northern Australia, Fiji and the Marianas. Native in Singapore and widely collected, including from Freshwater Isle [Pulau Bukom] (*Ridley 452*, Jan 1889, SING [SING0041305], W), Kent Ridge Park (*Chua 601*, 4 Oct 1991, SINU), Labrador (*Maxwell 76-816*, 22 Dec 1976, L, SINU), MacRitchie (*Duistermaat et al. 189*, 27 Sep 2003, SING [SING0059803]) and Sungei Buloh (*Chua et al. SB 3019*, 13 Oct 1993, SINU).

Ecology. Open, sandy grassland and beaches.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Notes. The plants are very variable and various infraspecific taxa have been recognised. These are mainly based on the pubescence of the parts and the sculpture of the lower glume of the sessile spikelets. We do not recognise these infraspecific taxa.

This species was previously recognised in Singapore as *Ischaemum magnum* but the plants identified thus are just fairly robust specimens of *I. barbatum* with underdeveloped awns in the sessile spikelet.

2. *Ischaemum ciliare* Retz.

(Latin, *ciliaris* = ciliate; referring to the ciliate pedicels)

Observ. Bot. 6 (1791) 36; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 160; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 171; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 83, fig. 80, pl. 13; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 271. **Synonyms:** *Meoschium ciliare* (Retz.) P.Beauv., Ess. Agrostogr. (1812) 111, 167. – *Spodiopogon obliquivalvis* Nees, Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19, Suppl. 1, prepr. (1841) 53, nom. illeg. superfl. – *Andropogon retzii* Steud., Syn. Pl. Glumac. 1, fasc. 4–5 (1854) 375, nom. nov., non *Andropogon ciliaris* (P.Beauv.) Rasp. (1825). – *Ischaemum ciliare* Retz. var. *genuinum* & subvar. *prorepens* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 226, nom. inval. – *Ischaemum aristatum* L. subvar. *ciliare* (Retz.) Roberty, Boissiera 9 (1960) 333. **Type:** *Collector unknown s.n.* (Osbeck?) (holotype LD [LD1229166]). **Fig. 41B, 42B.**

Andropogon malacophyllum Hochst. ex Steud., Syn. Pl. Glumac. 1, fasc. 4–5 (1854) 372. **Synonyms:** *Ischaemum ciliare* Retz. subvar. *malacophyllum* (Hochst. ex Steud.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 226. – *Ischaemum ciliare* Retz. var. *malacophyllum* (Hochst. ex Steud.) Hack. ex Ridl., Mat. Fl. Malay. Penins. 3 (1907) 160. – *Ischaemum aristatum* L. var. *malacophyllum* (Hochst. ex Steud.) Hack. ex Ridl., Fl. Malay Penins. 5 (1925) 203. – *Ischaemum indicum* (Houtt.) Merr. subvar. *malacophyllum* (Hochst. ex Steud.) Bor, Grasses Burma, Ceylon, India & Pakistan (1960) 180. – *Ischaemum indicum* (Houtt.) Merr. var. *malacophyllum* (Hochst. ex Steud.) Sur, J. Econ. Taxon. Bot. 25 (2001) 420. **Type:** *Hohenacker 917*, India, Montibus Nilagiri, 1851 (lectotype P [P02640887]), designated by Turner et al., Gard. Bull. Singapore 71 (2019) 6; isoelectotypes CAL, CORD, FI, HAL, JE [$\times 2$], K [$\times 2$], L, LECB, MPU [$\times 2$], S, TUB, W [$\times 3$]).

Ischaemum apricum Ridl., Fl. Malay Penins. 5 (1925) 203; Gilliland, Rev. Fl. Malaya 3 (1971) 262. **Synonym:** *Ischaemum aristatum* L. f. *apricum* (Ridl.) Roberty, Boissiera 9 (1960) 332, 341. **Type:** *Burkill SFN 4629*, [Malaysia], Malay Peninsula, Penang, Waterfall Gardens, 16 December 1918 (lectotype K [K000290093], first step designated by Roberty, Boissiera 9 (1960) 332, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 17; isoelectotypes G?, SING [SING0219195], US).

Ischaemum aristatum auct. non L.: Ridley, Fl. Malay Penins. 5 (1925) 203; Henderson, Malay. Wild Fls., Monocot. (1954) 351.

Ischaemum indicum auct. non (Houtt.) Merr.: Gilliland, Rev. Fl. Malaya 3 (1971) 263, pl. 32f, colour pl. 20.

Perennial. **Culms** tufted to mat-forming, erect or geniculate at base or trailing and prostrate and rooting at the decumbent nodes, 0.15–1.1(–1.3) m tall. **Rhizome** absent. **Stolons** sometimes present. **Nodes** usually bearded. **Sheaths** glabrous to pilose, sometimes auricled, auricles 0–1 mm long. **Ligules** collar-shaped, 0.8–2 mm high, outside glabrous or ciliate. **Leaf** blades broadly lanceolate to linear, 1.5–20(–60) cm by 2–10(–22) mm, pseudopetiole

absent, base gradually narrowed to broadly rounded, both sides glabrous to pilose, underneath 7- or 9-nerved. **Inflorescence** clearly exerted from the supporting sheath; racemes 2 (rarely 1 or 3), closely appressed to slightly divergent, 1.5–7.5(–12) cm long. **Joints** triangular in cross section, 1.8–3 mm long, 0.55–0.83 times as long as the sessile spikelet, outer edges setose, hairs 1–1.5 mm long, inner edges puberulous. **Pore** between joint and pedicel elongated with more or less parallel margins (U-shaped). **Sessile spikelets** subsessile, articulation pilose, hairs 0.5–1.5 mm long, pedicel 0.5–1 mm long. Lower **glume** 3–6.5 × 1.2–2 mm, smooth, in upper part broadly winged, minutely scaberulous and ciliolate, apex not wrinkled, auricles broadly extended beyond the acumen, margins scaberulous, acumen ± obtuse, erose, or bidentate (teeth to 0.3 mm long), dorsally more or less flat, without nodules, glabrous (but for the articulation) to densely long-pilose in the lower half, nervature hardly visible in dry specimens, intercarinal nerves 3–7(–15), distally not anastomosing; upper glume 3- or 5-nerved, nerves distally not anastomosing, apex mucronate to aristate, mucro 0.3–3 mm long, glabrous, keel minutely scaberulous, not winged. Lower **floret** male. Upper **lemma** awn exerted, 7–14 mm long, column twisted, 3–5 mm long. **Anthers** 1.5–2.5 mm long, yellow. **Pedicels** of pedicelled spikelets 1.5–2.8 mm long, 0.5–0.6 times as long as the sessile spikelet, as long as the joint, edge setose. **Pedicelled spikelets** 3–5 mm long, 2-flowered, lower floret neuter or male. Lower **glume** winged on one side, mucronate, mucro 0–0.7 mm long, without nodules or ridges, keels ciliolate. Upper **lemma** apex mucronate to awned, awn with or without a column, mucro, arista, or awn 0–15 mm long.

Distribution. Mauritius, Seychelles, Sri Lanka and India to southern China and through continental Southeast Asia and Malesia. Introduced in West Africa, southern Europe, Australia, Pacific islands, South and Central America. Native in Singapore and very widely distributed including Gallop Road (*Duistermaat* 215, 14 Oct 2003, L, SING [SING0059799]), Kranji (*Ridley* 449, 8 Jan 1890, SING [SING0041290]), Labrador (*Burkill* 41, 22 Feb 1955, SING [SING0041328]), MacRitchie (*Maxwell* 76-767, 9 Dec 1976, L, SINU) and Pulau Ubin (*Ali Ibrahim & Veldkamp* SING2017-081, Mar 2017, L, SING [SING0231213]).

Ecology. Open grasslands, road sides, ditch banks, pond margins, lawns.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Smut grass* (English).

Notes. Spikelets are often infected by the ergot *Sporisorium tonglinense* (Tracy & Earle) Rifai and then the inflorescence hardly emerges from the leaf sheath.

3. *Ischaemum feildingianum* Rendle

(John Basil Feilding, 1868–1942, British plant collector in Johor and Singapore)

J. Bot. 32 (1894) 101; Gilliland, Rev. Fl. Malaya 3 (1971) 257, pl. 32c, as '*feildingianum*'. **Synonym:** *Ischaemum aristatum* L. subvar. *feildingianum* (Rendle) Roberty, Boissiera 9 (1960) 333, as

'*fieldingianum*'. **Type:** *Feilding s.n.*, [Malaysia, Johor], Gunong Ledang (Mt Ophir), growing on rock of Padang Batu, November 1892 (lectotype BM [BM000959777], first step designated by Roberty, Boissiera 9 (1960) 333, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 18; isolectotypes E, G, K, SING [labelled 4114 – SING0054809]).

Ischaemum commelynifolium Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 202. **Synonym:** *Ischaemum aristatum* L. subvar. *commelynifolium* (Stapf ex Ridl.) Roberty, Boissiera 9 (1960) 333. **Type:** *Ridley 5152*, [Malaysia], Kedah, Kedah Peak, June 1893 (lectotype K [K000290149], first step designated by Roberty, Boissiera 9 (1960) 333, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 18; isolectotypes G, SING [SING0054810]).

Ischaemum maculatum Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 202. **Synonym:** *Ischaemum aristatum* L. subvar. *maculatum* (Stapf ex Ridl.) Roberty, Boissiera 9 (1960) 334. **Type:** *Ridley 9170*, [Malaysia], Malay Peninsula, Johor, road to Castlewood, 1898 (lectotype K [K000290178], first step designated by Roberty, Boissiera 9 (1960) 334, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 19; isolectotypes G, SING [SING0219223]).

Perennial. **Culms** tufted to mat-forming, erect to geniculate at base and rooting at the decumbent nodes, 0.5–1(–2) m tall. **Rhizome** and **stolons** absent. **Nodes** glabrous. **Sheaths** glabrous to pilose, auricled or not, auricles 0–5 mm long. **Ligules** collar-shaped, 1–2.5 mm high, outside glabrous, ciliolate, or sparsely pilose. **Leaf** blades linear, 6–26 cm by 12–20 mm, pseudopetiole 1–2 mm long, base more or less abruptly narrowed to cordate, above glabrous to appressed puberulous, underneath glabrous to pilose, 11–15-nerved. **Inflorescence** clearly exerted from the supporting sheath; racemes 2, closely appressed, 4.5–11 cm long. **Joints** 3–5 mm long, 0.57–0.75 times as long as the sessile spikelet, outer edges pilose, hairs 2–2.8 mm long, inner edges pilose. **Pore** between joint and pedicel tear-shaped. **Sessile spikelets** subsessile, articulation pilose, hairs 2–2.8 mm long. Lower **glume** 5–8.5 × 1.5–2 mm, distinctly indurate in the lower part, keels in upper part narrowly winged, minutely scaberulous, apex not wrinkled or auricled, acumen retuse or bidentate, dorsally upper part convex, with 0–5 nodules near the margins in the lower part, glabrous (but for the articulation) to pilose in the lower half, nervature hardly visible in dry specimens, intercarinal nerves 5–9, distally anastomosing; upper glume 3–6-nerved, nerves distally not anastomosing, apex apiculate to aristate, mucro or arista 0.5–2 mm long, glabrous, keel smooth, not to distinctly winged in the upper half. Lower **floret** male, female, or bisexual. Upper **lemma** awn 6–14 mm long, column twisted, 4–5 mm long. **Anthers** 2.8–4 mm long. **Pedicels** of pedicelled spikelets 1–3 mm long, 0.17–0.2 times as long as the sessile spikelet, 0.3–0.75 times as long as the joint, edge pilose. **Pedicelled spikelet** well-developed, 5–7.4 mm long, 2-flowered, lower floret neuter or male. Lower **glume** not winged, acuminate, without nodules or ridges, keels minutely scaberulous. Upper **lemma** apex acuminate.

Distribution. Western Malesia. Likely to be native in Singapore but only once collected without precise locality (*Teruya* 2144, SING [SING0219217]).

Ecology. In other parts of its distribution found at the edge of forest, scrub, rocky areas, beaches and on quartzite.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Notes. This species is very similar to *Ischaemum barbatum* but differs most obviously in the foliage. In *Ischaemum feildingianum* the blades are usually dark coloured in dry specimens, very broad, and have a broadly truncate to cordate base with a short pseudopetiole, while in *I. barbatum* they are green or straw-coloured in dry specimens, narrower, and the base ranges from pseudopetiolate to truncate, rarely cordate.

4. *Ischaemum muticum* L.

(Latin, *muticus* = blunt, without a point, awnless;
referring to the mostly unawned spikelets)

Sp. Pl. 2 (1753) 1049; Ridley, J. Straits Branch Roy. Asiatic Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 159; Ridley, Fl. Malay Penins. 5 (1925) 201; Henderson, Malay. Wild Fls., Monocot. (1954) 350, fig. 199a,b; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 172, fig. 276; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 84, fig. 82, pl. 15; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 228. **Synonyms:** *Andropogon muticus* (L.) Steud., Syn. Pl. Glumac. 1, fasc. 4–5 (1854) 374. – *Tripsacum muticum* (L.) Rasp., Ann. Sci. Nat. (Paris) 5 (1825) 306. – *Ischaemum aristatum* L. subvar. *muticum* (L.) Roberty, Boissiera 9 (1960) 334. **Type:** *Collector unknown s.n.*, ‘India’ (lectotype LINN [Herb. Linn. no. 1214.1], designated by Renvoize in Jarvis et al., List Linn. Gen. Names Types (1993) 57). **Fig. 41C, 43.**

Ischaemum repens Roxb., [Hort. Bengal. (1814) 82, nom. nud.] Fl. Ind. 1 (1820) 325. **Synonyms:** *Andropogon repens* (Roxb.) Steud., Syn. Pl. Glumac. 1, fasc. 4–5 (1854) 374. – *Ischaemum muticum* L. subvar. *repens* (Roxb.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 213. – *Ischaemum muticum* L. var. *repens* (Roxb.) Hack. ex Ridl., Fl. Malay Penins. 5 (1925) 201. **Type:** [Unpublished illustration] Icones Roxburghianae no. 2108 (lectotype K, designated by Turner et al., Gard. Bull. Singapore 71 (2019) 19).

Perennial. **Culms** mat-forming, erect or trailing and prostrate and rooting at the decumbent nodes, 0.05–1(–2?) m tall. **Rhizome** absent. **Stolons** present. **Nodes** glabrous. **Sheaths** glabrous or pilose along the margins, not auricled. **Ligules** collar-shaped, 0.3–0.5 mm high, outside glabrous or ciliolate. **Leaf** blades oblong to linear-lanceolate, 1–8(–17) cm by 4–11(–20) mm, pseudopetiole 0.5–1.5 mm long, base cordate, glabrous on both sides, underneath 9–11-nerved. **Inflorescence** usually still included in the sheath when mature (rarely well-exserted); racemes 2 (rarely 3), closely appressed, 1.5–4(–6) cm long. **Joints** 3–6 mm long, 0.5–0.8 times as long as the sessile spikelet, outer edges glabrous or ciliate, hairs 0–0.5 mm long, inner edges glabrous. **Pore** between joint and pedicel very narrow, linear. **Sessile spikelets** subsessile, articulation glabrous. Lower **glume** 5.5–7.5(–9) × 1.5–1.8(–3) mm, indurate all over, keels not or only winged in the upper part, keels smooth, apex not wrinkled, not auricled, acumen acutish, dorsally upper part more or less flat, without nodules, glabrous, nervature hardly visible in dry specimens, intercarinal nerves 7–11, distally anastomosing; upper glume nerves hardly visible 3–7, distally anastomosing, apex acute, glabrous, keel smooth, not winged. Lower **floret** female or bisexual. Upper **lemma** usually muticous, rarely aristate, arista hardly exserted, 0–5 mm long, column absent. **Anthers** 2.2–3 mm long. **Pedicels** of pedicelled spikelets 3–5.5 mm long, 0.3–0.85 times as long as the sessile spikelet, 0.5–1 times as long as the joint, edge glabrous or ciliate. **Pedicelled spikelet** usually well-developed, 4–7 mm long, spikelets 0–2-flowered, lower floret neuter to bisexual. Lower **glume** winged or not on



Figure 43. *Ischaemum muticum* L. **A.** Habit. **B.** Inflorescence. **C.** Detail of leaf sheath and blade. (From Singapore, Bishan Park, *SING2017-702*. Photos: L.M.J. Chen).

both sides, acute or acuminate or mucronate, without nodules or ridges, keels glabrous. Upper **lemma** apex acute.

Distribution. Sri Lanka and India to Micronesia and Australia (Queensland). Native in Singapore and very widely collected, including from an unknown locality (*Wallich s.n.* [EIC 8865E], 1822, CAL, E, K), Kent Ridge (*Seah & Chua* 5, 26 Nov 2001, SINU), Pulau Ubin (*Furtado SF 18625*, 31 Jul 1927, SING [SING0041297]), Sungei Buloh (*Chua & Wee* 475, 22 May 1991, SINU) and Bishan-Ang Mo Kio Park (*Chen SING2017-702*, 16 Nov 2017, SING [SING0233529]).

Ecology. Sandy soils, weedy and scrambling over other vegetation.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Seashore centipede grass* (English), *rumput tembaga jantan* (Malay).

5. *Ischaemum rugosum* Salisb.

(Latin, *rugosus* = wrinkled; referring to the sculptured lower glume of the sessile spikelet)

Icon. Stirp. Rar. 1 (1791) 1, t. 1; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 157; Ridley, Fl. Malay Penins. 5 (1925) 200; Henderson, Malay. Wild Fls., Monocot. (1954) 350, fig. 199c,d; Gilliland, Rev. Fl. Malaya 3 (1971) 259, pl. 31a,b, colour pl. 19; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 172; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 86, fig. 83; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 169, 271. **Synonyms:** *Meoschium rugosum* (Salisb.) Arn. & Nees, Gramineae (1841) 68 [preprint of Nov. Actorum Acad. Caes. Leop.-Carol. Nat. Cur. 19, Suppl. 1 (1843) 200. – *Ischaemum rugosum* Salisb. var. *genuinum* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 207, nom. inval. – *Ischaemum aristatum* L. subvar. *rugosum* (Salisb.) Roberty, Boissiera 9 (1960) 335. **Type:** *König s.n.*, locality unknown (lectotype BM [BM000959774], designated by Rendle, J. Bot. 32 (1894) 103). **Fig. 41D.**

Annual. **Culms** solitary to tufted, erect to geniculate at base, 0.45–1.8 m tall; nodes bearded or setose. **Sheaths** glabrous to moderately pilose, hairs with a bulbous base, auricles 0.5–9 mm long. **Ligules** collar-shaped to trapezoid, 0.5–9 mm high, outside glabrous or ciliate. **Leaf** blades linear, (3–)7–17(–30) cm by (2–)4–10 mm, pseudopetiole absent, base gradually narrowed to rounded, both sides above glabrous or appressed sparsely pilose, underneath 5-nerved. **Inflorescence** clearly exserted from the supporting sheath or base still included in the sheath when flowering; racemes 2, closely appressed to divergent, 4–10 cm long. **Joints** 2–3.5 mm long, 0.5–0.87 times as long as the sessile spikelet, outer edges glabrous or ciliate, hairs c. 1 mm long, inner edges glabrous or ciliate. **Pore** between joint and pedicel tear-shaped or very narrow, linear. **Sessile spikelets** subsessile, articulation pilose, hairs 0.5–2 mm long. Lower **glume** 3.5–5.5 × 1.5–2 mm, distinctly indurate in the lower part, keels not winged, ciliate, apex not wrinkled, not auricled, acumen acutish, dorsally distinctly transversally 4–6-ridged in the lower part, glabrous (but for the articulation), upper part very flat, nervature hardly visible

in dry specimens, visible in the upper part, intercarinal nerves 6–16, distally anastomosing. Upper **glume** 3-nerved, nerves distally anastomosing, apex acuminate, glabrous, keel smooth, not winged. Lower **floret** male. Upper **lemma** awned, awn long-exserted, 15–24 mm long, column twisted, 6.5–11 mm long. **Anthers** 0.8–2 mm long. **Pedicels** of pedicelled spikelets 0.5–2.5 mm long, 0.55–0.65 times as long as the sessile spikelet, 0.5–0.9 times as long as the joint, edge glabrous or pilose. **Pedicelled spikelet** well-developed to reduced to 1 glume, 1–4.5 mm long, 0–2-flowered, lower floret neuter. Lower glume winged on one side, acute, without nodules or ridges or with transverse wrinkles, keels ciliolate. Upper lemma apex acute, rarely aristate, arista 0–7.5 mm long.

Distribution. Bhutan, Nepal, Sri Lanka and India to southern China, through continental Southeast Asia and Malesia to the Pacific. Widely introduced elsewhere. Likely formerly native in Singapore but only once collected in ‘Galang’ (*Ridley 9134*, Feb 1898, SING [SING0017776]).

Ecology. Said to have occurred in Singapore on waste ground or in areas where it was not to dry.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Vernacular names. *Wrinkled centipede grass* (English), *rumput ekor cawi* (Malay).

6. *Ischaemum timorense* Kunth

(of Timor)

Révis. Gramin. 1 (1830) 369, t. 98; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 160; Ridley, Fl. Malay Penins. 5 (1925) 203; Henderson, Malay. Wild Fls., Monocot. (1954) 351, fig. 199e,f; Gilliland, Rev. Fl. Malaya 3 (1971) 264, fig. 56b; Turner, Gard. Bull. Singapore 45 (1993) 98; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 172; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 86, fig. 84; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 51, 170, 271. **Synonyms:** *Andropogon timorensis* (Kunth) Steud., Syn. Pl. Glumac. 1, fasc. 4–5 (1854) 376. – *Ischaemum timorense* Kunth var. *genuinum* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 230, nom. inval. – *Ischaemum aristatum* L. f. *timorense* (Kunth) Roberty, Boissiera 9 (1960) 335. **Type:** *Desfontaines s.n.*, Timor (not traced). **Fig. 41E, 44.**

Ischaemum macrurum Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 203. **Synonym:** *Ischaemum aristatum* L. subvar. *macrurum* (Stapf ex Ridl.) Roberty, Boissiera 9 (1960) 334. **Type:** *Hullett s.n.*, Singapore, 27 October 1893 (lectotype K [K000290111], designated by Jansen, Reinwardtia 2 (1953) 298). There were later superfluous lectotype designations with other specimens by Roberty, Boissiera 9 (1960) 334 and Traiperm et al., Kew Bull. 67 (2012) 78.

Perennial. **Culms** tufted or mat-forming, erect or geniculate at base or rooting at the decumbent nodes, 0.15–1.2 m tall. **Rhizome** absent. **Stolons** absent to short. **Nodes** bearded, rarely glabrous. **Sheaths** glabrous to moderately pilose, not or inconspicuously auricled,



Figure 44. *Ischaemum timorense* Kunth. **A.** Habit with detail of inflorescence in inset. **B.** Three flowering plants. **C.** Two racemes. **D.** Detail of leaf sheath and blade. **E.** Detail of stem with node. (From Singapore, MacRitchie, Leong-Škorničková & Leong SING2019-043. Photos: J. Leong-Škorničková).

auricles 0–1 mm long. **Ligules** collar-shaped, 1–4 mm high, outside glabrous to setulose. **Leaf** blades broadly lanceolate to linear, (1–)3.5–26 cm by 1–15 mm, pseudopetiole when present 0–50 mm long, base gradually narrowed to obtuse, both sides glabrous to pilose, underneath (4–)5–7(–9)-nerved. **Inflorescence** clearly exerted from the supporting sheath; racemes 2 (rarely 1 or 3), closely appressed to divergent, 1–6(–13) cm long. **Joints** 2–5 mm long, 0.6–0.85 times as long as the sessile spikelet, outer edges setose, rarely scaberulous, inner edges setose to puberulous, rarely glabrous; hairs 1–2 mm long. **Pore** pawn-shaped. **Sessile spikelets** with a short pedicel, articulation minutely ciliolate to pilose, hairs (0.1–)0.5–1.5 mm long; pedicels 0.7–1.5 mm long. Lower **glume** 3–7 × 1.5–2 mm (incl. callus), indurate in the lower part, keels not winged, minutely scaberulous, apex not wrinkled, not auricled, acumen retuse or bidentate to biaristate, apical teeth 0–1 mm long, dorsally upper part more or less flat, without nodules, glabrous (but for the articulation), sparsely hairy, or sometimes pilose in the upper half, intercarinal nerves 5–9, visible in the upper part, distally not anastomosing; upper glume 3–7-nerved, nerves distally not anastomosing, apex acuminate to aristate, mucro or arista 0–2.5 mm long, glabrous, keel minutely scaberulous, not winged. Lower **floret** male. Upper **lemma** awn long-exserted, (5.5–)10–17 mm long, column twisted, 3.5–5 mm long. **Anthers** 1.4–2.5 mm long. **Pedicels** of pedicelled spikelets often curved, 2–3.5 mm long, 0.6–0.75 times as long as the sessile spikelet, 0.7–1 times as long as the joint, edge setose. **Pedicelled spikelet** well-developed, 3–7 mm long, 2-flowered, lower floret male. Lower **glume** not winged, mucronate, mucro 0.5–3 mm long, without nodules or ridges, keels scaberulous to ciliolate. Upper **lemma** awn with a column, 6–13.5 mm long.

Distribution. Sri Lanka and India to southern China (Guangdong) and Taiwan and through continental Southeast Asia and Malesia to the Pacific (Vanuatu). Native in Singapore and widely collected, including from Bukit Timah (*Ridley 1698*, 1898, SING [SING0041340]), Kent Ridge (*Chua 407*, 4 Mar 1991, SINU), MacRitchie (*Duistermaat et al. 187*, 27 Sep 2003, SING [SING0059600]), Tanglin (*Ridley 83*, Jan 1889, SING [SING0041333]) and Bishan-Ang Mo Kio Park (*Chen SING2017-768*, 12 Dec 2017, SING [SING0254007]).

Ecology. Sunny to lightly shaded, more or less humid grounds and along roads.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Common centipede grass* (English).

Notes. Spikelets may be infected by the ergot *Sporisorium tonglinense* (Tracy & Earle) Rifai.

Ischaemum macrurum is doubtfully included in synonymy here. The pedicel of the sessile spikelet is more or less straight and the tip of its first glume is not slenderly acuminate, but otherwise there appear to be no real differences.

32. LEERSIA Sw.

(Johann Daniel Leers, 1727–1774, German pharmacist,
author of the *Flora herbonensis*)

Prodr. (1788) 21, nom. cons.; Launert, Senckenberg. Biol. 46 (1965) 129; Pyrah, Iowa State Coll. J. Sci. 44 (1969) 215; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 147. **Synonyms:** *Homalocenchrus* Mieg, Acta Helv. Phys.-Math. 4 (1760) 307, nom. rej. – *Ehrhartia* Wiggers, Prim. Fl. Holsat. (1780) 63, nom. illeg. non *Ehrhardia* Scop. (1777). – *Asperella* Lam., Tabl. Encycl. 1, fasc. 1 (1791) 166, non Humb. (1790). – *Asprella* Schreb., Gen. Pl. (1789) 45, nom. illeg. superfl. – *Oryza* L. sect. *Leersia* (Sw.) Döll in Martius, Fl. Bras. 2(2), fasc. 51 (1871) 9, t. 2. – *Laertia* Gromov ex Trautv., Trudy Imp. S.-Peterburgsk. Bot. Sada 9 (1884) 354, nom. illeg. superfl. – *Oryza* L. subg. *Leersia* (Sw.) Asch. & Graebn., Syn. Mitteleur. Fl. 2 (1898) 12. **Type:** *Leersia oryzoides* (L.) Sw., typ. cons.

Subaquatic **perennials**. **Culms** with rhizomes and stolons, branching intra- and extra-vaginally at base. **Ligule** membranous. **Leaf** blades inrolled when young, parallel-nerved, auriculate. **Inflorescence** a paniculate raceme. **Spikelets** imbricate or in two rows, 1-flowered, laterally flattened, articulating above the thickened remnant of the glumes. **Sterile lemmas** ('glumes') absent. **Fertile lemma** without callus-hairs, apex acute to incompletely awned, 5-nerved, chartaceous to coriaceous, muticous. **Palea** 3-nerved. **Stamens** (1–3 or) 6. **Caryopsis** oblong, flat to slightly compressed.

Distribution. A genus of 18 tropical to temperate species of which 1 native in Singapore.

Taxonomy. The genus belongs to the *Oryzoideae* – *Oryzinae* Griseb.

Notes. The glumes are actually reduced to the minute auricles forming the cup-shaped apex of the pedicel.

Leersia hexandra Sw.

(Greek, *hex-*, = six, *-andra* = men; a reference to the six stamens)

Prodr. (1788) 21; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Fl. Malay Penins. 5 (1925) 253; Henderson, Malay. Wild Fls., Monocot. (1954) 320, fig. 184a,c; Gilliland, Rev. Fl. Malaya 3 (1971) 97, fig. 16, pl. 10b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1349; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 173, fig. 277; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 88, fig. 85; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 170, 271. **Synonyms:** *Asprella hexandra* (Sw.) P.Beauv., Ess. Agrostogr. (1812) 2, 153; Roemer & Schultes, Syst. Veg., ed. 15 bis, 2(1817) 267, isonym. – *Homalocenchrus hexandrus* (Sw.) Kuntze, Revis. Gen. Pl. 2 (1891) 777. **Type:** Swartz *s.n.*, Jamaica (lectotype BM, designated by Clayton, Fl. Trop. E. Africa, Gramineae (Pt 1) (1970) 25; isolectotypes S, SBT). **Fig. 45A, 46.**

Culms slender, lower part creeping or floating, upper part erect, 0.5–1.5 m high; nodes swollen, glabrous to deflexed barbate. **Sheaths** 4–9.5 cm long, rounded, midrib (slightly) raised, glabrous, scaberulous at base, margins glabrous; auricles fused with ligule, triangular, glabrous. **Ligule** usually asymmetric, 1–9 mm long, truncate or notched. **Leaf** blades linear, (3.5–)11–18(–28) cm by 2–15 mm, scabrous or sparsely hairy to nearly glabrous on both sides.

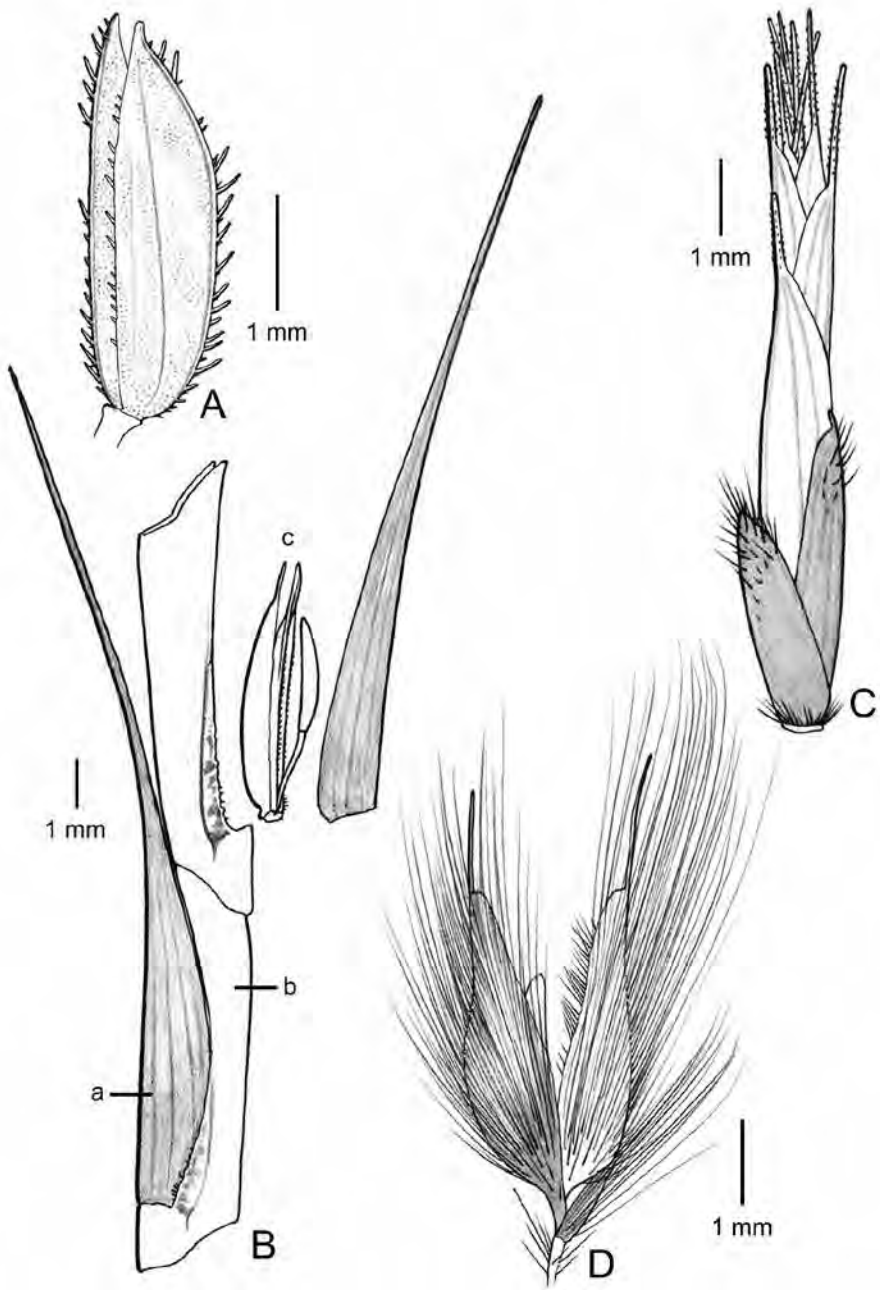


Figure 45. *Leersia hexandra* Sw. **A.** Spikelet, lateral view. *Lepturus repens* (G.Forst.) R.Br. **B.** Detail of inflorescence: **a.** spikelet, **b.** rachis, **c.** exploded view of spikelet. *Lophatherum gracile* Brongn. **C.** Spikelet, lateral view. *Melinis repens* (Willd.) Zizka. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).



Figure 46. *Leerstia hexandra* Sw. Habit with detail of inflorescence in inset. (From Singapore, HortPark, Chen SING2017-743. Photos: L.M.J. Chen)

Panicles 5–15 cm long; racemes 5–14, solitary or paired, ascending to patent, spikelets from at least the lower 0.33 of its length, filiform, 3–13 cm long, less than 1 mm thick; pedicels c. 0.5 mm long, scaberulous, tip cupuliform. **Lemmas** elliptic to oblong, hemi-circular, keeled, (3–)3.5–4.5 × c. 1.3 mm, acute to acuminate, muticous, strongly nerved, not sculptured, keel pectinately setose. Palea as the lemma, but narrower, their nerves interlocking, keels also setose.

Distribution. Throughout the tropics and subtropics. Native in Singapore and collected from Balestier Plain (*Ridley s.n.*, 1894, SING [SING0017778]), Dunearn Road (*Wong 3432*, Aug 1959, SINU), Geylang (*Teruya 2243*, 4 Mar 1933, SING [SING0017780]), Sungei Buloh (*Duistermaat et al. 79*, 19 Mar 2002, L, SING [SING0059597]) and Pasir Panjang-HortPark (*Chen SING2017-743*, 6 Dec 2017, SING [SING0255908]).

Ecology. On banks along fresh water streams and ponds, forming floats. Seeds are extremely rare and propagation occurs mainly vegetatively leading to the formation of local clones.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Rice grass* (English).

Notes. Goebel (*Ann. Jard. Bot. Buitenzorg* 36 (1926) 186) extensively described the response of the leaves to day and night.

33. LEPTURUS R.Br.

(Greek, *lept-* = narrow, *-urus* = tail; referring to the shape of the spikes)

Prodr. Fl. Nov. Holland. (1810) 207; Nowack & Veldkamp, *Blumea* 47 (2002) 385; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 390. **Synonyms:** *Monerma* P.Beauv., *Ess. Agrostogr.* (1812) 116, nom. illeg. superfl. – *Lepiurus* Dumort., *Observ. Gramin. Belg.* (1824 [‘1823’]) 140, nom. illeg. superfl. – *Leptocercus* Raf., *Amer. Monthly Mag. & Crit. Rev.* 4 (1819) 190, nom. illeg. superfl. – *Lepturus* R.Br. sect. *Eulepturus* Hack. in Engler & Prantl, *Nat. Pflanzenfam.* 2(2) (1887) 78, nom. inval. **Type:** *Lepturus repens* (G. Forst.) R. Br.

Perennial. **Culms** mat-forming, branching intra-vaginally at base, rootstock absent, stoloniferous. **Culms** solid. **Ligule** membranous. **Leaf** blades inrolled when young, linear, narrow, not pseudo-petiolate, parallel-veined. **Inflorescence** a single spike, with many spikelets, ending in a spikelet, espatheate, disarticulating into joints. **Joints** composed of an internode and sessile spikelet, disarticulating obliquely, linear, unappendaged, glabrous to somewhat hairy, without a basal knob. **Spikelets** all of the same sex and shape, distichous, embedded in the rachis, not subtended by bristles, hairs, or involucre, sessile, dorsoventrally compressed, adaxial, solitary. **Spikelets** 2-flowered, the terminal one reduced, not disarticulating above the glumes, dorso-ventrally compressed, callus absent. Lower **glume** minute, upper glumes well-developed (both well-developed in the terminal spikelet but very unequal), as long as

the spikelet, longer than the adjacent lemma, not subulate, acuminate to caudate, apically not winged; lower glume 0- or 1-nerved; upper glume 5–11-nerved. **Rachilla** process terminated by an incomplete floret (well-developed in the terminal spikelet). **Lemma** less indurated than the glumes, not indurated at maturity, 3-nerved, dorsally flattened, glabrous, apex entire, muticous, callus obtuse, glabrous. **Stamens** 3.

Distribution. 8–12 species on the shores of the Indian and Pacific oceans; 1 in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Eleusininae* Dumort.

Lepturus repens (G.Forst.) R.Br.

(Latin, *repens* = creeping; referring to the habit)

Prodr. Fl. Nov. Holland. (1810)207; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 182; Ridley, Fl. Malay Penins. 5 (1925) 254; Gilliland, Rev. Fl. Malaya 3 (1971) 83, fig. 12, pl. 13c; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 173; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 89, fig. 87, pl. 16; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 54, 170, 228. **Basionym:** *Rottboellia repens* G.Forst., Fl. Ins. Austr. (1786) 9. **Synonym:** *Monerma repens* (G.Forst.) P.Beauv., Ess. Agrostogr. (1812) 117, 168, 177. **Type:** [Unpublished illustration] Forster drawing 20 (lectotype BM, designated by Nicolson & Fosberg, Forsters Bot. Sec. Cook Exped. (2004) 234). **Fig. 36B, 45B.**

Culms 0.2–0.4 m long, creeping to erect; nodes glabrous. **Ligule** 0.3–1 mm long. **Leaves** 2.5–20 cm by 2–8 mm, glabrous. **Spikes** 5–17 cm by 1.2–2 mm. **Spikelets** 8–22 mm long. Rudiment of **lower glumes** triangular, 0.3–0.5 mm long; upper glumes 7–11-nerved, scabrous, glabrous, acuminate to long-caudate. **Lemmas** 4–5.1 mm long, (sub)glabrous, sometimes awn-tipped. **Anthers** 1.5–2 mm long.

Distribution. East Africa and the Mascarenes, Sri Lanka to Japan and through continental Southeast Asia and Malesia to northern Australia and Polynesia. Native in Singapore and collected in Changi (*Corner s.n.*, 20 Jul 1941, SING [SING0017785]) and on many of the offshore islands including Pulau Hantu (*Chua et al. H 56*, 28 Jan 1993, SINU), Pulau Serangoon (*Tan 1164*, 22 Dec 2003, SINU), Pulau Subar Darat (*Duistermaat et al. 237*, 19 Dec 2003, SING [SING0059674]) and Pulau Ubin (*Duistermaat 123*, 16 Mar 2003, K, L, SING [SING0059676]).

Ecology. Mat-forming on sandy and rocky seashores, preferably on coral sands, and along roads.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Uses. Efficient sand-binder.

34. LOPHATHERUM Brongn.

(Greek, *loph-* = crest, *-atherum*, spike; referring to the awns of the terminal sterile lemmas)

in Duperrey, Voy. Monde, Phan., fasc. 8 (1831) 49; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 285. **Type:** *Lophatherum gracile* Brongn.

Perennials, resembling a small bambusoid. **Culms** rhizomatous and with small root-tubers, hollow, branching intra- and extra-vaginally at base. **Ligules** rim-like, membranous. **Leaf** blades inrolled when young, pseudo-petiolate, lanceolate to linear, parallel-nerved, with cross-nerves. **Panicle** lax, composed of spike-like, whorled racemes. **Spikelets** distichous, very shortly pedicelled, 2–13(–22)-flowered, falling as a whole, laterally compressed, callus obtuse, glabrous to puberulous; lower floret bisexual, others reduced. **Glumes** unequal, acute to apiculate, shorter than the adjacent lemmas; lower glume 3- or 5-nerved; upper glume 5- or 7-nerved. **Fertile lemma** 1, dorsally keeled, 7–11-nerved, acute to bifid, distally with close-set reduced anthoecia, awn (sub)apical, straight, retrorsely scaberulous. **Rachilla process** present.

Distribution. A genus of 1 very variable species from India and Japan to Micronesia and northern Australia.

Taxonomy. The genus belongs to the *Panicoideae* – *Zeugiteae* Sánchez-Ken & L.G.Clark.

Notes. The spikelets are very polymorphic, possibly because of their cleistogamous flowers, and so the genus has often been regarded as composed of a number of distinct species and varieties. All intermediaries are present so no distinctions seem warranted, although locally the populations may often seem rather distinct. The awns of the sterile lemmas function as a burr in distribution.

Lophatherum gracile Brongn.

(Latin, *gracilis* = slender; referring to the panicle)

in Duperrey, Voy. Monde, Phan., fasc. 8 (1831) 50, pl. 8; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 181; Ridley, Fl. Malay Penins. 5 (1925) 253; Henderson, Malay. Wild Fls., Monocot. (1954) 308, fig. 177a–c; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1386; Gilliland, Rev. Fl. Malaya 3 (1971) 55, fig. 5, pl. 9c; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 173, fig. 278; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 89, fig. 88, pl. 19; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 57, 170, 229. **Synonym:** *Lophatherum gracile* Brongn. var. *genuinum* Hack., Bull. Herb. Boissier 7 (1899) 707, nom. inval. **Type:** *Dumont d'Urville s.n.*, Amboyna [Ambon] (lectotype P [P00624191], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 20; possible isolectotype P [P00624190]). **Fig. 45C, 47.**

Lophatherum lehmannii auct. non Steud.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 187, as '*lehmannii*'.

Culms single, or loosely tufted, erect to geniculate, 0.3–1.5 m tall; nodes glabrous. **Pseudopetiole** 0.2–3 cm long. **Ligule** up to 0.7 mm long. **Leaf** blades lanceolate, 5–30 cm by 8–22 mm, glabrous to sparsely hairy. **Panicle** 10–45 cm long; racemes 6–14 in whorls

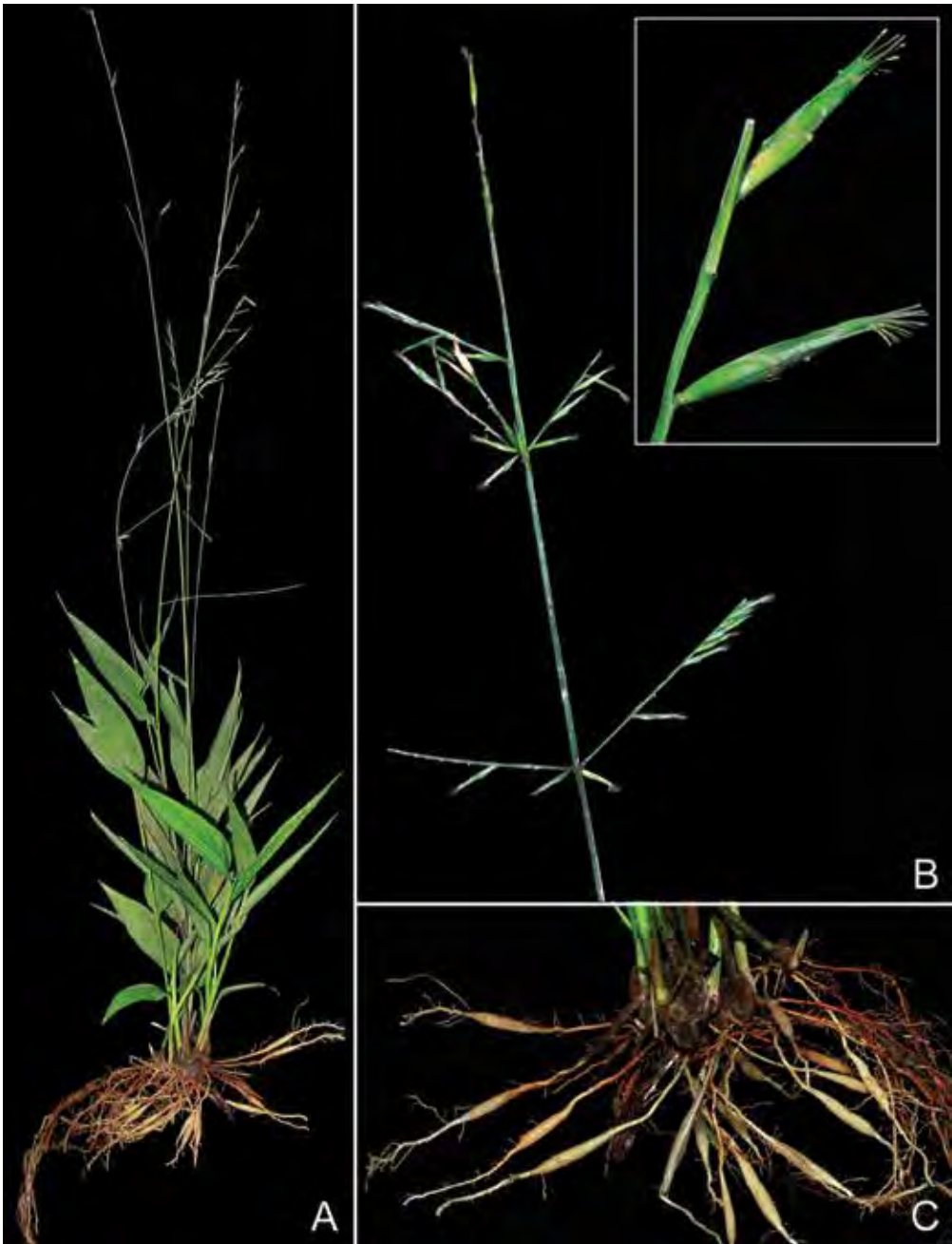


Figure 47. *Lophatherum gracile* Brongn. **A.** Habit. **B.** Inflorescence with spikelets in inset. **C.** Basal part with small root-tubers. (From Singapore, Nee Soon, *Ho et al. SING2017-689*. Photos: L.M.J. Chen)

of 1–4, longest one 7–12 cm long; pedicels 0–0.2 mm long, scaberulous to distally sparsely hairy. **Spikelets** erecto-patent to patent in fruit, 5–13 × 1.4–1.6 mm (excl. awns). **Fertile floret** cleistogamous; sterile anthoecia 1–12. Lower **glume** 2.9–4.5 mm long, 0.4–0.6 times as long as the first lemma, truncate to obtuse; upper glumes 4–6.5 mm long, acuminate. **First lemma** 4.5–6 mm long, mucro 0.2–2 mm long. **Anthers** 1–2 mm long. **Sterile lemmas** epaleate, awns 0–2 mm long. **Rachilla process** c. 1.5 mm long.

Distribution. As for the genus. Native in Singapore and widely distributed including in Singapore Botanic Gardens (*Goodenough 1701*, 8 Feb 1890, SING [SING0017789]), Bukit Timah (*Chua 345*, 10 Jan 1991, SINU), MacRitchie (*Jumali & Wee 636*, 9 Jan 1962, SINU), Pulau Ubin (*Ali Ibrahim & Lioe SING2010-938*, 29 Dec 2010, SING [SING0153696]) and Nee Soon (*Ho et al. 2017-689*, 28 Nov 2017, SING [SING0233527]).

Ecology. Shady, humid places in primary and secondary forests.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Crested grass* (English), *rumpu jarang* (Malay).

35. MELINIS P.Beauv.

(Greek, derivation obscure: either from *meline*, resembling millet, *Panicum miliaceum* L., or from *melas*, because the caryopses are sometimes black, or from *meli*, honey, because of the sweet smell of some species)

Ess. Agrostogr. (1812) 54, 167, pl. 11: fig. 4; Zizka, Biblioth. Bot. 138 (1988) 1; Zizka, Mitt. Inst. Allg. Bot. Hamburg 23b (1990) 563; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 340. **Type:** *Melinis minutiflora* P.Beauv.

Rhynchelythrum Nees in Lindley, Intr. Nat. Syst. Bot., ed. 2 (1836) 378, 446, as ‘*Rhynchelythrum*’. **Type:** *Rhynchelythrum dregeanum* Nees (= *Melinis repens* (Willd.) Zizka).

Annuals or perennials. **Culms** straggling, rooting at the decumbent nodes, branching intravaginally at base, hollow, sometimes filled with pith. **Ligule** a row of hairs. **Leaf** blades inrolled when young. **Inflorescences** of panicles. **Spikelets** quaquaversal, 2-flowered, pedicelled, abaxial, solitary, laterally compressed, callus truncate, falling as a whole. **Glumes** unequal; lower glume rounded to bilobed, 0- or 1-nerved; upper glume bilobed or beaked to awned, 5–7-nerved. Lower **lemma** bilobed, mucronate to awned, 5-nerved, epaleate or paleate and sterile; upper lemma smooth, chartaceous, 1–5-nerved, callus absent, dorsally rounded, glabrous, germination flap absent, margins lying flat on the palea, apex entire, muticous.

Distribution. A genus of 22 species from tropical and southern Africa. In Singapore 1 species has naturalised.

Taxonomy. This genus belongs to the *Panicoideae* – *Melinidinae* Stapf.

Notes. Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 60, 170, 250) report the presence in cultivation of *Melinis nerviglumis* (Franch.) Zizka. It is native in Africa south of the Sahara, Madagascar, and disjunct from Thailand to Vietnam. It is cultivated elsewhere. It differs from *Melinis repens* by being a densely tufted perennial, basal blades setaceous, lower lemma similar to the upper glume.

Melinis repens (Willd.) Zizka

(Latin, *repens* = creeping; referring to the habit)

Biblioth. Bot. 138 (1988) 55; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 173; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 89, fig. 89, pl. 20; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 60, 170, 267. **Basionym:** *Saccharum repens* Willd., Sp. Pl., ed. 4, 1(1) (1797) 322. **Synonyms:** *Erianthus repens* (Willd.) P.Beauv., Ess. Agrostogr. (1812) 14, 162. – *Rhynchelythrum repens* (Willd.) C.E.Hubb., Bull. Misc. Inform. Kew 1934 (1934) 110. – *Tricholaena repens* (Willd.) Hitchc., Man. Grasses W. Ind. (1936) 331; Roberty, Bull. Inst. Franç. Afrique Noire, A 17 (1955) 57, isonym. **Type:** *Iseri s.n.*, Guinea [Ghana] (lectotype B-W [B-W01499010], designated by Fosberg, Smithsonian Contr. Bot. 47 (1981) 3; isolectotypes C, S). **Fig. 36C, 45D.**

Tricholaena rosea Nees in Schauer, Index Seminum. Hort. Bot. Vratisl. 1835 (1836) [3]; Nees, Litt.-Ber. Linnaea 1837 (1837) 129; Nees, Fl. Afr. Austral. Ill. (1841) 17; Henderson, Malay. Wild Fls., Monocot. (1954) 325, fig. 187c,d. **Synonyms:** *Monachyron roseum* (Nees) Parl., Fl. Ital. 1 (1850) 131. – *Panicum roseum* (Nees) Steud., Syn. Pl. Glumac. 1, fasc. 2 (1854) 92, nom. illeg. non Spreng. (1824). – *Panicum teneriffae* (L.f.) Spreng. var. *rosea* (Nees) F.M.Bailey, Queensl. Gr. (1888) 22. – *Melinis rosea* (Nees) Hack., Oesterr. Bot. Z. 51 (1901) 464. – *Rhynchelythrum roseum* (Nees) Stapf & C.E.Hubb. ex Bews, World Grasses (1929) 223. – *Rhynchelythrum repens* (Willd.) C.E.Hubb. var. *roseum* (Nees) Chiov., Miss. Biol. Borana, Racc. Bot., Angiosp.-Gymnosp. (1939) 275. – *Tricholaena repens* (Willd.) Hitchc. var. *rosea* (Nees) Alberts., Bull. Imp. Bur. Pastures. 37 (1947) 10. **Type:** *Drège 4319*, South Africa (lectotype B [B100715446], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 41).

Annuals or perennials. **Culms** loosely tufted, 0.5–1(–2) m long, hollow; nodes hairy. **Sheaths** glabrous to pilose. **Ligule** a fringe of 0.5–1 mm long hairs. **Leaf** blades flat to folded, (4–)9–20 cm by (1.5–)4–10 mm, sparsely hairy in lower half. **Panicle** lax, 8–17 × (2.5–)4–7(–9.5) cm. **Branches** 3–7 cm long; pedicels 1–3.5 mm long, apically pilose. **Spikelets** yawning, 3.5–5.5 × c. 2 mm. Lower **glume** 0.75–1.5 mm long, 0.2–0.3 times as long as the spikelet, apex rounded to notched, 1-nerved; pilose (at least at base), hairs up to 6.5 mm long, red; internode 0.1–0.6 mm long; upper glumes 3.2–4.5 mm long, 0.8–0.9 times as long as the spikelet, pilose, apex truncate to obtuse, awn 1–5 mm long. **First lemma** paleate, sterile or male, rarely epaleate, narrower and less gibbous than the upper glume, 5-nerved, pilose, awn 0.5–5 mm long; upper lemma bisexual, 1.8–2 mm long, 5-nerved. **Anthers** 2–2.5 mm long.

Distribution. Originally from Africa, now pantropical. Naturalised and widespread in Singapore in Katong (*Teruya* 2246, 11 Mar 1933, KEP), Mandai Quarry (*Duistermaat & Hillier* 42, 12 Mar 2002, K, L, SING [SING0059672]), Pulau Hantu (*Chua et al. H 61*, 20 Jan 1993, SINU), Sungei Buloh (*Chua et al. SB 3018*, 13 Oct 1993, SINU) and Sungei Punggol (*Tan 797*, 26 Nov 2003, SINU).

Ecology. Dry, open, grassy areas along roads, sandy sea shores, disturbed areas, giving a pinkish hue to the landscape.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. Cultivated as an ornamental.

Vernacular name. *Natal grass* (English).

36. MNESITHEA Kunth

(Mnesitheus Cyzicenus, c. 300 BC, a Greek herbalist, from Cyzicus in Mysia, Turkey)

Révis. Gramin. 1 (1829) 153; Veldkamp et al., *Blumea* 58 (2013) 277; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 299. **Synonyms:** *Thyridostachyum* Nees in Lindley, *Intr. Nat. Syst. Bot.*, ed. 2 (1836) 379, nom. illeg. superfl. – *Rottboellia* L.f. sect. *Mnesithea* (Kunth) Hook.f., *Fl. Brit. India* 7, fasc. 21 (1896) 158. **Type:** *Mnesithea laevis* (Retz.) Kunth.

Coelorachis Brongn. in Duperrey, *Voy. Monde, Phan.*, fasc. 8 (1831) 64, pl. 14. **Synonyms:** *Rottboellia* L.f. subg. *Coelorachis* Hack. in De Candolle & De Candolle, *Monogr. Phan.* 6 (1889) 293, nom. illeg. superfl. – *Rottboellia* L.f. sect. *Coelorachis* (Brongn.) Pilg. in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 14e (1940) 139; Roberty, *Boissiera* 9 (1960) 74, as ‘*Coelorrhachis*’, isonym. **Type:** *Coelorachis glandulosa* Brongn. (= *Mnesithea glandulosa* (Trin.) de Koning & Sosef).

Annuals or perennials. **Culms** solid, with pith, or hollow. **Ligule** collar-shaped, membranous. **Inflorescence** a compound, leafy panicle of spatheate racemes; peduncles not articulating at base; rachis articulating at the joints, with a 1 or 2 sessile spikelets and 1 pedicelled one; joints at base with a remnant of a vascular bundle (‘knob’) which fits into a cavity in the top of the joint below. **Spikelets** paired (1 sessile, 1 pedicelled, and the topmost a triad: 1 sessile, 2 pedicelled) or in triads (2 sessile, 1 pedicelled, but in the topmost one 1 sessile and 2 pedicelled). **Sessile spikelets** dorso-ventrally flattened, more or less immersed in cavities in the joints, 2-flowered, awnless, the lower floret epaleate or paleate and sterile, the upper one bisexual. Lower **glume** indurate, smooth or sculptured, 4–13-nerved, apex winged or not; upper glume chartaceous, 3–15-nerved. Lower **lemma** membranous, upper one even thinner. **Pedicels** free or adnate to the joint. **Pedicelled spikelets** dorso-ventrally flattened, varying from a single small scale to 2-flowered.

Distribution. A pantropical genus of approximately 32 species of which 1 native and 1 doubtfully native in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Rottboelliinae* J.Presl.

Key to *Mnesithea* species

1. Perennials with cataphylls; joints 2.7–5.5 mm long; sessile spikelet 3.8–5.5 mm long (incl. callus); lower glume ovate-oblong, smooth, laterally with 2–7 gland-like appendages, apex winged; pedicel free from the joint **1. *M. glandulosa***
Annuals (without cataphylls); joints 1.4–2.6 mm long; sessile spikelet 1–2.6 mm long (incl. callus); lower glume suborbicular, reticulate-rugosely sculptured, apex rounded, not winged; pedicel adnate to the joint **2. *M. granularis***

1. *Mnesithea glandulosa* (Trin.) de Koning & Sosef

(Latin, *glandulosus* = glandular; referring to the gland-like appendages of the lower glume of the sessile spikelet)

Blumea 31(2) (1986) 290; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 174; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 92, fig. 91; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 61, 170, 222. **Basionym:** *Rottboellia glandulosa* Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 2 (1832) 250; Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 157; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 161. **Synonyms:** *Manisuris glandulosa* (Trin.) Kuntze, Revis. Gen. Pl. 2 (1891) 780. – *Coelorachis glandulosa* (Trin.) Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 204; Henderson, Malay. Wild Fls., Monocot. (1954) 347, fig. 197c,d; Gilliland, Rev. Fl. Malaya 3 (1971) 270, fig. 57, pl. 4c. **Type:** *Collector unknown s.n.*, Java (holotype LE [Herb. Trinius 113.1]). **Fig. 48A.**

Rottboellia striata Nees ex Steud. var. *glabrior* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 302. **Type:** *Wallich s.n.* [EIC 8876], Singapore, October 1822 (lectotype K-W [K001131724], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 38; possible isoelectotypes G [G00164612], K-W [K001131726]).

Rottboellia striata auct. non Nees ex Steud.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 162.

Perennial. **Culms** 0.6–2.1 m long. **Cataphylls** ovate-oblong, (2–)10–27(–48) × (1–)4.5–6(–10) mm, puberulous or ciliate along the margin, apex acute, acuminate, mucronate, rarely retuse; nodes glabrous to setose. **Sheaths** glabrous to hairy. **Ligule** 0.6–5 mm long, glabrous to margin ciliolate or setose. **Leaf** blades inrolled when young, flat to folded, (4.5–)11–60(–110) cm by 4–24 mm, both sides glabrous to hairy to glabrescent, glabrous behind the ligule to setose behind the ligule, margins at base glabrous to pectinate. **Peduncles** 1–5 together, glabrous. **Spatheoles** (2–)6.5–12.5(–18) cm long, blade absent to present. **Racemes** (2–)5–9(–12) cm by 1.5–3.5 mm. **Joints** 2.7–5.5 mm long, glabrous, smooth to ciliolate at base. **Sessile spikelet** callus ciliolate, 3.8–5.5 mm long (incl. callus), spikelets shorter to longer than the joint. Lower **glume** flat to convex, ovate-oblong, glabrous to hairy, coriaceous, smooth, laterally with 2–7 small appendages, yellowish to greenish yellow to margins purplish, 6–9-nerved, apex winged; upper glume boat-shaped, ovate-oblong, 2.8–4.9 mm long, glabrous to ciliolate along the margin, 3–7-nerved, nerves anastomosing or not, apex acute. **Lemmas** ovate to ovate-oblong, glabrous to ciliolate along the margin, apex rounded to acute; first lemma spikelet epaleate to paleate, 2.5–3.7 mm long, 2–4-nerved; second lemma 3-nerved. **Anthers** 1.2–2.1

mm long. **Pedicels** of pedicelled spikelets free from the joint, 3.3–5.5 mm long, glabrous to pubescent. **Pedicelled spikelets** reduced to 1 glume or composed of 2 glumes and 1 bisexual floret, laterally flattened to dorso-ventrally flattened, (0.6–)0.8–1.9(–4.5) mm long. Lower **glume** chartaceous, glabrous to margins ciliolate, apex winged. **Anthers** 0.9–1.8 mm long.

Distribution. Nicobar Islands, Myanmar, Thailand and Malaysia. Native in Singapore and collected from an unknown locality (*Wallich s.n.* [EIC 8876], Nov 1822, CAL, K), Changi (*Ridley 136*, 16 Feb 1884, SING [SING0064283]), Kusu Island (*Chua et al. K 43*, 28 Jan 1994, SINU), Pulau Ubin (*Duistermaat et al. 177*, 23 Sep 2003, L, SING [SING0064171]), Sungei Buloh (*Duistermaat et al. 80*, 19 Mar 2002, SING [SING0059814]) and several other parts of Singapore.

Ecology. Sunny, grassy places, disturbed forests, and along roads.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 61, 170, 222).

Vernacular names. *Mat grass* (English), *terubong* (Malay).

2. *Mnesithea granularis* (L.) de Koning & Sosef

(Latin, *granularis* = composed of granules; referring to the pustules on the keels of the lower glumes of the sessile spikelets)

Blumea 31(2) (1986) 295; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 174; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 92, fig. 92.

Basionym: *Cenchrus granularis* L., Mant. Pl. Altera (1771) 575. **Synonyms:** *Manisuris granularis* (L.) Naezèn, Nov. Gram. Gen. (1779) 40; Baron, Rev. Madagascar 8 (1906) 838, as '*Manularis granularis*'. – *Tripsacum granulare* (L.) Raspail, Ann. Sci. Nat. (Paris) 5 (1825) 306. – *Hackelochloa granularis* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 776; Gilliland, Rev. Fl. Malaya 3 (1971) 277, fig. 60, pl. 33c. – *Ryttilix granularis* (L.) Raf. ex Skeels, Bull. Bur. Pl. Industr. U.S.D.A. 282 (1913) 20. – *Rottboellia granularis* (L.) Roberty, Boissiera 9 (1960) 79. **Type:** *Collector unknown s.n.*, 'India orientali' (lectotype LINN [Herb. Linn. no. 1217.12], designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 849). **Fig. 48B.**

Annual. **Culms** 0.2–1 m long; nodes glabrous to setose. **Sheaths** hairy to setose, margin pilose to ciliate. **Ligule** 0.6–2 mm long, margin ciliolate. **Leaf** blades flat (folded when young), 2.5–31 cm by 2.5–12 mm, margins at base pectinate, hairy on both sides, glabrous behind the ligule. **Peduncles** solitary or paired, glabrous to hairy. **Spatheoles** 1–3 cm long, blade present. **Racemes** 0.6–3.6 cm by 1.5–2.8 mm. **Joints** 1.4–2.6 mm long, glabrous, smooth. **Sessile spikelet** 1–2.6 mm long (incl. callus), about as long to longer than the joint. Lower **glume** convex, suborbicular, glabrous, coriaceous, reticulate-rugosely sculptured, yellowish to greenish yellow, 5- or 6-nerved, apex rounded, not winged; upper glume concave, ovate-oblong, 1–1.8 mm long, glabrous, 3-nerved, nerves not anastomosing, apex acute. **Lemmas** ovate to ovate-oblong, glabrous, apex acute; first lemma epaleate, 0.8–1.7 mm long, 2- or

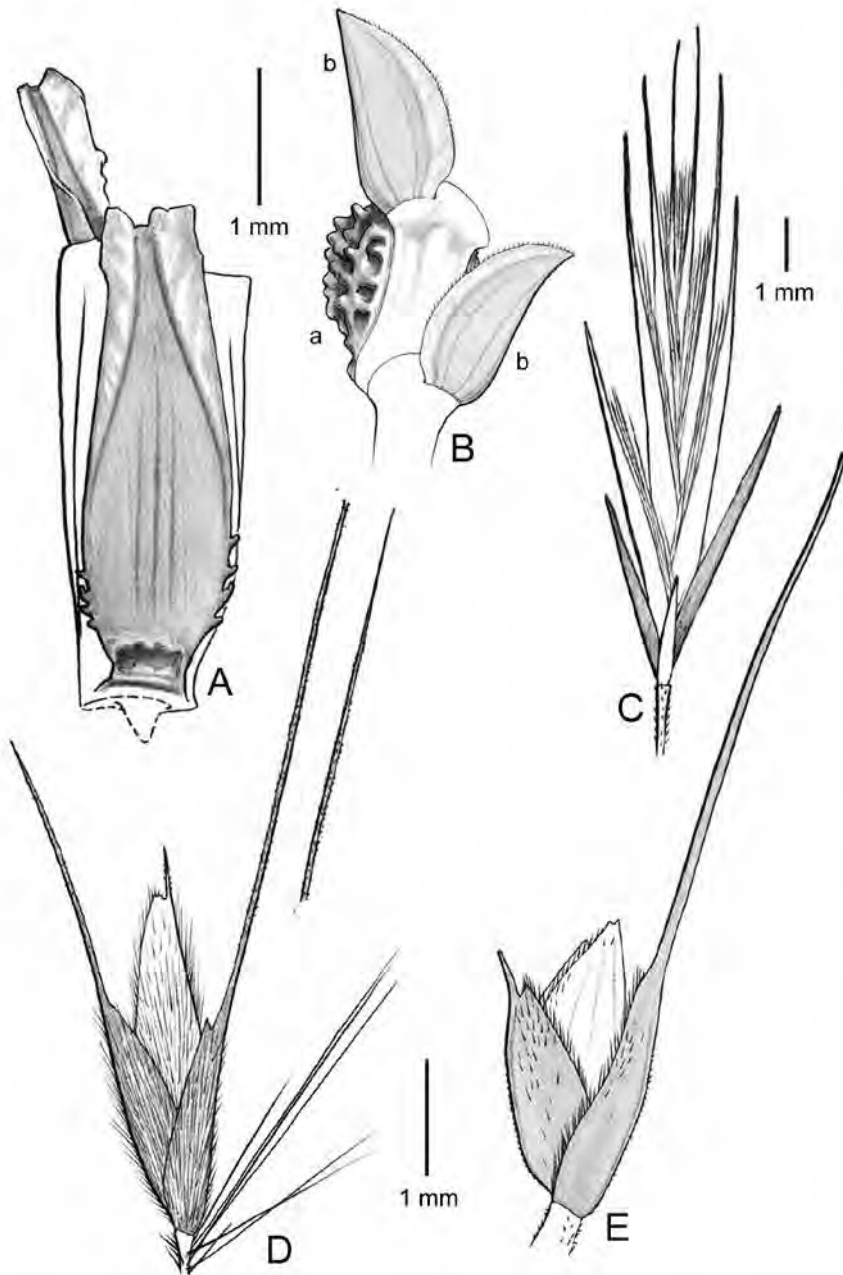


Figure 48. *Mnesithea glandulosa* (Trin.) de Koning & Sosef. **A.** Pair of spikelets. *Mnesithea granularis* (L.) de Koning & Sosef. **B.** Detail of inflorescence: **a.** sessile spikelet, **b.** pedicelled spikelet. *Neyraudia arundinacea* (L.) Henrard var. *zollingeri* (Buse) Henrard. **C.** Spikelet, lateral view. *Oplismenus burmanni* (Retz.) P.Beauv. **D.** Spikelet, lateral view. *Oplismenus compositus* (L.) P.Beauv. **E.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

3-nerved; second lemma 2-nerved. **Anthers** 0.4–0.9 mm long. **Pedicels** of pedicelled spikelets adnate to the joint, 0.8–2.4 mm long, glabrous. **Pedicelled spikelets** reduced to 2 glumes to composed of 2 glumes and 1 bisexual floret, laterally flattened to dorso-ventrally flattened, 1.2–4 mm long. Lower **glume** chartaceous, margins ciliolate, apex winged. **Anthers** 1–1.7 mm long.

Distribution. Bhutan and India to China and Southeast Asia and throughout Malaysia. In Singapore it is possibly native but has been collected only once on Pulau Ayer Merbau, now part of Jurong Island (*Sinclair SFN 38600*, 28 Aug 1949, SING [SING0017791]).

Ecology. Elsewhere in somewhat disturbed places in forest, common in evergreen forest and in open areas.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it is unclear whether it was ever native but is nonetheless now presumed Nationally Extinct.

37. NEYRAUDIA Hook.f.

(anagram of (*Arundo*) *reynaudiana* Kunth, for Auguste Adolphe Marc Reynaud, 1804–1887, French naval surgeon, naturalist who collected in India and Java)

Fl. Brit. India 7, fasc. 22 (1896) 305; Conert, Bot. Jahrb. Syst. 78 (1959) 208, 233; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 363. **Type:** *Neyraudia madagascariensis* (Kunth) Hook.f., nom. illeg. superfl. (= *Neyraudia arundinacea* (L.) Henrard).

Perennial reed-like plant, branching intra- and extra-vaginally at base, rhizomatous. **Culms** solid. **Ligule** a membranous ciliate collar. **Leaf** blades inrolled when young. **Panicle** contracted to lax, branches ending in spikelets. **Spikelets** solitary, pedicelled, abaxial, laterally compressed, 2–7-flowered, chasmogamous, disarticulating above the glumes, laterally flattened. **Glumes** unequal, shorter than the adjacent lemmas, glabrous, acuminate to caudate; lower glumes 1- or 3-nerved; upper glumes 3-nerved. **Rachilla** articulating, glabrous, process ending in a reduced floret. **Lemma callus** stipitate, hairy; dorsally keeled, 3- or 5-nerved, margins pilose, apex acute or bidentate, then awned from between the teeth. **Awns** recurved. **Stamens** 3.

Distribution. A genus of 4 species in the tropics of the Old World. In Singapore 1 species is doubtfully native.

Taxonomy. The genus belongs to the *Chloridoideae* – *Triraphideae* P.M.Peterson.

Neyraudia arundinacea (L.) Henrard

(Latin, *arundin-* = pertaining to *Arundo* L., *-acea* = resembling, having nature of;
similar to *Arundo*, the reed genus)

Meded. Rijks-Herb. 58 (1929) 8. **Basionym:** *Aristida arundinacea* L., Mant. Pl. Altera (1771) 186. **Type:** *König s.n.*, 'India orientali' (lectotype LINN [Herb. Linn. no. 98.8], designated by Hubbard, Fl. Trop. E. Africa, Gramineae (Pt 1) (1970) 133).

Arundo madagascariensis Kunth, Révis. Gramin. 2 (1830) 273, t. 48. **Synonyms:** *Donax thouarii* P.Beauv., Ess. Agrostogr. (1812) 78, 161, pl. 16: fig. 5, as '*thuarii*', nom. nud. – *Arundo thouarii* T.Durand & Schinz, Consp. Fl. Afric. 5 (1894 ['1895']) 875, nom. illeg. superfl. – *Ampelodesma thouarii* T.Durand & Schinz ex B.D.Jacks., Index Kew. Suppl. 1, fasc. 1 (1902) 24, nom. illeg. superfl. – *Neyraudia madagascariensis* (Kunth) Hook.f., Fl. Brit. India 7, fasc. 22 (1896) 305. – *Triraphis madagascariensis* (Kunth) Hook.f. ex Prain, Bengal Pl. 2 (1903) 1219; Ridley, Fl. Malay Penins. 5 (1925) 251; Henderson, Malay. Wild Fls., Monocot. (1954) 310, fig. 178c; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2225. **Type:** *Du Petit-Thouars s.n.*, Madagascar (lectotype P [P00446272], designated by Hubbard, Fl. Trop. E. Africa, Gramineae (Pt 1) (1970) 133; isolectotype US (fragment ex B)).

var. zollingeri (Buse) Henrard

(Heinrich Zollinger, 1818–1859, Swiss nineteenth century collector
and phytogeographer in Java, Madura and Bali)

Blumea 3(3) (1940) 439; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 94, fig. 90. **Basionym:** *Arundo zollingeri* Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 3 [(Aug 1854) 343]. – *Phragmites zollingeri* (Buse) Steud., Syn. Pl. Glumac. 1, fasc. 3 (Apr 1854) 196. – *Arundo madagascariensis* Kunth var. *zollingeri* (Buse) Boerl., Ann. Jard. Bot. Buitenzorg 8 (1890) 72. – *Neyraudia madagascariensis* (Kunth) Hook.f. var. *zollingeri* (Buse) Hook.f., Fl. Brit. India 7, fasc. 22 (1896) 305. **Type:** *Zollinger 337*, Java (lectotype L [L0044754], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 9; isolectotypes G, K, L [L0044753], P). **Fig. 48C.**

Arundo reynaudiana Kunth, Révis. Gramin. 1 (1829) 275, t. 49. **Synonym:** *Neyraudia reynaudiana* (Kunth) Keng ex Hitchc., Amer. J. Bot. 21 (1934) 131, as '*reynaudia*'; Gilliland, Rev. Fl. Malaya 3 (1971) 61, fig. 6. **Type:** *Reynaud s.n.*, Burma [Myanmar], Pegu, 1829 (lectotype B [B100365260], designated by Conert, Bot. Jahrb. Syst. 78 (1959) 240; isolectotypes L, LE [Herb. Trinius 2252.1] (fragment), P).

Culms 1.5–3.5 m high; nodes glabrous. **Ligule** 2–5 mm long. **Leaf** blades linear, 30–60 cm by 6–20 mm, base slightly auriculate. **Panicle** erect to nodding, 30–65 × 10–20 cm; branches solitary to fascicled, the longest lowermost 12–25 cm long; pedicels 3–4 mm long, scaberulous. **Spikelets** 6–10.5 mm long. Lower **glumes** 2.4–2.8 mm long, glabrous; upper glumes 2.7–3.2 mm long. **First lemma** similar to the glumes, sterile, epaleate, persistent, 3.5–4 mm long, acute; fertile lemmas 3.5–4.2 mm long, callus straight, c. 0.3 mm long, margin silky-hairy, apex teeth 0.2–0.5 mm long, awn 0.8–2 mm long. **Anthers** c. 1.8 mm long.

Distribution. Eastern India and Bhutan to southwestern China, the Andaman & Nicobar Islands and Malesia. Naturalised in North America and the Caribbean. In Singapore it is doubtfully native as it has only ever been collected once on Bartley Road (*Wong s.n.*, Aug 1959, SINU).

Ecology. Elsewhere in sunny, infertile, rocky localities.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it is unclear whether it was ever native but is nonetheless now presumed Nationally Extinct.

Notes. Easily confused with the regionally much more common *Phragmites karka* (Retz.) Trin. ex Steud. of wet places with hollow culms, hairy rachilla, and first lemma 7–9 mm long, other lemmas pilose.

38. OPLISMENUS P.Beauv.

(Greek, *hoplismenos* = armed; referring to both the awned glumes)

Fl. Oware 2, fasc. 12 (1810) 14, nom. cons.; Hasskarl, Cat. Hort. Bot. Bogor. (1844) 16, as '*Hoplismenus*'; Scholz, Phanerog. Monogr. 13 (1981) 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 330. – *Hippagrostis* Rumph. ex Kuntze, Revis. Gen. Pl. 2 (1891) 776, nom. illeg. superfl. **Type:** *Oplismenus africanus* P.Beauv. (= *Oplismenus hirtellus* (L.) P.Beauv. subsp. *fasciculatus* U.Scholz).

Perennials. **Culms** solid to hollow, mat-forming, rooting at the decumbent nodes, branching intra-vaginally at base. **Ligule** a row of basally fused hairs. **Leaf** blades inrolled when young, ovate to lanceolate, broad, often somewhat undulate. **Panicles** composed of racemes. **Spikelets** paired to clustered, more or less biseriate (the basal sessile ones often reduced), secund, abaxial, more or less terete to laterally compressed, mucronate to awned. **Callus** obtuse. **Glumes** unequal, more than half as long as the spikelet; lower glumes 3–5(–7)-nerved, awned; upper glumes 5–7-nerved, mucronate to awned. Lower **lemma** epaleate to paleate, sterile, rarely male, 5–9-nerved, muticous to awned; upper lemma dorsally compressed, leathery at maturity, smooth, 3–5-nerved, germination flap present, margins inrolled over the palea, apex minutely crested to mucronate.

Distribution. A pantropical to warm temperate genus of 5–9 species with 2 species which are probably introduced rather than native in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Boivinellinae* Pilg.

Notes. The possession of viscid awns in some species (e.g. *Oplismenus compositus*) is a rather unique dispersal mechanism in the family.

Key to *Oplismenus* species

1. At least the lowermost spikelets close-set and imbricate, awns filiform, antrorsely scaberulous, not viscid; lower lemma sparsely to densely hairy, apex mucronate to awned; lowermost racemes 0.5–3 cm long **1. O. burmanni**
Spikelets in distant pairs, awns smooth, viscid; lower lemma glabrous to margins ciliate, apex obtuse to apiculate; lowermost racemes 2.5–10 cm long **2. O. compositus**

1. *Oplismenus burmanni* (Retz.) P.Beauv.

(Nicolaas Laurens Burman, 1733–1793, Dutch physician and botanist)

Ess. Agrostogr. (1812) 54, 168; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 145; Ridley, Fl. Malay Penins. 5 (1925) 221; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1612; Gilliland, Rev. Fl. Malaya 3 (1971) 172, colour pl. 11; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 94, fig. 94. **Basionym:** *Panicum burmanni* Retz., Observ. Bot. 3 (1783) 10. **Synonyms:** *Orthopogon burmanni* (Retz.) R.Br., Prodr. Fl. Nov. Holland. (1810) 194; Trin., Fund. Agrost. (1820) 181, isonym. – *Hippagrostis burmanni* (Retz.) Kuntze, Revis. Gen. Pl. 2 (1891) 777. **Type:** *König s.n.* (lectotype LD [LD1244466], designated by Fischer, Bull. Misc. Inform. Kew 1932 (1932) 73; possible isoelectotypes BM [\times 3], C, LINN, S). **Fig. 48D.**

Panicum hirtellum auct. non L. (1759): Burm.f., Fl. Ind. (1768) 24, t. 12: fig. 1.

Culms decumbent, rooting at the nodes, 0.1–0.45 m long; internodes with a longitudinal line of hairs (at least on the lower ones). **Ligule** 0.5–1 mm long, margins setose, hairs 0.5–0.6 mm long. **Leaf** blades elliptic to linear-lanceolate, 1.5–10 cm by 4–14 mm, sparsely to moderately setose on both sides. **Inflorescence** 2–10 cm long; common axis glabrous to distally pilose; racemes 3–9, lowermost (excl. awns) 0.5–3 cm long. Lowermost **spikelets** close-set and imbricate, 2.3–3.2 mm long (excl. awns), pilose to densely silvery pilose, rarely subglabrous, awns filiform, antrorsely scaberulous, not viscid, dull. Lower **glume** 1.5–2.85 mm long, 3-nerved, sparsely to densely hairy; awn 2–16 mm long; upper glume 1.5–2.85 mm long, 5-nerved, awn 1.1–5.25 mm long. Lower **lemma** epaleate or paleate, sterile, 2–3 mm long, sparsely to densely hairy, apex mucronate to awned, 5–9-nerved, awn 0.2–2 mm long. **Anthers** 0.7–1.5 mm long.

Distribution. Tropical, Central and South America, Africa, Asia to northern Australia. In Singapore it has only relatively recently been collected by Pierce Reservoir (*Duistermaat et al.* 166, 26 Aug 2003, K, L, SING [SING0064172]) and the Sultan of Johor's land at Tyersall (*Ali Ibrahim et al.* AI 325, 9 Jun 1998, SING [SING0041472]). An earlier but not confirmed collection in SINU may be this (*Kassim s.n.*, 13 Aug 1959, SINU).

Ecology. In shaded places and in fields, plantations and lawns.

Provisional conservation assessment. Globally Least Concern (LC). Probably not native in Singapore (Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 94) but rare nevertheless.

Notes. The epithet *burmanni*, celebrating Burman as Burmannius, is correct and not to be corrected to *burmannii* or *burmanii*.

2. *Oplismenus compositus* (L.) P.Beauv.

(Latin, *compositus* = compound; referring to the inflorescence)

Ess. Agrostogr. (1812) 54, 168; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 145; Ridley, Fl. Malay Penins. 5 (1925) 221; Henderson, Malay. Wild Fls., Monocot. (1954) 335, fig. 192a,b; Burkill, Dict. Econ.

Prod. Malay Penins., ed. 2, 2 (1966) 1613; Gilliland, Rev. Fl. Malaya 3 (1971) 171, fig. 34, pl. 19c; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 95, fig. 95. **Basionym:** *Panicum compositum* L., Sp. Pl. 1 (1753) 57. **Synonyms:** *Orthopogon compositus* (L.) R.Br., Prodr. Fl. Nov. Holland. (1810) 194. – *Orthopogon remotus* Trin., Fund. Agrost. (1820) 181, nom. illeg. superfl. – *Hippagrostis composita* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 777. **Type:** Herb. Hermann vol. 3: 45 (lectotype BM [BM000621970], designated by Hitchcock, U.S.D.A. Bull. 772 (1920) 238). **Fig. 48E.**

Culms 0.3–1.05 m long. **Ligule** c. 2 mm long. **Leaf** blades (3–)4–9(–16) cm by 5–16(–22) mm. **Inflorescence** 2.5–32 cm long; common axis usually glabrous; lowermost raceme 2.5–10 cm long. **Spikelets** in distant pairs, 2.5–3.6(–5.2) mm long (excl. awns), glabrous to pilose, awns smooth, viscid. Lower **glume** 1.8–2.6(–3.7) mm long, (3–)5-nerved, sparsely to densely hairy, awn 3–15 mm long, smooth, viscid; upper glume 1.8–2.5(–3.8) mm long, (5–)7-nerved, awn 0.4–5 mm long. Lower **lemma** epaleate to paleate, sterile, 2.2–3.3(–5) mm long, 9-nerved, glabrous to margins ciliate, apex obtuse to apiculate, mucro 0.1–0.4(–2) mm long, 5-nerved. **Anthers** c. 1 mm long.

Distribution. (Sub)tropical Central and South America, Africa, China, Japan and through continental Southeast Asia and Malesia to Australia, New Zealand and the western Pacific. In Singapore probably not native and only once collected (*Kassim s.n.*, 15 Jun 1959, SINU).

Ecology. Elsewhere on moderately shaded soil, open places in primary and secondary forest.

Provisional conservation assessment. Globally Least Concern (LC). Probably not native in Singapore but nationally extinct nevertheless.

Vernacular name. *Common wood grass* (English).

39. ORYZA L.

(Greek, *oruz*a = rice)

Sp. Pl. 1 (1753) 333; Second, ORSTOM Etudes et Thèses (1985) 1–190; Duistermaat, Blumea 32 (1987) 157; Vaughan, Wild relatives of rice (1994) 1; Terrell et al., Smithsonian Contr. Bot. 91 (2001) 1; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 147. – *Oryza* L. sect. *Euoryza* Baill., Hist. Pl. 12[2] (1893) 165, nom. inval. – *Oryza* L. subg. *Euoryza* Asch. & Graebn., Syn. Mitteleur. Fl. 2 (1898) 10, nom. inval. – *Oryza* L. sect. *Sativa* Roshev., Trudy Prikl. Bot. 27(4) (1931) 37, nom. inval. – *Oryza* L. ser. *Sativae* Sharma & Shastri, Indian J. Genet. Pl. Breed. 25 (1965) 176, nom. inval. **Type:** *Oryza sativa* L.

Annuals or perennials. **Ligule** membranous, nerved. **Leaf** blades inrolled when young, shortly pseudo-petiolate or not, parallel-nerved with or without distinct cross-veins. **Inflorescence** panicate with racemose branches. **Spikelets** solitary, bisexual, 3-flowered, the lower two anthoecia sterile, laterally flattened, usually articulating above the glumes (persistent in the cultigens). **Glumes** reduced to a small sometimes 2-lobed ring. **Sterile lemmas** subequal, usually shorter than the spikelet, 1-nerved. **Fertile lemma** without callus-hairs, 5-nerved, usually awned, dorsally keeled. **Palea** 3-nerved. **Stamens** 6.

Distribution. A genus of about 20 species throughout the tropics and subtropics to temperate regions. In Singapore 1 species is reported to be casual.

Uses. *Oryza sativa* is one of the world's major cereal crops with numerous cultivars. The species is here treated in a wide sense. For an introduction to *Oryza sativa*, and some economically important relatives, see Vergara & De Datta (PROSEA 10 (1996) 102–115), Meertens (PROTA 1 (2006) 112) and an enormous body of professional literature.

Taxonomy. The genus belongs to the *Oryzoideae* – *Oryzinae* Griseb. The morphology of the genus is discussed by Terrell et al. (Smithsonian Contr. Bot. 91 (2001) 1–50). They regard the 'sterile lemmas' or 'glumes' to be 'merely expanded apices of the pedicels'.

Notes. Most authors have distinguished *Oryza sativa* and *O. rufipogon* Griff. on the shedding habit of *O. rufipogon*, a feature which is typical for wild grasses but selected against by farmers. This is very difficult to see in the herbarium. There the most obvious difference seems to be in the length of the anthers. Also, the caryopsis of *Oryza sativa* is somewhat wider. *Oryza rufipogon* was reported for Singapore by Duistermaat (Blumea 32 (1987) 171) and Turner (Gard. Bull. Singapore 45 (1993) 99) but no specimens have been seen and it is excluded here.

***Oryza sativa* L.**

(Latin, *sativus* = cultivated)

Sp. Pl. 1 (1753) 333; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1619; Gilliland, Rev. Fl. Malaya 3 (1971) 99; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 95, fig. 93. – *Oryza sativa* L. f. *spontanea* Roshev., Trudy Prikl. Bot. 27(4) (1931) 37, nom. inval., non Back. (1928). **Type:** *Collector unknown s.n.*, 'Habitat forte in Aethiopia, colitur in Indiae paludosis' (lectotype LINN [Herb. Linn. no. 460.1] designated by Meikle, Fl. Cyprus 2 (1985) 1716). **Fig. 49A.**

Annuals or perennials. **Culms** solitary, sometimes tufted, erect to ascending, 0.5–2 m high, branching intra-, or rarely extra-vaginally at base; nodes glabrous. **Auricles** rarely absent, deciduous, linear-lanceolate and falcate, 1–5 × 0.5–1 mm, hairy, hairs 0–2 mm long. **Ligules** triangular, ovate to ovate-lanceolate, (6–)10–36 × 2.5–8 mm, glabrous, tearing in dry specimen, with or without transverse veinlets. **Leaf** blades linear, 24–60 × 0.6–2.2 cm, glabrous on both sides, beneath smooth to scabrous, without transverse veinlets. **Panicles** loosely contracted, 9–30 × 1–8 cm; branches ascendingly patent to erect, glabrous or axils with a tuft of white hairs, lowermost branches 1–3 together, the longest one 2–13 cm long, simple or branched, spikelets 1–7, with 1–3 secondary branches; pedicels clavate, adaxially curved inward, 1–7 mm long, glabrous to minutely pubescent, tip cup-shaped. **Spikelets** obliquely inserted on their pedicels, not deciduous, ellipsoid to oblong, 7–11 × (2.25–)2.65–4.6 mm, 1.8–3.6 times as long as wide. **Glumes** reduced to minute auricles that form the cup at the tip of the pedicel, 0–0.2 mm long. **Sterile lemmas** ovate-oblong to ovate-lanceolate, 1.4–4 × 0.5–1.7 mm, 0.2–0.4(–0.95) times as long as the spikelet, acuminate to cuspidate, glabrous. **Fertile lemmas** oblong to lanceolate, 6–10.2 × 1.6–3.1 mm, apex acuminate, dorsally sulcate, finely reticulate, covered by glassy hairs, bony, awn very variable, absent to present, slender to stout, callus at base, 0–60(–150) mm long. **Anthers** 0.8–2(–2.5) mm long. **Caryopsis** 5.1–7.5 × 2.2–3.8 mm.

Distribution. Originally from Southeast Asia, now cultivated all over the world in tropical to Mediterranean areas. It is no longer cultivated in Singapore but Duistermaat (Gard. Bull. Singapore 57, Suppl. (2005) 95) reports that it is casual from scattered bird-seed. There are a number of older unlocalised collections reported from Singapore that are not clearly marked as of cultivated plants (*Cantley s.n.*, SING [SING0041598]; *Wee s.n.*, 1961, SINU) and one from Tivoli (*Ridley s.n.*, 29 Dec 1889, SING [SING0036127]).

Ecology. Throughout its range in marshes and wet, inundated fields, in fresh and brackish water, or on dry hill slopes.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. The staple food in many parts of the world, grown in innumerable forms.

Vernacular names. *Rice* (English), *padi* (Malay).

Notes. The literature on this most important cereal crop is vast. For the numerous forms described from Southeast Asia see the more specialised accounts.

40. OTTOCHLOA Dandy

(Otto Stapf, 1857–1933, Austrian botanist, from 1890 at Kew, and from Greek *-chloa* = grass)

J. Bot. 69 (1931) 54; Henrard, Blumea 4(3) (1941) 530; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 331. **Synonyms:** *Panicum* L. sect. *Breviglumae* Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 27, 43. – *Hemigymnia* Stapf, Fl. Trop. Afr. 9(4) (1920) 741, nom. illeg. non Griff. (1843). **Type:** *Ottochloa nodosa* (Kunth) Dandy.

Perennials. **Culms** hollow. **Ligules** rim- to collar-shaped, membranous. **Leaf** blades inrolled when young. **Panicles** composed of branches with short determinate racemes. **Pedicel** apices cupuliform. **Spikelets** paired, biseriate, secund, abaxial, solitary, dorso-ventrally compressed, 2-flowered; callus truncate. **Glumes** subequal to unequal, acute; the lower 0.5–0.7 times as long as the spikelet, 3–5-nerved; the upper 0.5–0.93 times as long as the spikelet, 5–7-nerved. Lower **lemma** epaleate, 5–7-nerved; upper lemma indurate, 5-nerved, dorsally flattened, germination flap present, margins lying flat on the palea, apex minutely crested, microscopically granulate to smooth, white in fruit. **Stamens** 3.

Distribution. A genus of 3 species in the Old World tropics of which 1 species is native in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Boivinellinae* Pilg.

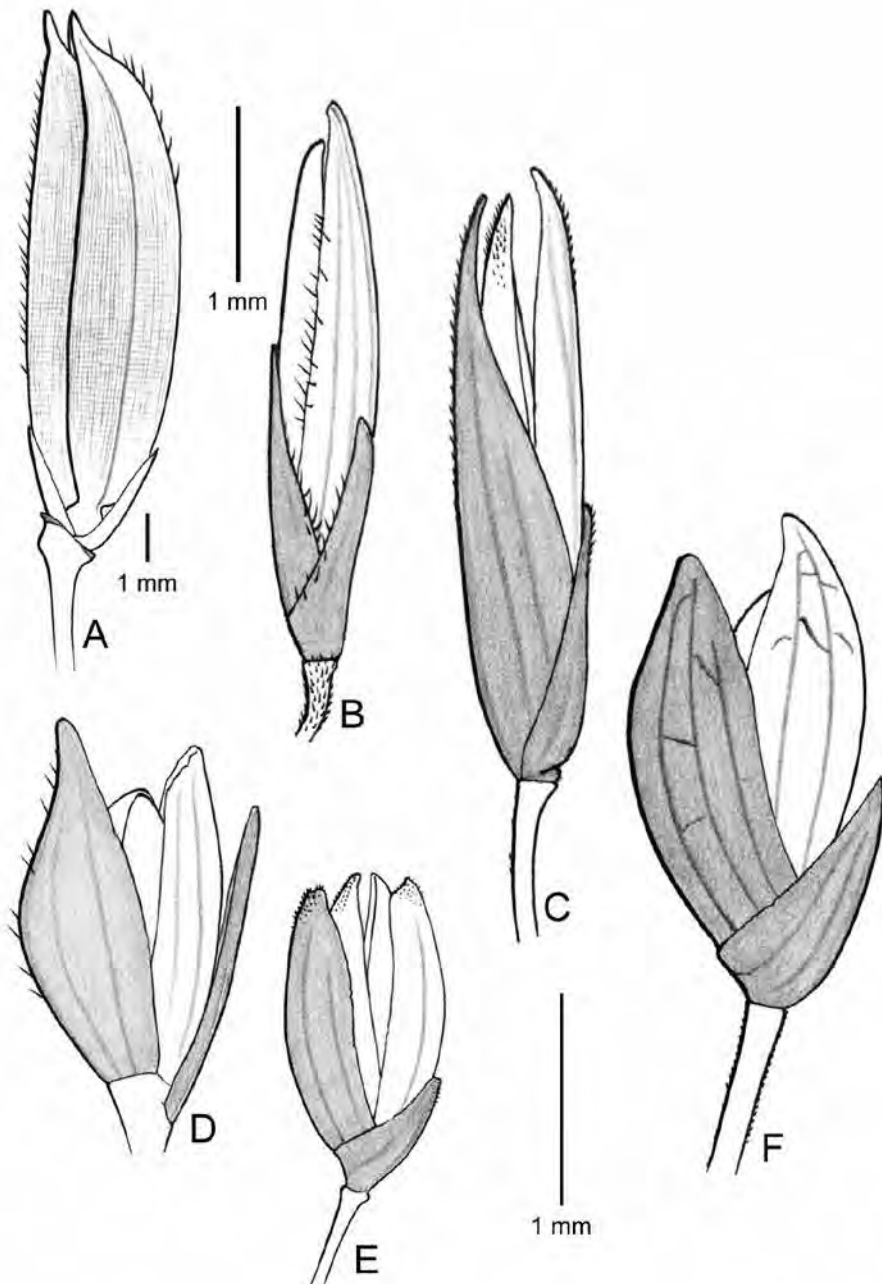


Figure 49. *Oryza sativa* L. **A.** Spikelet, lateral view. *Ottochloa nodosa* (Kunth) Dandy. **B.** Spikelet, lateral view. *Panicum auritum* J.Presl ex Nees. **C.** Spikelet, lateral view. *Panicum brevifolium* L. **D.** Spikelet, lateral view. *Panicum laxum* Sw. **E.** Spikelet, lateral view. *Panicum luzonense* J.Presl. **F.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

Ottochloa nodosa (Kunth) Dandy

(Latin, *nodosus* = knotted; possibly referring to the long culms with obvious nodes)

J. Bot. 69 (1931) 55; Turner, Gard. Bull. Singapore 45 (1993) 99; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 174; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 96, fig. 96; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 65, 170, 229. **Basionym:** *Panicum nodosum* Kunth, Enum. Pl. 1 (1833) 97; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 137; Henderson, Malay. Wild Fls., Monocot. (1954) 332, fig. 190a,d. **Synonyms:** *Panicum multinode* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 303, nom. illeg. non Lam. (1798). – *Hemigymnia multinodis* Stapf, Fl. Trop. Afr. 9(4) (1920) 742, nom. illeg. superfl.; Ridley, Fl. Malay Penins. 5 (1925) 228; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1156. **Type:** *Haenke s.n.* [Philippines, Luzon, Sorsogon] (lectotype MO [MO-2114722]), designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 47; isoelectotypes B, BM, HAL, LE [Herb. Trinius 844.1], PR [sheet nos. 194817A and B, 194818A and B], US (fragment), W [$\times 3$]. **Fig. 49B, 50.**

Panicum arnottianum Nees ex Steud., Syn. Pl. Glumac. 1, fasc. 1 (1853) 59. **Synonyms:** *Hemigymnia arnottiana* (Nees ex Steud.) Stapf, Fl. Trop. Afr. 9(4) (1920) 742. – *Ottochloa arnottiana* (Nees ex Steud.) Dandy, J. Bot. 69 (1931) 55. **Type:** *Macrae s.n.* (Wight 36), Ceylon [Sri Lanka], 1829 (lectotype B [B100366169]), designated by Turner et al., Gard. Bull. Singapore 71 (2019) 23; probable isoelectotype CGE).

Hemigymnia fusca Ridl., Fl. Malay Penins. 5 (1925) 228; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 1156. **Synonyms:** *Ottochloa fusca* (Ridl.) Dandy, J. Bot. 69 (1931) 55. – *Panicum creperum* Reeder, J. Arnold Arbor. 29 (1948) 267, nom. illeg. superfl. **Type:** *Ridley 1704*, Singapore, Chan Chu Kang, March 1890 (lectotype SING [SING0041601]), designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 16; isoelectotype K [K000290325]).

Culms erect to scrambling, rooting at the decumbent nodes, branching intra-vaginally, 0.3–1.5(–2) m long; nodes glabrous or hairy. **Ligule** 0.5–0.7 mm long, glabrous. **Leaf** blades (3–)4.5–17(–27.5) cm by (6–)8–16(–18) mm, glabrous to densely hairy, pseudopetiole 0.7–2 mm long, 7–13-nerved below. **Panicles** contracted to lax, (4–)10–28 \times (0.8–)1.5–12(–22) cm; longest lowermost inflorescence branch (0.8–)4–17.5 cm long, simple (if branched, branchlets very short) to branched, clusters of spikelets usually very remote with long internodes, rarely close-set; pedicels 0.5–1.3 mm long. **Spikelets** (2.6–)2.9–3.4(–3.75) \times 0.8–1.5 mm, glabrous to shortly pilose (usually). Lower **glume** 1–1.7(–2.1) mm long, (0.45–)0.7–0.87(–1) times as long as the upper glume, obtuse, 3–5-nerved; upper glume 1–2.2(–2.6) mm long, 0.33–0.72(–0.8) times as long as the spikelet, 5–7-nerved. Lower **lemma** glabrous to hairy, obtuse to truncate, 7–9-nerved; upper lemma microscopically granulate, 5-nerved. **Anthers** 0.75–1.3(–1.8) mm long.

Distribution. Central Africa, Sri Lanka and India to southern China, and through continental Southeast Asia and Malesia to Australia (eastern Queensland). Native in Singapore and widely collected, including from Bishan-Ang Mo Kio Park (*Chen SING2017-767*, 12 Dec 2017, SING [SING0254006]), Bukit Timah (*Ali Ibrahim et al. SING2017-266*, 4 Jul 2017, SING [SING00231224]), Freshwater Isle [Pulau Bukom] (*Ridley 79*, 13 Jan 1889, SING [SING0041602]), MacRitchie (*Duistermaat et al. 196*, 27 Sep 2003, SING [SING0060187]) and Sungei Buloh (*Chua & Wee 481*, 22 May 1991, SING).



Figure 50. *Ottochloa nodosa* (Kunth) Dandy. **A.** Inflorescence. **B.** Detail of inflorescence. **C.** Detail of leaf sheath and blade. (From Singapore, Bishan Park, *Chen SING2017-767*. Photos: L.M.J. Chen).

Ecology. Somewhat shaded, not too dry places, such as at forest margins.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Slender panic grass* (English).

Notes. The species is variable in its indumentum, the structure of the inflorescence, the colour of the spikelets, etc. Attempts have, therefore, been made to divide it up but due to the very many intermediate forms this is untenable. A mutant with the upper floret having 4 ovaries with 2 or 3 stigmas each occurs rarely.

41. PANICUM L.

(Latin, *panicum* = bread; due to some species being a cereal crop)

Sp. Pl. 1 (1753) 55; Veldkamp, *Blumea* 41 (1996) 181; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 341. **Synonyms:** *Panicum* L. subg. *Eupanicum* Hack., *Oesterr. Bot. Z.* 51 (1901) 369, nom. inval. – *Panicum* L. sect. *Miliaria* Trin., *Gram. Panic.* (1826) 53, 184, nom. illeg. superfl. – *Panicum* L. sect. *Eupanicum* Benth. in Bentham & Hooker, *Gen. Pl.* 3(2) (1883) 1102, nom. inval. – *Panicum* L. subg. *Miliaria* Honda, *J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot.* 3 (1930) 243, nom. illeg. superfl. **Type:** *Panicum miliaceum* L., lectotype designated by Hitchcock & Chase, *Contr. U.S. Natl. Herb.* 15 (1910) 14.

Annuals or perennials. **Culms** hollow or filled with pith. **Ligule** from a row of hairs to a setose membranous collar. **Leaf** blades inrolled when young. **Panicles** with branches pointing in all directions and ending in a spikelet. **Pedicel** apices cupuliform. **Spikelets** usually paired or solitary, disarticulating below the glumes, or glumes deciduous and fertile floret somewhat persistent, abaxial, dorso-ventrally compressed, muticous (glumes sometimes awned); callus truncate. Lower **glume** much shorter than to as long as the spikelet, 0–9-nerved; upper glume as long as the spikelet, 5–15-nerved. Lower **lemma** paleate and male to epaleate and sterile, 3–11-nerved, herbaceous, not longitudinally grooved, without a hyaline area at the base; upper lemma coriaceous, 3–11-nerved, smooth to microscopically sculptured, not rugose, germination flap present, yellow to brown in fruit, margins inrolled over the palea, muticous to microscopically crested. **Stamens** 2 or 3.

Distribution. A pantropical genus of approximately 450 species, extending into the subtropics and a few into temperate areas. In Singapore there are 8 species of which 4 are native and 4 introduced.

Taxonomy. The genus belongs to the *Panicoideae* – *Panicineae* Fr.

Notes. A very large genus, formerly even larger as it was the default genus for otherwise unplaced panicoid taxa. Molecular phylogenetic research (Morrone et al., *Cladistics* 28 (2012) 333–356; Grass Phylogeny Working Group II, *New Phytologist* 193 (2012) 304–312), based mainly on sampling of American taxa, suggests that it should be broken up into smaller

genera. As only a few Malesian taxa were included in these studies, and the morphological differences between the groupings is often rather obscure, the wider circumscription from the late twentieth century is maintained here. *Panicum auritum* and *P. (Steinchisma) laxum* are consequently included here in *Panicum*. *Panicum maximum* Jacq. has been shown to be a *Urochloa* (note the rugose upper lemma).

Key to *Panicum* species

1. Lower glume collar-shaped; culms inflated at base; spikelets acuminate 2
Lower glume deltoid or ovate; culms not inflated at base; spikelets obtuse or acute 3
2. Sheaths glabrous, margins glabrous; ligule a pilose collar; blades glabrous; spikelets 3.3–4.5 mm long; upper glume 3.3–4.1 mm long; lower lemma epaleate or paleate, sterile
.....**5. *P. paludosum***
Sheaths puberulous, margins pilose; ligule a membranous ciliolate collar; blades pilose; spikelets 2.6–3.25 mm long; upper glume 2.6–3.0 mm long; lower lemma paleate, male (anthers often shining through) **6. *P. repens***
3. Blades linear-lanceolate or linear; panicle branches without glands; lower glume 0.12–0.83 times as long as the spikelet; upper glume and lower lemma obtuse or acute 4
Blades ovate-lanceolate; panicle branches with minute glands; lower glume 0.88–0.96 times as long as the spikelet; upper glume and lower lemma acuminate ... **2. *P. brevifolium***
4. Panicle not composed of spike-like racemes; spikelets 1.5–3.0 mm long; upper glume 1.65–3 mm long; anthers 0.75–2 mm long 5
Panicle composed of spike-like racemes; spikelets 1.1–1.4 mm long; upper glume 1.1–1.3 mm long; anthers c. 0.5 mm long **3. *P. laxum***
5. Perennial; nodes glabrous or puberulous; blade margin at base glabrous or hairy; glumes without a distinct internode; upper glume 5–7-nerved; upper lemma apex acute to apiculate 6
Annual; nodes bearded; blade margin at base pectinate; glumes with a distinct internode; upper glume 9–11-nerved; upper lemma apex obtuse **4. *P. luzonense***
6. Blade base rounded to pseudo-petiolate; panicle main axis smooth; pedicels smooth or pilose under the spikelet; upper lemma apex apiculate, incurved; stamens 3 7
Blade base truncate or cordate; panicle main axis scaberulous; pedicels scaberulous; upper lemma apex acute or acuminate, straight; stamens 2 **1. *P. auritum***
7. Ligule a pilose collar; blades 10–30 mm wide; panicle laxly contracted, branches with spikelets to base; spikelets obtuse; lower glume ovate, 1.05–1.9 mm long, 0.48–0.83 times as long as the spikelet, acute, 3–5-nerved; upper glume acute; lower lemma nerves without transverse veinlets; lower palea 0.55–0.77 times as long as the lemma; anthers 0.9–1.1 mm long **7. *P. sarmentosum***

Ligule a membranous ciliolate collar; blades 4–8 mm wide; panicle lax to very lax, branches naked at base; spikelets acute; lower glume deltoid, 0.3–0.9 mm long, 0.12–0.3 times as long as the spikelet, retuse to obtuse, 0-nerved; upper glume obtuse; lower lemma nerves with transverse veinlets; lower palea as long as the lemma; anthers 1.3–2 mm long **8. *P. trichocladum***

1. *Panicum auritum* J.Presl ex Nees

(Latin, *auritus* = eared; application uncertain)

in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 176; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 135; Ridley, Fl. Malay Penins. 5 (1925) 226; Henderson, Malay. Wild Fls., Monocot. (1954) 332, fig. 190h–k; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1684; Turner, Gard. Bull. Singapore 45 (1993) 100; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 174; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 99, fig. 97; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 66, 170, 272. **Synonyms:** *Hymenachne aurita* (J.Presl ex Nees) Balansa, J. Bot. (Morot) 4 (1890) 144. – *Sacciolepis aurita* (J.Presl ex Nees) A.Camus, Fl. Indo-Chine 7, fasc. 4 (1922) 459. **Type:** *Haenke s.n.*, Philippines (lectotype MO [MO-156243], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 46; isolectotypes BM, HAL, LE [Herb. Trinius 592.2], PR [sheet nos. 194822A and B, 194823A and B, 194824A, B and C], W [×3]). **Fig. 49C.**

Perennial, rhizome and cataphylls present. **Culms** solitary, erect, 0.5–2(–4) m long, erect to geniculate at base or sometimes scrambling, hollow, not inflated at base; nodes glabrous. **Sheaths** glabrous, margins glabrous to 1 margin hairy. **Ligule** a membranous collar, ciliolate, 0.4–1 mm long. **Leaf** blades flat or loosely involute, linear, (5–)10–60 cm by (2–)4–35 mm, (sub)glabrous, base truncate to cordate, margin pectinate at base, apex long-acuminate, underneath with 7–18 major nerves. **Panicle** branches appressed to laxly contracted, erecto-patent, (5–)9–45 × (0.5–)2–15 cm. Main axis scaberulous, glabrous. **Panicle branches** scaberulous, glabrous, spikelets present to base, the lowermost solitary, eglandular, the lowermost longest one (1–)1.5–18 cm long; pedicels 0.5–1.8 mm long, shorter than the spikelets, scaberulous. **Spikelets** not yawning at maturity, 2–3 × 0.7–0.8 mm, acute to acuminate. **Glumes** without a distinct internode, glabrous; lower glume ovate, 0.75–1.3 mm long, 0.3–0.5 times as long as the spikelet, acute, faintly 3–5-nerved; upper glume 2–3 mm long, acute, glabrous, 5–7-nerved, nerves with very faint transverse veinlets. Lower **lemma** epaleate or paleate, sterile, acute, glabrous, 5(–7)-nerved, nerves without or with very faint transverse veinlets. Lower **palea** 0.6–1.7 mm long, 0–0.8 times as long as the lemma (very inconspicuous, check in dry spikelet). Upper **lemma** sessile, smooth, shiny, glabrous to apically microscopically scaberulous, 1.6–2.4 mm long, apex acute to acuminate, straight. **Stamens** 2, anthers 0.75–1 mm long.

Distribution. Sri Lanka and India to southern China (Guangdong) and through continental Southeast and Malesia. Native in Singapore and widely but infrequently collected, including from Ang Mo Kio (*Ridley 81*, 8 Mar 1889, SING [SING0041610]), Cluny Road (*Hose 75*, Jan 1904, SING [SING0041613]), Geylang (*Teruya 2522*, Jul 1934, SING [SING0041605]), Newton (*Teruya s.n.*, 22 Jun 1933, SING [SING0041607]) and the Race Course (*Teruya 558*, 21 Apr 1929, SING [SING0058867]).

Ecology. Can grow in shallow water, but usually collected on dry land in sunny to slightly shaded humid places.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Vernacular names. *Giant panic grass* (English), *rumput kumpai* (Malay).

2. *Panicum brevifolium* L.

(Latin, *brevi-* = short, *-folium* = leaved; with short leaves)

Sp. Pl. 1 (1753) 59; Henderson, Malay. Wild Fls., Monocot. (1954) 329, fig. 188a–c; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1684; Turner, Gard. Bull. Singapore 45 (1993) 100; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 175; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 99, fig. 98. **Type:** *Collector unknown s.n.*, India (lectotype LINN [Herb. Linn. no. 80.64], designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 496). **Fig. 49D.**

Panicum ovalifolium Poir., Encycl., Suppl. 4 (1816) 279; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Fl. Malay Penins. 5 (1925) 227. **Type:** *Collector unknown s.n.*, Guinea (holotype P [P00442141]).

Panicum hirtifolium Ridl., Fl. Malay Penins. 5 (1925) 228. **Synonym:** *Panicum brevifolium* L. var. *hirtifolium* (Ridl.) Jansen, Reinwardtia 2 (1953) 315. **Type:** *Ridley 12046*, [Malaysia], Malay Peninsula, Selangor, Semangkok, 1904 (lectotype SING [SING0054931], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 25; isolectotype K [K000290294]).

Annual. **Culms** 0.3–1.2 m long, creeping and geniculate at base, rooting from the decumbent nodes, hollow, not inflated at base, glabrous to pilose; internodes hollow; nodes glabrous to bearded (on one side). **Sheaths** glabrous to pilose, margins pilose. **Ligule** a membranous collar, glabrous to ciliolate, c. 0.5 mm long. **Leaf** blades ovate-lanceolate, 1.75–8 cm by 5–27 mm, glabrous to appressed pilose, base cordate, margin pectinate at base, underneath with 9–13 major nerves. **Panicle** very lax, 2.5–15 × 2–8 cm, main axis smooth, glabrous to pilose; branches erecto-patent, glabrous to pilose, with minute glandular patches, naked at base, the lowermost solitary to fascicled (1–3), the longest one 1.5–8 cm long; pedicels c. 1.5 mm long, longer than the spikelets, usually smooth. **Spikelets** not yawning at maturity, 1.6–2.1 × 0.6 mm, acute. **Glumes** with a distinct internode; lower glume ovate, 1.6–1.95 mm long, 0.88–0.96 times as long as the spikelet, acute, 1–3-nerved; upper glume and lower lemma acuminate, glabrous to sparsely puberulous, 5-nerved, nerves without transverse veinlets; upper glume 1.5–1.9 mm long, 5-nerved. Lower **lemma** paleate, sterile (said to be sometimes male). **Palea** 0.88–1 times as long as the lemma. Upper **lemma** sessile, c. 1.3 mm long, smooth, shiny, glabrous, apex acute, straight. **Anthers** 3, 0.75–1 mm long.

Distribution. Tropical Africa and Asia. In Singapore possibly casual or formerly naturalising; only once collected on Government Hill [Fort Canning] (*Ridley s.n.*, Jan 1894, SING [SING0017792]).

Ecology. Elsewhere in shady localities, in thickets, forest margins, plantations and in rice fields, locally dominant.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Short-leaved panic grass* (English).

3. *Panicum laxum* Sw.

(Latin, *laxus* = lax; possibly due to the structure of its inflorescence)

Prodromus (1788) 23; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 100, fig. 99. **Synonym:** *Steinchisma laxa* (Sw.) Zuloaga in Aliscioni et al., Amer. J. Bot. 90 (2003) 817; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 171, 268. **Type:** Swartz *s.n.*, Jamaica (lectotype S [S-R-3977], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 143; possible isolectotypes UPS [$\times 2$], US (fragment)). **Fig. 49E, 51.**

Annual or perennial, rhizome absent, cataphylls absent. **Culms** single or tufted, geniculate to prostrate, 0.2–0.45 m long, erect or geniculate at base, hollow, not inflated at base; internodes hollow; nodes glabrous. **Sheaths** glabrous, margins pilose, with transverse veinlets. **Ligule** a membranous collar, ciliolate, 0.3–0.4 mm long. **Leaf** blades flat or involute, linear, 2–11 cm by 2–10 mm, glabrous, base rounded to truncate, margin at base glabrous, apex acute, underneath with 5 or 7 major nerves. **Panicle** composed of spike-like racemes, laxly contracted, the branches erecto-patent to lax, 4–13 \times 1–5 cm; main axis smooth, glabrous, branches scaberulous, glabrous, spikelets present to base or naked at base, eglandular, the lowermost solitary, 1.3–6 cm long; pedicels 0.5–1 mm long, shorter than the spikelets, scaberulous. **Spikelets** paired, not yawning at maturity, 1.1–1.4 \times c. 0.7 mm, obtuse. **Glumes** without a distinct internode; lower glume ovate, 0.5–0.7 mm long, 0.38–0.54 times as long as the spikelet, obtuse, 1- or 3-nerved; upper glume 1.1–1.3 mm long, obtuse, glabrous, 3–5-nerved, without transverse veinlets. Lower **lemma** paleate, sterile, obtuse to acute, glabrous, 3- or 5-nerved, nerves without transverse veinlets. **Palea** 0.9–1 times as long as the lemma, not enlarged or indurate at maturity. Upper **lemma** sessile, smooth, shiny, glabrous, apex obtuse, straight. **Anthers** 2, c. 0.5 mm long.

Distribution. Mexico and West Indies to Paraguay and Argentina, introduced in West Africa, India, Australia (Queensland) and Malesia. Naturalised in Singapore and collected from Bishan-Ang Mo Kio Park (*Chen SING2017-703*, 16 Nov 2017, SING [SING0233530]), Clementi Road (*Duistermaat 285*, 21 Mar 2004, K, L, SING [SING0064174]), Holland Grove Road (*Duistermaat 037*, 4 Mar 2002, L, SING [SING0064173]), Pulau Serangoon (*Tan 1269*, 14 Jan 2004, SINU) and Sembawang Crescent (*Boo SING2011-167*, 18 Mar 2011, SING [SING00170111]).

Ecology. Moist to wet grassland, forest edges and roadsides.



Figure 51. *Panicum laxum* Sw. **A.** Habit. **B.** Detail of inflorescence. **C.** Detail of leaf sheath and blade. (From Singapore, HortPark, Chen SING2017-738. Photos: L.M.J. Chen).

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. The Malesian material differs slightly from the American specimens by the relatively short culms and the absence of broad (i.e. more than 10 mm wide) leaves.

4. *Panicum luzonense* J.Presl

(of Luzon)

in Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 308; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 136; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 175; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 100, fig. 100; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 66, 170, 229. **Type:** *Haenke s.n.*, Philippines, Luzon, Sorsogon (lectotype PR [sheet no. 612343], designated by Veldkamp, Blumea 41 (1996) 195; isolectotype LE [Herb. Trinius 800.1], W). **Fig. 49F.**

Panicum cambogiense Balansa, J. Bot. (Morot) 4 (1890) 142; Turner, Gard. Bull. Singapore 45 (1993) 100. **Type:** *Godefroy 62*, Cambodge [Cambodia], 1875 (lectotype L [L0044815], designated by Veldkamp, Blumea 41 (1996) 195; isolectotypes K [K000290303] (fragment), P).

Panicum reticulatum Thwaites ex Trimen in Britten, J. Bot. 23 (1885) 271, nom. illeg. non Torrey (1852). **Synonyms:** *Panicum caesium* Nees [ex Trimen, J. Bot. 23 (1885) 139, nom. nud.] ex Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 48, nom. illeg. non Nees (1837); Ridley, Fl. Malay Penins. 5 (1925) 225. – *Panicum cruciabile* Chase, J. Arnold Arbor. 20 (1939) 309. **Type:** *CP 3890*, Sri Lanka (lectotype PDA, designated by Veldkamp, Blumea 41 (1996) 195).

Panicum tuberculatum auct. non J.Presl: Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1686.

Annual. **Culms** tufted, 0.15–1.55 m long, more or less erect, hollow, not inflated; nodes bearded. **Sheaths** tuberculately hispid, without cross-veins, margins pilose. **Ligule** a row of hairs or a pilose collar, 1–2.1 mm long. **Leaf** blades linear-lanceolate to linear, 2.5–39 cm by 3.5–13 mm, pilose, rarely puberulous or tuberculately hispid, green, base rounded to subcordate, margin pectinate at base and often along the margins, underneath without major nerves (but for midrib), or with 9–17 faint major nerves. **Panicles** laxly contracted to very lax, 7–52 × 4.5–15 cm, main axis scaberulous, pilose, rarely glabrous, branches glabrous to sparsely pilose, eglandular, spikelets present to base or not, the lowermost solitary to fascicled, the longest one 3–29 cm long; pedicels 0.8–3 mm long, shorter to longer than the spikelets, glabrous, scaberulous. **Spikelets** not yawning at maturity, 2–2.55(–2.85) × 0.7–1.1 mm, acute. **Glumes** somewhat distant, glabrous; lower glume broadly ovate, 0.75–1.1(–1.4) mm long, 0.32–0.51 times as long as the spikelet, obtuse to acute, 5–9-nerved; upper glume and lower lemma acute, glabrous, nerves with transverse veinlets; upper glume 1.6–2.6 mm long, 7–11-nerved, with transverse veins. Lower **lemma** paleate, sterile, 5–11-nerved. **Palea** 1.6–1.7 mm long, 0.8–1 times as long as the lemma. Upper **lemma** sessile, 1.3–1.4 mm long, apex obtuse, straight, smooth, shiny, glabrous. **Anthers** 3, 0.7–1.1(–1.3) mm long.

Distribution. Sri Lanka, India and Myanmar to southern China, through continental Southeast Asia and Malesia, to northern Australia. Native in Singapore and collected from Balestier

Plains (*Ridley 6255*, 1894, SING [SING0041615]), Bukit Timah (*Wong s.n.*, 7 Jun 1959, SINU), Raffles College grounds (*Nur SF 26113*, 14 Nov 1932, K, L, SING [SING0041616]), Tampines Road (*Wong s.n.*, Aug 1959, SINU) and Ulu Pandan (*Wong s.n.*, Jul 1959, SINU).

Ecology. Elsewhere in open, sunny to moderately shaded roadsides, waste areas, fields, beaches, and grasslands.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Notes. Very variable in size. Small plants have been called *Panicum capillare* L., which is a North American species, large ones *P. cambogiense*.

5. *Panicum paludosum* Roxb.

(Latin, *paludosus* = marshy, swampy; growing in marshes)

[Hort. Bengal. (1814) 8, nom. nud.] Fl. Ind. 1 (1820) 310; Gilliland, Rev. Fl. Malaya 3 (1971) 134, pl. 14f; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 102, fig. 102. **Synonyms:** *Panicum decompositum* R.Br. var. *paludosum* (Roxb.) Trimen, Syst. Cat. Fl. Pl. Ceylon (1885) 105. – *Panicum repens* L. var. *paludosum* (Roxb.) Kuntze, Revis. Gen. Pl. 3(3) (1898) 363. – *Panicum proliferum* Lam. var. *paludosum* (Roxb.) Stapf in Thiselton-Dyer (ed.) Fl. Cap. 7(3) (1899) 407. **Type:** *Roxburgh s.n.* [EIC 8711A] (lectotype K-W [K001131333], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 28). **Fig. 52A.**

Panicum proliferum auct. non Lam.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 139; Ridley, Fl. Malay Penins. 5 (1925) 225; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1686.

Perennial aquatics. **Rhizome** said to be present (not seen). **Culms** 0.25–1 m long (erect part), geniculate at base to creeping, rooting from the decumbent nodes, hollow, without aerenchyma, inflated; nodes glabrous. **Sheaths** glabrous, without transverse veins. **Ligule** a pilose collar, c. 1.5 mm long. **Leaf** blades linear, 9–30 cm by 5–15(–22) mm, glabrous, green, base truncate, margin glabrous to pectinate at base, underneath with 9–12(–19) major nerves. **Panicles** laxly contracted, the branches erecto-patent to lax, 8.5–25(–30) × 2.5–12(–30) cm; main axis glabrous; branches erecto-patent, eglandular, naked at base, the lowermost solitary to subopposite or whorled, the longest one 6–13(–20) cm long; pedicels longer than the spikelet, glabrous, scaberulous. **Spikelets** not yawning at maturity, 3.3–3.9(–4.5) × c. 1 mm, acute to acuminate. **Glumes** without a distinct internode; lower glume collar-shaped, 0.5–1 mm long, 0.15–0.29 times as long as the spikelet, truncate to erose to abruptly acute, 0-nerved; upper glume and lower lemma acuminate, glabrous, 7–9-nerved, nerves with or without transverse veinlets; upper glume 3.3–3.9(–4.1) mm long, glabrous. Lower **lemma** paleate (rarely completely epaleate), sterile. **Palea** (0–)0.32–0.7 times as long as the lemma. Upper **lemma** sessile, 2–2.2 mm long, acuminate, smooth, shiny, glabrous. **Anthers** 3, 1–1.65 mm long.

Distribution. Pakistan, India and Sri Lanka to Taiwan, Southeast Asia and Malesia to northern Australia. Probably native in Singapore but infrequently collected including from an unknown locality (*Keng et al.* 4066, 18 Nov 1965, SINU), Pulau Semaku (*Chua et al.* 867, 22 Sep 1992, SINU) and Tampines Road (*Wong s.n.*, 7 Aug 1959, SINU).

Ecology. Shallow water, bogs and ditches.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

6. *Panicum repens* L.

(Latin, *repens* = creeping; referring to the habit)

Sp. Pl., ed. 2, 1 (1762) 87; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 139; Ridley, Fl. Malay Penins. 5 (1925) 225; Henderson, Malay. Wild Fls., Monocot. (1954) 330; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1686; Turner, Gard. Bull. Singapore 45 (1993) 100; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 175; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 103, fig. 103, pl. 21; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 66, 170, 229. **Type:** *Alströmer 2a*, [Spain] (lectotype LINN [Herb. Linn. no. 80.47], designated by Hitchcock & Chase, Contr. U.S. Natl. Herb. 15 (1910) 85). **Fig. 52B, 53A.**

Perennial, terrestrial or aquatic. **Culms** rhizomatous, (0.15–)0.3–0.85(–1.5) m long, erect or geniculate at base, or creeping and rooting at the decumbent nodes, over 1.5 m long, hollow, inflated, without aerenchyma; nodes glabrous. **Sheaths** glabrous to sparsely pilose, margins pilose, with transverse nerves. **Ligule** a ciliate rim, 0.5–0.8 mm. **Leaf** blades linear, 4–22(–30) cm by 2.5–6(–9) mm, pilose above, rarely glabrous, green, base truncate, margin pectinate at base, underneath with 7–9 major nerves. **Panicles** laxly contracted, (7–)13–22 × 2–9 cm; main axis glabrous; branches erecto-patent, eglandular, naked at base, the lowermost one solitary, (3.5–)8.5–14(–19) cm long; pedicels as long as to longer than the spikelet, glabrous, scaberulous. **Spikelets** not yawning at maturity, 2.6–3.1(–3.25) × 0.9–1 mm, acute to acuminate. **Glumes** without a distinct internode, glabrous; lower glume collar-shaped, 0.45–0.8 mm long, 0.15–0.24 times as long as the spikelet, truncate, 0-nerved; upper glume and lower lemma acuminate, 9-nerved, nerves without transverse veinlets; upper glume 2.6–3 mm long. Lower **lemma** paleate, male, glabrous. **Palea** 0.8–0.92 times as long as the lemma. Upper **lemma** sessile, 2–2.2 mm long, apex acuminate, straight, smooth, shiny, glabrous. **Anthers** 3, 1–1.5 mm long.

Distribution. Throughout the tropics and subtropics but probably introduced in the Malesian region. Consequently, probably not native but rather naturalised in Singapore and widely but infrequently collected, including from Bishan-Ang Mo Kio Park (*Chen SING2017-704*, 16 Nov 2017, SING [SING0233531]), Changi (*Ridley 1699*, 7 Oct 1890, SING [SING0041622]), Jurong Park (*Chua & Tan 401*, 12 Feb 1991, SINU), Sungei Buloh (*Chua et al. SB 3022*, 13 Oct 1993, SINU) and Sungei Serangoon (*Tan 1218*, 17 Dec 2003, SINU).

Ecology. Sunny to slightly shaded, usually humid places, lawns and along sandy sea shores (salt and heavy metal resistant).

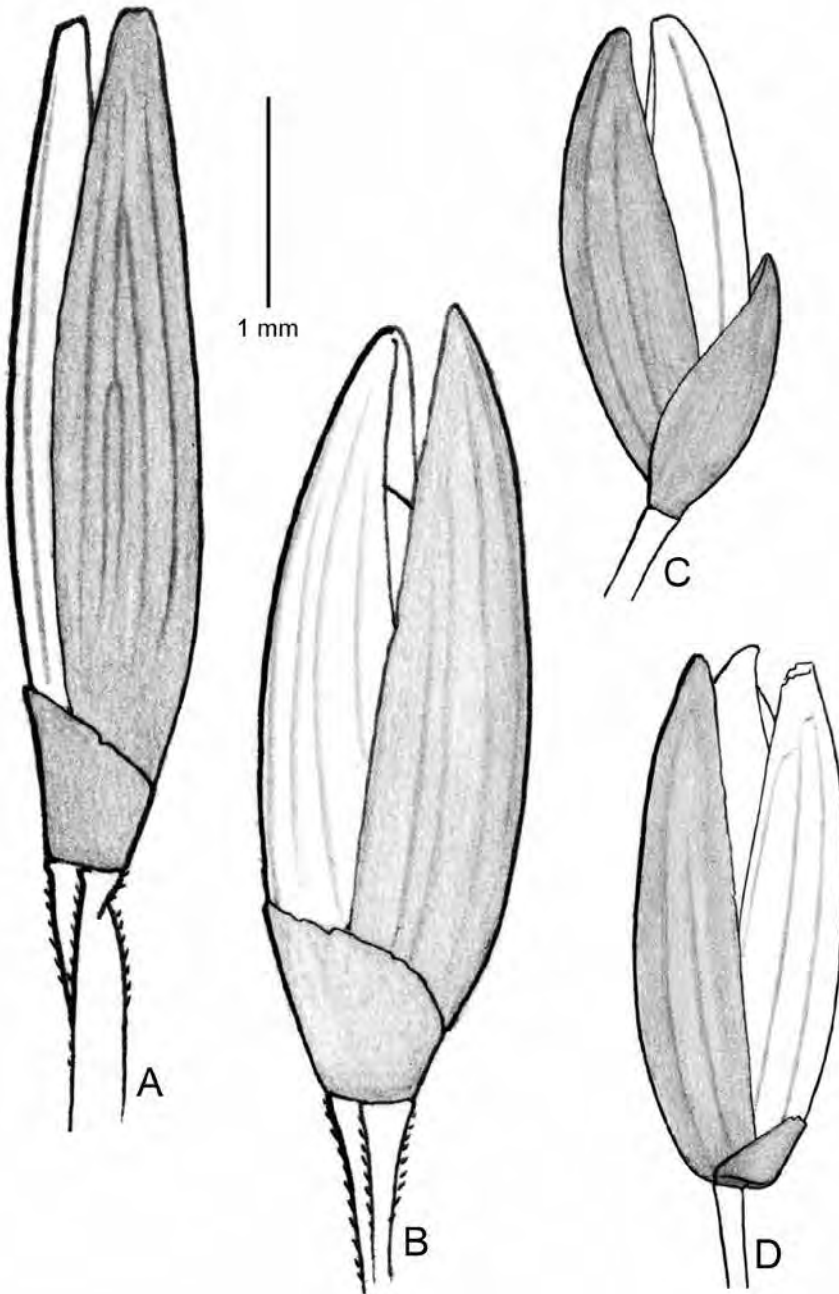


Figure 52. *Panicum paludosum* Roxb. **A.** Spikelet, lateral view. *Panicum repens* L. **B.** Spikelet, lateral view. *Panicum sarmentosum* Roxb. **C.** Spikelet, lateral view. *Panicum trichocladum* Hack. ex K.Schum. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).



Figure 53. *Panicum repens* L. **A.** Two inflorescences. *Paspalum conjugatum* P.J.Bergius. **B.** Detail of raceme. *Paspalum scrobiculatum* L. var. *bispicatum* Hack. ex Merr. **C.** Detail of raceme. (From Singapore, A from Singapore Botanic Gardens; B, C exact localities uncertain. Photos: H. Duistermaat).

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Creeping panic grass* (English).

Notes. Never seen with open flowers or ripe grains so possibly only propagating vegetatively.

7. *Panicum sarmentosum* Roxb.

(Latin, *sarmentosus* = with long runners)

[Hort. Bengal. (1814) 8, nom. nud.] Fl. Ind. 1 (1820) 311; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 140; Henderson, Malay. Wild Fls., Monocot. (1954) 332, fig. 190e–g; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1686; Gilliland, Rev. Fl. Malaya 3 (1971) 139, pl. 17b, colour pl. 4; Turner, Gard. Bull. Singapore 45 (1993) 100; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 103, fig. 104; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 66, 170, 229. **Type:** *Roxburgh s.n.* (lectotype BR [BR0000006883584], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 30). **Fig. 52C.**

Panicum incoctum Trin., Gram. Panic. (1826) 200. **Type:** *Von Chamisso s.n.*, Philippines, Manila (lectotype LE [Herb. Trinius 760.2], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 25).

Panicum concinnum Nees, Hooker's J. Bot. Kew Gard. Misc. 2 (1850) 97, nom. illeg. non Schrad. (1838); Ridley, J. Straits Branch Roy. Asiat. Soc. 23 (1891) 21. **Type:** *Cuming 2284*, Philippines (lectotype CGE [06335(CGE)]), designated by Veldkamp, *Blumea* 41 (1996) 203; isolectotypes E, K, L, MO, P).

Perennial. **Culms** rhizomatous (?), 0.7–8(–15) m long, scrambling, rooting from the lower nodes, filled with pith to hollow, not inflated at base; nodes glabrous to puberulous. **Sheaths** disarticulating at base, glabrous to pilose, transverse nerves absent, margins pilose. **Ligule** a pilose collar, 0.6–0.8 mm long. **Leaf** blades linear, (12–)16–38(–45) cm by 10–30 mm, glabrous to puberulous, green, base rounded to slightly pseudo-petiolate, margin glabrous to hairy at base, underneath with 11–18 major nerves. **Panicle** laxly contracted, (12–)18–37(–50) × 5–17(–27) cm; main axis smooth, sometimes viscid, pilose to glabrous upward; branches erecto-patent to patent, (6–)18–37(–50) cm long, puberulous to glabrous upward, eglandular, spikelets present more or less to base, the lowermost solitary to paired, the longest one 5–19 cm long; pedicels shorter than to as long as the spikelets, smooth. **Spikelets** not yawning at maturity, (1.5–)2–2.55 × 0.7–0.9 mm, obtuse. **Glumes** without a distinct internode, glabrous to puberulous; lower glume ovate, 1.05–1.9 mm long, 0.48–0.83 times as long as the spikelet, acute, 3–5-nerved; upper glume and lower lemma acute, 5-nerved, nerves without transverse veinlets; upper glume 1.65–2.5 mm long, 5-nerved. Lower **lemma** paleate, sterile, rarely male. **Palea** 0.55–0.77 times as long as the lemma. Upper **lemma** sessile, 1.5–1.8 mm long, smooth, shiny, glabrous to apically microscopically scaberulous, apex apiculate, incurved. **Anthers** 3, 0.9–1.1 mm long.

Distribution. India to southern China and Taiwan and through continental Southeast Asia and Malesia to Australia (Queensland). Native in Singapore although infrequently collected, including from an unknown locality (*Wallich s.n.* [EIC 8709E], Sep 1822, CAL, K), Changi (*Ridley 84*, Mar 1889, SING [SING0017797]), Sumbawang (*Ridley 118*, SING [SING0017793]) and Tanglin (*Ridley s.n.*, 19 Mar 1889, SING [SING0017794]). The first author reports that he saw it but did not collect it on Pulau Ubin in 2017.

Ecology. Sunny to somewhat shaded localities, thickets, edges of (secondary) forest, old clearings.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore Data Deficient (DD). From the specimens alone, it would be assessed as nationally extinct but the first author reports a sighting of it in 2017. Further data is necessary to make a national assessment.

Vernacular names. *Scrambling panic grass* (English), *rumput janggut ali* (Malay).

Notes. Some authors have distinguished two taxa here (see Majumdar, *Bull. Bot. Soc. Bengal* 27 (1973) 49; Chen & Phillips, *Fl. China* 22 (2006) 505).

8. *Panicum trichocladum* Hack. ex K.Schum.

(Greek, *tricho-* = hairy, *-cladum* = branch; presumably referring to the hairy inflorescence branches in some plants)

[Hack. ex Engl., Abh. Königl. Akad. Wiss. Berlin 1891(2) (1892) 119, nom. nud.] in Engler, Pflanzenw. Ost-Afrikas C (1895) 103; Veldkamp, Fl. Males. Bull. 12 (1999) 235; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 103, fig. 105. **Type:** *Meyer 140*, Tanzania, Kilimandscharo [Kilimanjaro], [grassland above the tree line], July 1887 (B [B 10 0715462]), designated by Vorontsova, Candollea 73 (2018) 178; isolecto US [US00140067]). **Fig. 52D.**

Perennial. **Culms** shortly rhizomatous, cataphylls not seen, 0.2–3 m long, erect, geniculate at base, creeping, and scrambling, rooting at the decumbent nodes, hollow, not inflated at base; nodes glabrous. **Sheaths** glabrous or tuberculate hispid, margins glabrous to pilose. **Ligule** a membranous collar, ciliolate, 0.4–0.5 mm long. **Leaf** blades flat, linear, 5–12 cm by 4–8 mm, puberulous to pilose, base rounded and pseudo-petiolate (1–2 mm), margin at base glabrous, apex long-acuminate, underneath with 5–11 major nerves. **Panicle** lax to very lax, 6–13 × 2–7 cm, main axis smooth, glabrous or pilose, branches patent, smooth to scaberulous, glabrous or pilose, naked at base, the lowermost solitary or paired or whorled, eglandular, the lowermost longest one 2–6 cm long; pedicels longer than the spikelets, smooth, scaberulous, or pilose under the spikelet. **Spikelets** solitary or paired, not yawning at maturity, 2.1–2.7 × 0.9–1 mm, obtuse to acute. **Glumes** without a distinct internode, glabrous; lower glume deltoid to quadrate, 0.3–0.9 mm long, 0.12–0.3 times as long as the spikelet, retuse or erose or truncate or obtuse, 0-nerved; upper glume 2–2.7 mm long, obtuse, glabrous, faintly 5-nerved, nerves with or without transverse veinlets. Lower **lemma** paleate, male, obtuse to acute, glabrous, faintly 5-nerved, nerves with transverse veinlets. **Palea** as long as the lemma. Upper **lemma** sessile, 1.8–2 mm long, smooth, shiny, glabrous, apex apiculate, incurved. **Anthers** 3, 1.3–2 mm long.

Distribution. Tropical and subtropical Africa and the Comores, widely introduced elsewhere. Naturalised in Singapore and collected from Bukit Timah (*Ali Ibrahim & Chin AI 237*, 2 Sep 1994, SING [SING0041623]; *Leong et al. SING2011-421*, 12 Oct 2011, SING [SING0166587]), Mount Faber Park (*Tan & Morgany s.n.*, 20 Apr 2001, SINU) and the Sultan of Johor's land at Tyersall (*Duistermaat 200*, 14 Oct 2003, K, L, SING [SING0064185]).

Ecology. Shaded road sides and open grassy areas.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

42. PASPALUM L.

(Greek, *paspalos* = millet; an arbitrary name for the genus)

Syst. Nat., ed. 10, 2 (1759) 855; Chase, Contr. U.S. Natl. Herb. 28 (1929) 1; de Koning & Sosef, Blumea 30(2) (1985) 279; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 322. **Synonyms:** *Sabsab* Adans., Fam. Pl. 2 (1763) 31, 599, nom. illeg. superfl. – *Panicum* L. sect. *Paspalum* (L.) Trin., Gram. Panic. (1826) 49, 87; Ascherson & Graebner, Syn. Mitteleur. Fl. 2 (Apr 1898) 67, as '*Paspalus*', isonym; Kuntze, Revis. Gen. Pl. 3(3) (1898) 359. **Type:** *Paspalum dimidiatum* L., nom. illeg. superfl., lectotype designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 116 (= *Paspalum dissectum* (L.) L.).

Perennials. **Culms** hollow to solid. **Ligules** membranous or collar-shaped, glabrous. **Leaf** blades inrolled when young. **Inflorescences** composed of 1–many, paniculate to (sub)opposite unilateral racemes; common axis 0–15 cm long; rachis subterete to distinctly winged. **Spikelets** abaxial (but may seem adaxial when the lower glume is absent, and the lower epaleate lemma is interpreted as the upper glume), sessile or shortly pedicelled, solitary, paired, or in 2–4 rows, 2-flowered, dorso-ventrally compressed, mucicous, callus truncate, glabrous. Lower **glume** usually absent, when present 0–3-nerved; upper glume membranous, smooth, margins usually involute, rarely flat, 2–13-nerved, outer nerve(s) submarginal. Lower **lemma** similar to the upper glume, epaleate, sterile, 3–9-nerved, thinly herbaceous; upper lemma bisexual, slightly shorter than the spikelet, 3–5-nerved, indurate, germination flap present, margins inrolled over and exposing much of the palea, mucicous.

Distribution. A genus of 200–250 species, mainly tropical. In Singapore 4 native species and 3 naturalised species.

Taxonomy. This genus belongs to the *Panicoideae* – *Paspalinae* Griseb.

Notes. *Paspalum dilatatum* Poir., introduced in Singapore according to Burkill (Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1702), Gilliland (Rev. Fl. Malaya 3 (1971) 183) and Keng et al. (Concise Fl. Singapore, vol. 2, Monocot. (1998) 176), is not included as there is no material from Singapore in K, SING or SINU. Like *Paspalum conjugatum*, it has an upper glume with a fringe of hairs, but the inflorescence has 3–5(–9) branches and the spikelets are paired, 3.3–3.5 mm long.

Key to *Paspalum* taxa

1. Upper glume with a fringe of hairs along the margins, framing the spikelet at least in the upper half 2
Upper glume glabrous, or pubescent along the margins, or pubescent 3
2. Plants stoloniferous; rachis 0.7–0.8 mm wide; spikelets solitary, ovate; upper glume with a fringe of hairs along the entire margins **1. P. conjugatum**
Plants tufted, not stoloniferous; rachis 0.5–1.5 mm wide; spikelets paired, elliptic to obovate; upper glume with a fringe of hairs along the margins in the upper half only
..... **7. P. virgatum**
3. Spikelets paired, at least in the middle of the raceme 4
Spikelets solitary 6
4. Plants tufted; blades appressed hirsute behind the ligule; spikelets broadly ovate, broadly obovate, or suborbicular; upper glume nerves darker than the intervenium; sterile lemma similar to the upper glume; fertile lemma and palea in fruit yellowish brown or brown; anthers 0.5–1.1 mm long 5

- Plants stoloniferous or rhizomatous; blades with some white hairs behind the ligule; spikelets ovate, obovate, or oblong; upper glume nerves concolourous; sterile lemma different from the upper glume; fertile lemma and palea in fruit dark brown; anthers 1.5–1.7 mm long **3. *P. plicatum***
5. Ligules 0.3–1 mm long; racemes 2–4, 1–6.5 cm long, rachis 1–1.5 mm wide; upper glume glabrous; blades 8–25 cm long **2. *P. orbiculare***
Ligules 1–3 mm long; racemes 4–12, 6.5–8 cm long, rachis 2–3.5 mm wide; upper glume sparsely minutely puberulous all over or only along the margins, very rarely entirely glabrous; blades 17–40 cm long **5. *P. sumatrense***
6. Plants tufted; blades appressed hirsute behind the ligule, hairs 3 mm long; racemes with spikelets from the base; spikelets broadly ovate, broadly obovate, or suborbicular, yellow-brown or brown; fertile lemma and palea in fruit yellowish brown, dark brown, or brown 7
Plants stoloniferous; blades with some white hairs behind the ligule, hairs c. 0.5 mm long; racemes with a naked base; spikelets oblong, pale green; fertile lemma and palea in fruit pale green **6. *P. vaginatum***
7. Racemes mostly 1–6.5 cm long, rachis mostly 1–1.5 mm wide; upper glume 3–5-nerved, nerves darker than the intervenium; upper lemma in fruit yellow-brown to mid-brown ...
..... **2. *P. orbiculare***
Racemes mostly 5–9.5 cm long, rachis mostly 1.3–2.2 mm wide; upper glume 5–7-nerved, nerves concolourous; upper lemma in fruit dark brown
..... **4. *P. scrobiculatum* var. *bispicatum***

1. *Paspalum conjugatum* P.J.Bergius

(Latin, *conjugatus* = joined, connected, coupled;
referring to the two subopposite inflorescence branches)

Acta Helv. Phys.-Math. 7 (1762) 129, t. 8; Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 11; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Fl. Malay Penins. 5 (1925) 218; Henderson, Malay Wild Fls., Monocot. (1954) 339, fig. 193h–l; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1703; Gilliland, Rev. Fl. Malaya 3 (1971) 180, fig. 37, pl. 24d; Turner, Gard. Bull. Singapore 45 (1993) 100; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 176, fig. 280; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 106, fig. 106, pl. 22; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 170, 267. **Synonym:** *Paspalum tenue* Gaertn., Fruct. Sem. Pl. 2, fasc. 1 (1790) 2, t. 80: fig. [4], nom. illeg. superfl. **Type:** *Rolander s.n.*, Suriname, 4 August 1755 (lectotype SBT [Bergius Herb. 1.2.7.36], designated by de Koning & Sosef, Blumea 30(2) (1985) 290). **Fig. 53B, 54A.**

Culms with long stolons, 0.4–0.8(–1) m high. **Sheaths** more or less flattened. **Ligules** collar-shaped, 0.2–1.6 mm long. **Leaf** blades flat, (1–)8–20(–23) cm by (1–)3–12(–15) mm, with some c. 3 mm long white hairs at the immediate base of the ligule, sparsely pubescent on both sides, usually less so beneath, to glabrous. **Inflorescence** with peduncle glabrous; racemes 2,

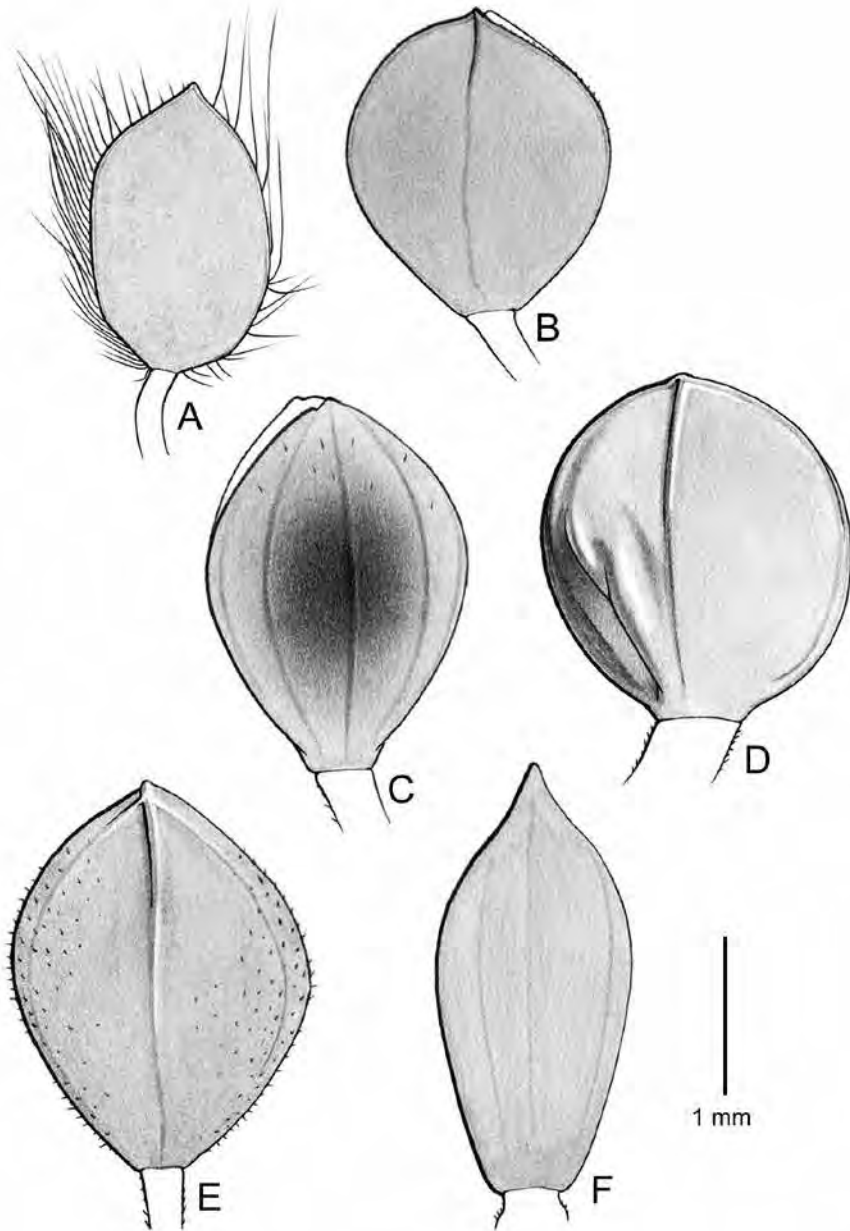


Figure 54. *Paspalum conjugatum* P.J.Bergius. **A.** Spikelet facing upper glume. *Paspalum orbiculare* G.Forst. **B.** Spikelet facing upper glume. *Paspalum plicatum* Michx. **C.** Spikelet facing upper glume. *Paspalum scrobiculatum* L. var. *bispicatum* Hack. ex Merr. **D.** Spikelet facing upper glume. *Paspalum sumatrense* Roth. **E.** Spikelet facing upper glume. *Paspalum vaginatum* Sw. **F.** Spikelet facing upper glume. (Drawn by J.J. Vermeulen).

subopposite; common axis absent, rarely with a third below them, spikelets present to the base, (5–)7–16.5 cm long, with a few long hairs at base; rachis 0.7–0.8 mm wide; pedicels 0.5–0.8 mm long, glabrous. **Spikelets** solitary, ovate (the lower ones often oblong), 1.5–1.8(–2.1) × 1–1.4(–1.6) mm, pale green to yellowish. Lower **glume** absent; upper glume about as long as the spikelet, with 2 (or 4) concolorous nerves, and a fringe of 1.5–2 mm long white hairs along the margins framing the spikelet, otherwise glabrous, smooth. Lower **lemma** as the upper glume; upper lemma pale green. **Anthers** 0.5–0.7 mm long.

Distribution. Of American origin, introduced into the Malasian region in the nineteenth century. Naturalised in Singapore and widely distributed including on Balestier Road (*Hullett 474*, 4 Jun 1884, SING [SING0041252]), Bukit Timah Road (*Duistermaat 019*, 14 Feb 2002, K, L, SING [SING0064188]), Holland Road (*Duistermaat 114*, 4 Jan 2003, SING [SING0060099]), Pulau Tekong (*Tan & Chua Tekong 174*, 26 Mar 1996, SINU) and Sungei Punggol (*Tan 749*, 26 Nov 2003, SINU).

Ecology. Lawns, road sides, waste land, with a preference for poor, open to moderately shaded, humid habitats.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular names. *Buffalo grass* (English), *rumput kerbau* (Malay).

2. *Paspalum orbiculare* G.Forst.

(Latin, *orbicularis* = globular; referring to the spikelets)

Fl. Ins. Austr. (1786) 7; Ridley, Fl. Malay Penins. 5 (1925) 217; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1703; Gilliland, Rev. Fl. Malaya 3 (1971) 184, fig. 24b, pl. 15; Turner, Gard. Bull. Singapore 45 (1993) 100; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 176; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 107, fig. 108. **Synonyms:** *Paspalum scrobiculatum* L. var. γ Flügge, Gram. Monogr., Paspalum (1810) 88. – *Paspalum scrobiculatum* L. var. *orbiculare* (G.Forst.) Hack., Bot. Jahrb. Syst. 6 (1885) 233; Makino, Bot. Mag. (Tokyo) 10 (1896) 60, isonym. **Type:** *Forster s.n.* (syntypes C [C10017146], K [K000215190], UPS). **Fig. 54B.**

Culms tufted, not stoloniferous, (0.1–)0.3–0.7(–1) m long. **Ligules** collar-shaped, 0.3–1(–2) mm long. **Leaf** blades flat or once folded lengthwise, (2–)8–25(–40) cm by (1.5–)4–7(–8.5) mm, hirsute at base at least behind the ligule. **Inflorescence** with peduncle glabrous; racemes 2–4(–6), alternate, spikelets present from the base, 1–6.5 cm long; rachis 1–1.5(–1.9) mm wide. **Spikelets** paired or solitary, the inner one sometimes developed, usually reduced in the middle of the raceme, sometimes absent at its ends, usually broadly obovate, less often suborbicular to broadly obovate, (1.7–)1.9–2.3(–2.7) × (1.2–)1.5–1.8(–2) mm, yellow-brown to brown. Lower **glume** absent; upper glume about as long as the spikelet, 3–5-nerved, darker than the intervenium, glabrous. Lower **lemma** as the upper glume; upper lemma yellow-brown to brown. **Anthers** 0.5–0.9 mm long.

Distribution. Sri Lanka and northeastern India and Nepal to southern China and Taiwan, through continental Southeast Asia and Malesia to northern Australia and the Pacific to Hawai'i. Native in Singapore and widely collected, including from Tanglin (*Hullett 482*, 12 Nov 1885, SING [SING0266039]), Bukit Timah (*Ali Ibrahim & Chin AI 239*, 2 Sep 1994, SING [SING0229909]), Pulau Ubin (*Duistermaat et al. 182*, 23 Sep 2003, L, SING [SING0059669]), Tuas (*Chua 1046*, 5 Oct 1994, SINU) and the Western Catchment (*Samsuri et al. WC 32*, 20 Apr 2004, SING [SING0054292]).

Ecology. Generally in moist places, e.g. marshes, swamp grasslands and ponds, but also in sunny grassy places near the sea, on sandy soils, clay or peat, in up to 25 cm deep water.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Notes. When the inner spikelets are all reduced whereby the outer ones may appear to be solitary, this species is very similar to *Paspalum scrobiculatum* var. *bispicatum*. We can, therefore, understand why Clayton (Kew Bull. 30 (1975) 101) treated it as a synonym of *Paspalum scrobiculatum* and Phillips (Fl. Fl. Ethiopia Eritrea 7 (1995) 233) as a variety.

3. *Paspalum plicatulum* Michx.

(Latin, *plicatulus* = a little folded (lengthwise); referring to the lower lemma)

Fl. Bor.-Amer. 1 (1803) 45; Duistermaat, Gard. Bull. Singapore 56 (2004) 37; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 107, fig. 109; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 170, 263. **Synonyms:** *Panicum plicatulum* (Michx.) Kuntze, Revis. Gen. Pl. 3(3) (1898) 363. – *Paspalum plicatulum* Michx. var. *genuinum* Parodi, Revista Mus. La Plata, new ser. 1 (1937) 231, nom. inval. **Type:** Michaux 2, USA, 'Hab in Georgiâ, Floridâ' (lectotype P-MICH [P00670149], designated by Hitchcock, Contr. U.S. Nat. l. Herb. 12 (1908) 146; isoelectotypes P-JUSS [Herb. Juss. 2636], US (fragment)). **Fig. 54C.**

Culms tufted, sometimes rhizomatous, often geniculate, 0.3–1.5 m long. **Sheaths** keeled. **Ligules** collar-shaped, 1–3.5 mm long. **Leaf** blades flat to loosely folded, 6–50 cm by 4–12 mm, usually white pilose near the base and underneath. **Inflorescence** with peduncle glabrous; common axis 3–15 cm long; racemes 2–12, alternate, spikelets present to the base, 2–11 cm long; rachis 0.7–1.1 mm wide; pedicels c. 0.5 mm long, glabrous. **Spikelets** paired, at least in the middle of the raceme, oblong to ovate or obovate, 2.4–2.8 × 1.4–2 mm, glabrous, greyish to brown, with a conspicuous dark centre and paler margin. Lower **glume** absent; upper glume about as long as the spikelet, faintly 5–7-nerved, usually appressed pubescent, often with a dark red spot in the centre (in fresh material). Lower **lemma** faintly 5-nerved, glabrous, transversely wrinkled at maturity; upper lemma shiny dark brown. **Anthers** 1.5–1.7 mm long.

Distribution. Native in South America. In Singapore it is naturalised or casual and known from only one collection from Pulau Sakijang (*Teo L 3*, 2003, SINU).

Ecology. Elsewhere in open pastures on a wide range of soil types.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

4. *Paspalum scrobiculatum* L.

(Latin, *scrobiculatus* = minutely pitted; supposedly referring to the lemma)

Mant. Pl. (1767) 29; Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 10; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Henderson, Malay. Wild Fls., Monocot. (1954) 340, fig. 193e–g; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1703; Gilliland, Rev. Fl. Malaya 3 (1971) 185, t. 38; Turner, Gard. Bull. Singapore 45 (1993) 100; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 170, 272. **Synonym:** *Paspalum scrobiculatum* L. var. *frumentaceum* Stapf, Fl. Trop. Afr. 9(3) (1919) 575, nom. inval. **Type:** *Collector unknown s.n.*, Sweden, Uppsala, cultivated (lectotype LINN [Herb. Linn. no. 79.4], designated by Clayton, Kew Bull. 30 (1975) 101).

Notes. This is possibly an aggregate swarm of apomicts, which would explain the great variability. Only 1 variety is recorded from Singapore. The difference with *Paspalum orbiculare* is not always clear (see notes under that species).

var. *bispicatum* Hack. ex Merr.

(Latin, *bi-* = two, *-spicatum* = spikes; referring to the inflorescence)

Fl. Manila (1912) 86; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 177; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 107, fig. 110, pl. 23. **Type:** *Merrill 272*, Philippines, Luzon, Province of Rizal, San Pedro Macati, July 1910 (lectotype W [1916-0041752], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 33). **Fig. 53C, Fig. 54D.**

Paspalum commersonii Lam., Tabl. Encycl. 1, fasc. 1 (1791) 175, t. 43; Ridley, Fl. Malay Penins. 5 (1925) 218. – *Paspalum scrobiculatum* L. var. *commersonii* (Lam.) Stapf, Fl. Trop. Afr. 9(3) (1919) 573. **Type:** *Commerson s.n.*, Isle de France [Mauritius] (lectotype P-JU [P00665168] [Herb. Juss. 2629], first step designated by Clayton, Kew Bull. 30 (1975) 101, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 32; isolectotypes L, P-LA [P00563992]).

Paspalum cartilagineum J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 216; Gilliland, Rev. Fl. Malaya 3 (1971) 184. **Type:** *Haenke s.n.* [Philippines, Luzon, Sorsogon] (lectotype MO [MO-2114871], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 49; isolectotypes HAL, K (fragment), LE [Herb. Trinius 0529.04-b], US (fragment), W).

Culms tufted, 0.08–0.7(–1.3) m high. **Sheaths** flattened. **Ligules** collar-shaped, 0.3–1.8 mm long. **Leaf** blades flat or once folded lengthwise, 8–40 cm by 4–9(–15) mm, appressed hirsute behind the ligule, pubescent at base or glabrous to rarely pubescent on both sides. **Inflorescence** with peduncles glabrous or rarely with a few white hairs; common axis 1.5–3 mm long; racemes (1–)2–6(–14), alternate or subopposite (rarely) or solitary (rarely), spikelets present from the base, lowermost (1.5–)5–9.5(–11) cm long; rachis (0.8–)1.3–2.5(–3) mm wide; pedicels c. 0.5 mm long, glabrous. **Spikelets** solitary, suborbicular (usually) or broadly ovate to broadly obovate (rarely), 1.7–3.25 × 1.2–2.6 mm, brown (to orange- or dark brown). Lower **glume** absent; upper glume about as long as the spikelet, rumped, 5- or 7-nerved,

nerves concolorous, glabrous. Lower **lemma** different from the upper glume, 5–9-nerved, glabrous, not wrinkled at maturity; upper lemma 5–7-nerved, and palea brown to dark brown. **Anthers** 0.5–1.2 mm long.

Distribution. Tropical Africa, Madagascar, Mauritius, Asia to the Pacific and northern and eastern Australia. Native in Singapore and widely collected, including from Bahtera Track (*Duistermaat* 250, 30 Dec 2003, K, SING [SING0059663]), Pulau Ubin (*Latifah* 6, 7, 17 Jun 1990, SINU), Changi (*Goodenough s.n.*, 11 Mar 1889, SING [SING0041624]), MacRitchie (*Jumali* 1077, 11 Feb 1965, SINU) and Pulau Tekong (*Samsuri et al. PT31*, 31 Oct 2001, SING [SING0039708]).

Ecology. In many habitats and on many types of soil although in natural stands it tends to become crowded out by other grasses.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Kodo millet* (English).

5. *Paspalum sumatrense* Roth

(of Sumatra)

in Roemer & Schultes, *Syst. Veg.*, ed. 15 bis, 2 (1817) 316; Roth, *Nov. Pl. Sp.* (1821) 35. **Type:** *Heyne s.n.*, Sumatra (lectotype K (fragment) [K000290255], designated by Turner et al., *Gard. Bull. Singapore* 71 (2019) 34). **Fig. 54E, 55.**

Paspalum longifolium Roxb., [*Hort. Bengal.* (1814) 7, nom. nud.] *Fl. Ind.* 1 (1820) 283; Ridley, *Fl. Malay Penins.* 5 (1925) 217; Gilliland, *Rev. Fl. Malaya* 3 (1971) 182, fig. 24a, pl. 14; Turner, *Gard. Bull. Singapore* 45 (1993) 100; Keng et al., *Concise Fl. Singapore*, vol. 2, Monocot. (1998) 176; Duistermaat, *Gard. Bull. Singapore* 57, Suppl. (2005) 106, fig. 107; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 67, 170, 229. **Type:** *Roxburgh s.n.*, India (lectotype BM [BM000959597], designated by de Koning & Sosef, *Blumea* 30(2) (1985) 297).

Paspalum platycoleum Ridl., *Fl. Malay Penins.* 5 (1925) 217. **Type:** *Nur SF 4509*, [Malaysia], Selangor, Klang, Port Swettenham (lectotype SING [SING0054935], designated here; isotype K).

Culms tufted, not stoloniferous, (0.2–)0.5–1.25(–1.5) m long. **Sheaths** more or less flattened. **Ligules** collar-shaped, 1–3 mm long. **Leaf** blades usually once folded lengthwise, (2–)17–40(–56) cm by (2–)4–9(–9.5) mm, appressed hirsute at least behind the ligule or at base. **Inflorescence** with peduncle glabrous or with a few hairs; common axis 5–10 cm long; racemes (3–)4–12(–16), alternate, spikelets present to the base, 6.5–8 cm long; rachis (1.5–)2–3.5(–5) mm wide; pedicels 0.5–1.5 mm long, glabrous. **Spikelets** paired (the inner spikelet sometimes reduced to minute glumes, but usually well-developed at least in the middle part of the raceme), broadly ovate to broadly obovate, 2–2.5(–2.8) × 1.2–2(–2.2) mm, yellow-green to light brown, sometimes purplish. Lower **glume** absent; upper glume about as long as the spikelet, with 3 darker nerves, sparsely minutely puberulous all over or only along



Figure 55. *Paspalum sumatrense* Roth. **A.** Inflorescence. **B.** Detail of inflorescence. **C.** Detail of leaf sheath and blade. (From Singapore, Jalan Lam San state land, *Lua & Chen SING2018-297*. Photos: L.M.J. Chen).

the margins, very rarely entirely glabrous. Lower **lemma** like the upper glume; upper lemma pale brown. **Anthers** 0.7–1.1 mm long.

Distribution. Nepal, Bhutan, northeastern India and Sri Lanka to China, and through continental Southeast Asia and Malesia to northern Australia and the Pacific. Native in Singapore and widely collected, including from an unknown locality (*Cuming* 2410, end 1839, BM, CGE, K), Geylang (*Teruya* 2701, 9 Jul 1935, SING [SING0017805]), Pulau Tekong (*Samsuri et al.* 137, 15 Nov 2001, SING [SING0039813]), Seletar (*Chua et al.* 751, 7 Feb 1992, SINU) and state land near Jalan Lam San (*Lua & Chen* SING2018-297, 27 Mar 2018, SING [SING0254021]).

Ecology. Solitary or in groups in moist places, growing in up to 60 cm deep water. On sandy, loamy, clayey, alluvial soils.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

6. *Paspalum vaginatum* Sw.

(Latin, *vaginatus* = sheathed; referring to the nodes generally being covered by the sheaths)

Prodr. (1788) 21; Henderson, Malay. Wild Fls., Monocot. (1954) 339, fig. 193m–o; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1704; Gilliland, Rev. Fl. Malaya 3 (1971) 182, pl. 24c; Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 177; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 108, fig. 111, pl. 24; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 67, 170, 229. **Synonyms:** *Paspalum distichum* L. var. *vaginatum* (Sw.) Sw. ex Griseb., Fl. Brit. W. I., fasc. 6–7 (1864) 541. – *Panicum vaginatum* (Sw.) Godr. in Gren. & Godr., Fl. France 3 (1856) 462, nom. illeg. non Nees (1829). – *Digitaria vaginata* (Sw.) Philippe, Fl. Pyren. 2 (1859) 415; Magnier, Scrin. Fl. Select. 6 (1887) 120, isonym; Magnier ex Debeaux in Lucante, Rev. Bot. Bull. Mens. 12 (1895) 303. – *Sanguinaria vaginata* (Sw.) Bubani, Fl. Pyren. 4 (1901–1902) 258. – *Paspalum distichum* L. subsp. *vaginatum* (Sw.) Maire, Bull. Soc. Hist. Nat. Afrique N. 32 (1941) 217. **Type:** Swartz *s.n.*, ‘fl. ind. occ. ex ins. Sti Crucis Am.’ (lectotype S [S-R-4070], first step designated by Clayton & Renvoize, Fl. Trop. E. Africa, Gramineae (Pt 3) (1982) 609, second step designated by de Koning & Sosef, Blumea 30(2) (1985) 310; possible isolectotypes S, UPS). **Fig. 54F.**

Paspalum distichum auct. non L.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 184; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 124; Ridley, Fl. Malay. Penins. 5 (1925) 218.

Culms tufted, stolons up to 3 m long, (0.15–)0.25–0.8(–1) m long. **Sheaths** terete to somewhat flattened. **Ligules** collar-shaped, 0.5–1.1 mm long. **Leaf** blades flat or involute, (2–)8–18 cm by (1–)1.5–4(–6) mm, usually with some c. 0.5 mm long, white hairs at the immediate base of the ligule, otherwise glabrous. **Inflorescence** with peduncle glabrous; common axis absent; racemes 2, opposite, rarely up to 5, then the upper 2 opposite, the lower ones alternate, naked for the lower c. 5 mm, 2–5.5(–8) cm long; rachis 1–2 mm wide; pedicels 0.5–0.7 mm long, glabrous to scaberulous. **Spikelets** solitary, oblong, 2.7–4.5 × 1.2–1.6 mm, glabrous, pale

green. Lower **glume** rarely developed, then a minute, oblong scale; upper glume about as long as the spikelet, 3–7-nerved, glabrous. Lower **lemma** with 3–7 concolorous nerves; upper lemma pale green. **Anthers** 1.2–1.5 mm long.

Distribution. Throughout the tropics and subtropics. Native in Singapore and widely collected, including from Geylang (*Teruya 1235*, 20 May 1930, SING [SING0041259]), Pasir Panjang (*Keng & Jumali 582*, 23 Nov 1961, SINU), Pasir Ris (*Maxwell 81-67*, 7 Apr 1981, L, SING [SING0041258]), Pulau Ubin (*Ali Ibrahim & Veldkamp SING2017-080*, 18 Mar 2017, KEP, L, SING [SING0231212]) and Sungei Buloh (*Turner & Wong SB 1036*, *Samsuri 46*, 22 May 1991, SINU).

Ecology. Beaches, tidal pools, river mouths and mangrove margins.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Saltwater paspalum* (English), *rumpud dawai* (Malay).

7. *Paspalum virgatum* L.

(Latin, *virgatus* = with rods; referring to the many long racemes)

Syst. Nat., ed. 10, 2 (1759) 855. **Type:** *Browne s.n.*, Jamaica (lectotype LINN [Herb. Linn. no. 80.26], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 116). **Fig. 56.**

Culms tufted, not stoloniferous, 1–2 m long. **Sheaths** outer margin hairy. **Ligule** membranous, 2–3 mm long, lacerate. **Leaf** blades flat, 30–75 cm by 10–25 mm, margins spinulose. **Inflorescence** with 10–16 racemes, borne along a 10–30 cm long central axis, spreading or drooping, 7–15 cm long; rachis 0.5–1.5 mm wide. **Spikelets** in pairs, elliptic or obovate, 2.2–3 mm long, obtuse to subacute, brownish. Lower **glume** absent; upper glume about as long as the spikelet, 3-nerved, margins ciliolate in upper half. Lower **lemma** similar to upper glume; upper lemma dark brown.

Distribution. Native to the Americas from the United States to Brazil. In Singapore it was found to be naturalising for the first time in 2018 in Bishan-Ang Mo Kio Park (*Chen SING2018-127*, 12 Dec 2018, SING [SING254020]).

Ecology. Reported elsewhere on moist or swampy ground.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

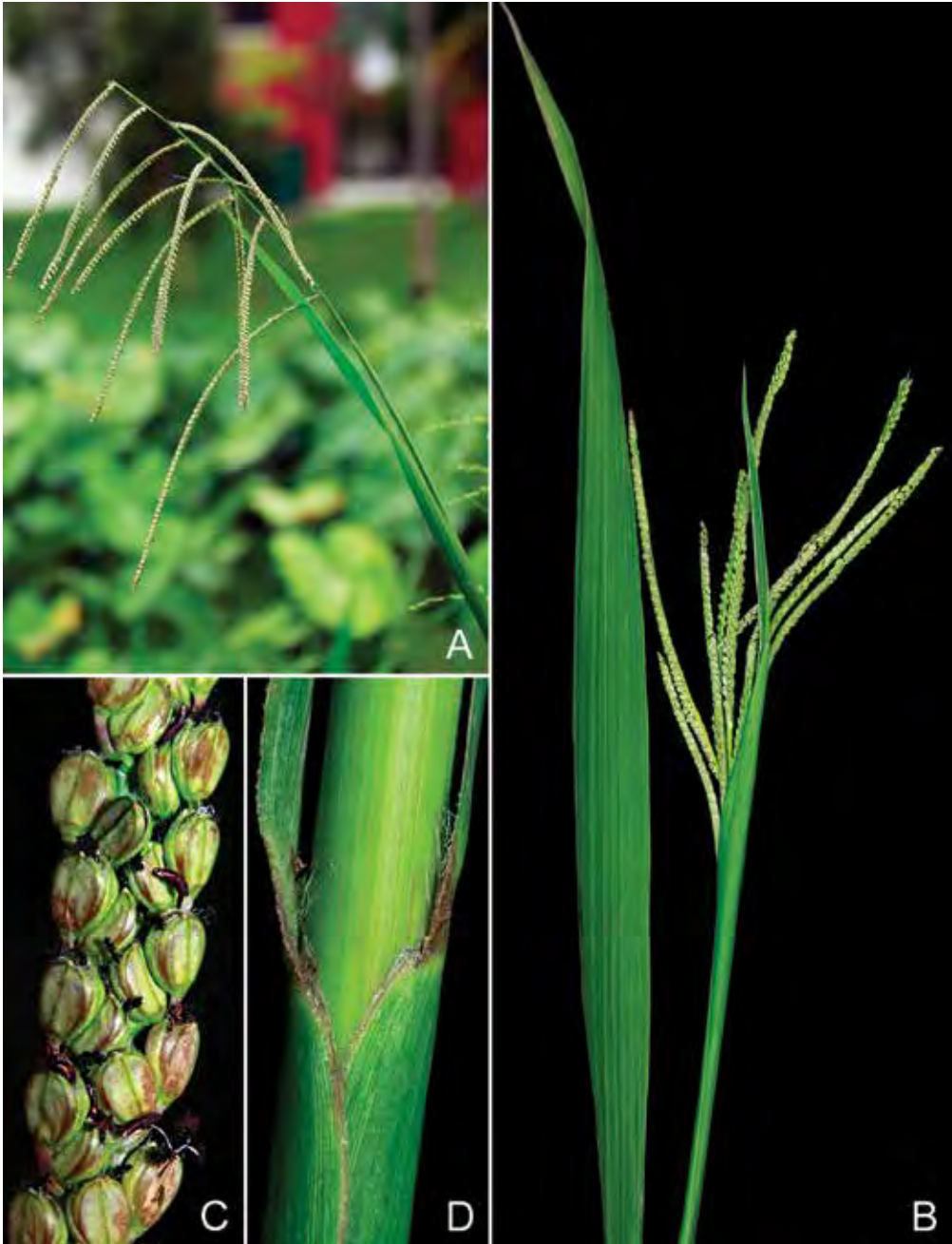


Figure 56. *Paspalum virgatum* L. **A, B.** Inflorescence. **C.** Detail of raceme. **D.** Detail of leaf sheath and blade. (From Singapore, Bishan Park, *Chen SING2018-127*. Photos: L.M.J. Chen).

43. PEROTIS Aiton

(likely a combination of Latin *per-* = very, completely, Greek *-otis* = ear; very eared, referring to the long-awned glumes)

Hort. Kew. 1 (1789) 85; Aiton, Hort. Kew. 3 (1789) 506; Veldkamp & Steenbergen, *Austrobaileya* 3 (1992) 609; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 384. **Type:** *Perotis latifolia* Aiton, nom. illeg. superfl. (= *Perotis indica* (L.) Kuntze).

Annuals. **Culms** tufted, hollow or filled with pith. **Ligules** collar-shaped, membranous. **Leaf** blades inrolled when young. **Racemes** solitary, ending in a spikelet, not breaking up. **Spikelets** lateral to the rachis, solitary, quaquaversal, shortly pedicelled, more or less laterally compressed, falling entire with the callus, 1-flowered; callus acute, laterally bearded. **Glumes** subequal, as long as the spikelet, dorsally rounded, 1-nerved, awn 1, apical, straight. **Rachilla** process absent. **Lemma** membranous, 3-nerved, glabrous, dorsally rounded, acute, muticous; callus absent. **Anthers** 3.

Distribution. About 10 species in the Old World tropics of which 1 species native in Singapore.

Taxonomy. The genus belongs to the *Chloridoideae* – *Perotidinae* P.M.Peterson et al.

Perotis indica (L.) Kuntze

(from the Indies)

Revis. Gen. Pl. 2 (1891) 787; Henderson, *Malay. Wild Fls., Monocot.* (1954) 319, fig. 183d,e; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 1725; Gilliland, *Rev. Fl. Malaya* 3 (1971) 113, t. 20, pl. 13b; Turner, *Gard. Bull. Singapore* 45 (1993) 101; Keng et al., *Concise Fl. Singapore*, vol. 2, *Monocot.* (1998) 178, fig. 282; Duistermaat, *Gard. Bull. Singapore* 57, *Suppl.* (2005) 112, fig. 114; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 68, 170, 230. **Basionym:** *Anthoxanthum indicum* L., *Sp. Pl.* 1 (1753) 28. **Type:** Herb. Hermann 1: 29, no. 25, India (lectotype BM [BM000621332], designated by Clayton, *Fl. Trop. E. Africa, Gramineae* (Pt 2) (1974) 395). **Fig. 57A.**

Saccharum spicatum L., *Sp. Pl.* 1 (1753) 54; Linnaeus, *Sp. Pl.*, ed. 2, 1 (1762) 79. **Synonyms:** *Perotis latifolia* Aiton, Hort. Kew. 1 (1789) 85, nom. illeg. superfl.; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 185; Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 149; Ridley, *Fl. Malay Penins.* 5 (1925) 243. – *Perotis spicata* (L.) T.Durand & H.Durand, *Syll. Fl. Congol.* (1909) 628. – *Perotis latifolia* Aiton var. *typica* Domin, *Biblioth. Bot.* 20 (1915) 285, nom. inval. **Type:** [Published illustration] ‘Tsjeriakuren-pullu’, Rheedee, *Hort. Malab.* 12 (1693) t. 62, lectotype designated by Clayton, *Fl. Trop. E. Africa, Gramineae* (Pt 2) (1974) 395. **Epitype:** *Collector unknown s.n.* (epitype LINN [Herb. Linn. no. 77.5], designated by Veldkamp & Steenbergen, *Austrobaileya* 3 (1992) 610 and corrected by Veldkamp, *Gard. Bull. Singapore* 71 (2019) 40).

Perotis hordeiformis Nees in Hooker & Arnott, *Bot. Beechey Voy.*, fasc. 6 (1838) 248. **Type:** Royle 280, N.W. India (lectotype K [K000245204], designated by Veldkamp & Steenbergen, *Austrobaileya* 3 (1992) 610; isolectotypes B, LE [Herb. Trinius 390.1], LIV).

Culms tufted, geniculate to decumbent, 0.2– 0.75 m long, filled with pith; nodes glabrous. **Ligules** c. 0.3 mm long. **Leaf** blades 1–3.5 cm by 2–10 mm, glabrous, base more or less

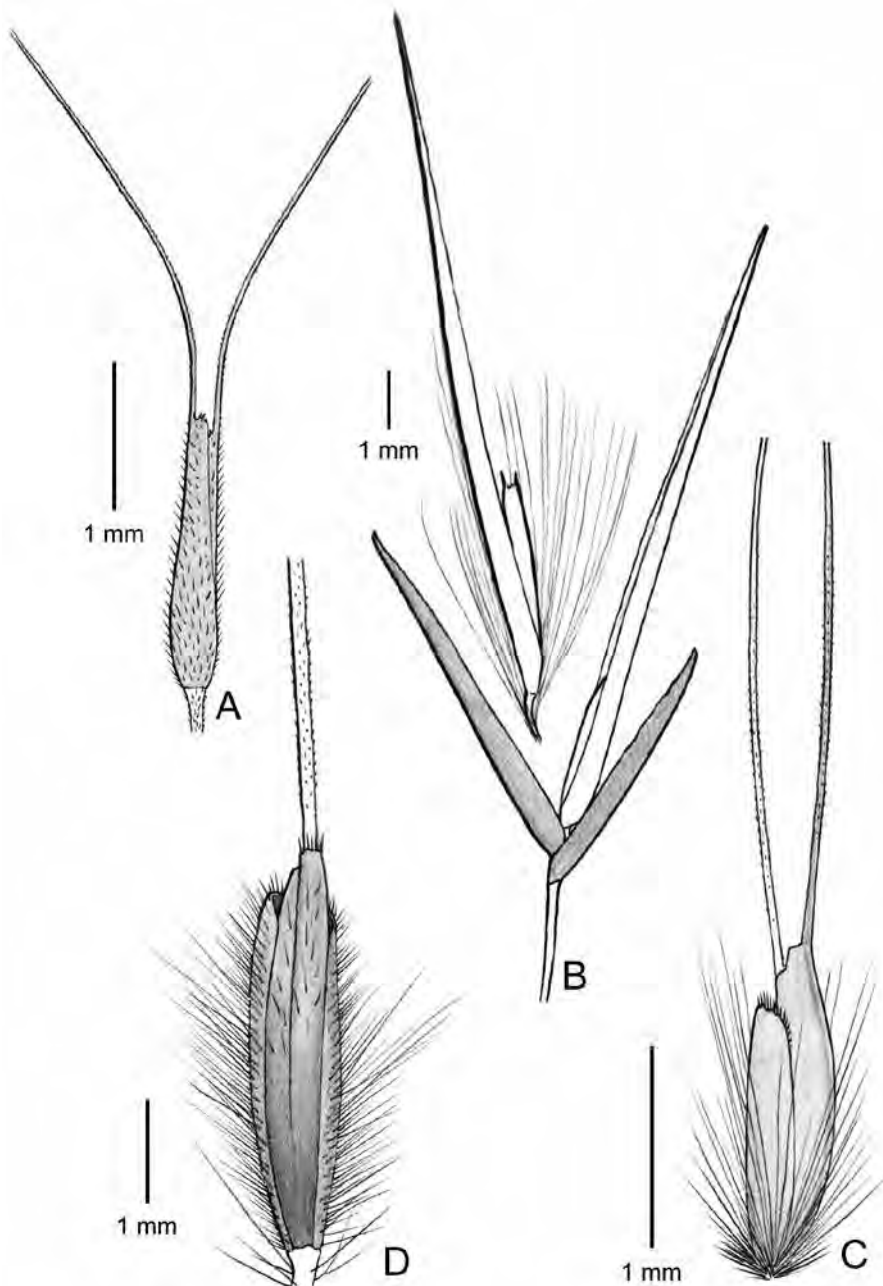


Figure 57. *Perotis indica* (L.) Kuntze. **A.** Spikelet, lateral view. *Phragmites karka* (Retz.) Trin. ex Steud. **B.** Spikelet with rachilla articulated above the first floret. *Pogonatherum crinitum* (Thunb.) Kunth. **C.** Spikelet, lateral view. *Polytrias indica* (Houtt.) Veldkamp. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

cordate to amplexicaul, usually bristly along the margins. **Racemes** 2–20 cm long; pedicels c. 0.3 mm long, bristle-hairy, persistent. **Spikelets** patent at maturity, 6.5–30 × 0.4 mm (incl. awns, excl. the up to 0.3 mm long, terete, stipe-like, puberulous callus). **Glumes** scaberulous all over, midrib scabrous; lower glume 1.5–2.5 mm long, not gradually passing into the up to 16 mm long awn.

Distribution. India to southeastern China and Taiwan, through continental Southeast Asia and Malesia. Native in Singapore but infrequently collected, including from Changi (*Chua & Turner 659*, 18 Dec 1991, SINU), Geylang (*Teruya 1964*, 17 Oct 1932, SING [SING0017806]), Pulau Carimon (*Ridley s.n.*, May 1890, SING [SING0017809]) and Pulau Tekong (*Enoch 230*, 5 Feb 1950, SINU; *Samsuri et al. 50*, 31 Oct 2001, SING [SING0039727]).

Ecology. Sandy soil near coast, under *Casuarina*, dry grasslands.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore there are very few recent collections and it is rarely encountered. There are likely to be fewer than 1000 individuals and so it is assessed here as Vulnerable VU (VU/D).

Vernacular names. *Cat's tail grass* (English), *rumput ekor kucing* (Malay).

44. PHRAGMITES Adans.

(Greek, *phragma* = fence; presumably from its use as a fencing material)

Fam. Pl. 2 (1763) 34, 559; Conert, Syst. & Anat. Arundineae (1961) 36; Clayton, Kew Bull. 21 (1967) 113; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 406. **Synonyms:** *Arundo* L. sect. *Phragmites* (Adans.) Trin. ex Ledeb., Fl. Ross. 4 (1852) 393. – *Miphragtes* Nieuwl., Amer. Midl. Naturalist 3 (1914) 332, nom. inval. **Type:** *Phragmites communis* Trin. (= *Phragmites australis* (Cav.) Trin. ex Steud.).

Trichoon Roth, Arch. Bot. (Leipzig) 1(3) (1798) 37. **Type:** *Trichoon karka* (Retz.) Roth (= *Phragmites karka* (Retz.) Trin ex Steud.).

Perennials. **Culms** tufted, rhizomatous, stoloniferous, branching intra- and extra-vaginally at base, hollow. **Ligule** a membranous collar, margin with a row of hairs. **Leaf** blades inrolled when young, broad. **Panicle** large, lax. **Spikelets** solitary, pedicelled, laterally compressed, disarticulating above the glumes and between the anthoecia, 4–6-flowered, lowest floret paleate, male or sterile, uppermost one reduced. **Callus** pungent, long-hairy, apex entire. **Glumes** unequal, about half as long as the spikelet, shorter than the adjacent lemmas, acute to acuminate, 3(or 5)-nerved. **Rachilla** pilose, process terminated by a reduced floret. **First lemma** sterile, membranous, dorsally rounded, glabrous, 3-nerved; fertile lemmas similar to the first one, bisexual. **Stamens** 2.

Distribution. A genus of 4 species in temperate and tropical areas of which 1 species in Singapore.

Taxonomy. The genus belongs to the *Arundinoideae* – *Molininae* Ohwi.

Notes. The differences between the four species recognised by Clayton, Kew Bull. 21 (1967) 113 are mainly statistical. Later, Allred, Fl. N. Amer. 25(2) (2003) 10, recognised only a single species, *Phragmites australis* (Cav.) Trin. ex Steud.

***Phragmites karka* (Retz.) Trin. ex Steud.**

(supposedly a Tamil vernacular name, but not found in modern lists)

Nomencl. Bot., ed. 2, 1 (1840) 144; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 175; Gilliland, Rev. Fl. Malaya 3 (1971) 49, t. 3. **Basionym:** *Arundo karka* Retz., Observ. Bot. 4 (1786) 21. **Synonym:** *Trichoon karka* (Retz.) Roth, Arch. Bot. (Leipzig) 1(3) (1798) 37. **Type:** *König s.n.*, India (lectotype LD [LD1213145], designated by Fischer, Bull. Misc. Inform. Kew 1932 (1932) 74; isolectotype K (fragment)). **Fig. 57B, 58.**

Arundo vallatoria L., Herb. Amboin. (1754) 15, nom. inval. – *Phragmites vallatoria* Veldkamp, Blumea 37(1) (1992) 233, nom. illeg. superfl.; Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 178; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 112, fig. 115.

Phragmites communis auct. non Trin.: Ridley, Fl. Malay Penins. 5 (1925) 240; Henderson, Malay. Wild Fls., Monocot. (1954) 309, fig. 178a,b; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1745.

Culms 2–4 m long; nodes glabrous. **Ligules** 0.3–0.5 mm long. **Leaf** blades with some shallow impressions caused by the higher sheaths when in bud, 20–60 cm by 8–35 mm, tapering to a fine point, glabrous, beneath nearly smooth to scabrid. **Panicles** 20–75 cm long, many-branched, axils often pubescent, lowermost branches often many together, spikelets not present to base; pedicels glabrous, scabrous. **Callus** hairs 4.5–5.5 mm long. **Spikelets** persistent, 10–12 mm long. Lower **glume** 3–4.5 mm long; upper glume 3.6–6 mm long, acute. **Rachilla** joints 0.5–1 mm long, hairs 5–7 mm long. **First lemma** 7–9 mm long, apex long-acuminate. **Anthers** 1.5–2 mm long.

Distribution. Tropical West Africa to Japan, through continental Southeast Asia and Malesia to Australia and Pacific islands. Native in Singapore but only collected in an unknown year in the 1880s on Freshwater Isle [Pulau Bukom] (*Ridley* 59, 188?, SING [SING0017810]) and recently in Kranji (*Chen et al. LCMJ 2019-001*, 23 Jan 2019, SING [SING0267386]).

Ecology. Humid soils, along water.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore Data Deficient (DD) due to uncertainty about how many plants there are in Kranji Marshes.

Vernacular names. *Common reed* (English; not to be confused with the Common reed of temperate areas which is *Phragmites australis* (Cav.) Trin. ex Steud.), *rumpit gedabung* (Malay).

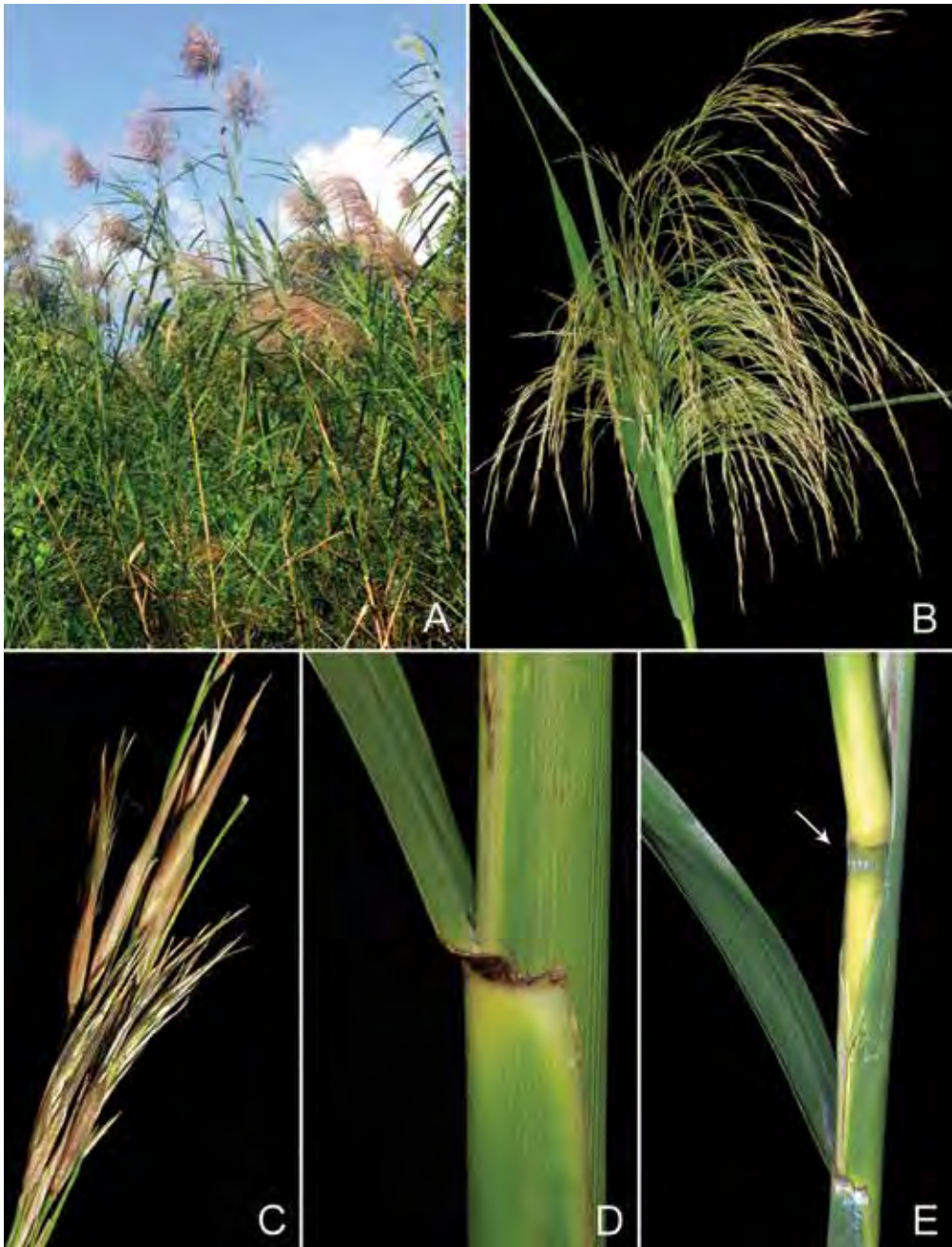


Figure 58. *Phragmites karka* (Retz.) Trin. ex Steud. **A.** Habit. **B.** Inflorescence. **C.** Detail of inflorescence. **D.** Detail of leaf sheath and blade. **E.** Detail of culm with node. (From Singapore, Kranji, *Chen et al. LCMJ 2019-001*. Photos: L.M.J. Chen).

Notes. Very similar to the temperate *Phragmites australis*, which differs by the smooth leaf blades with a filiform and flexuous tip, few lowermost inflorescence branches, some with spikelets to base, upper glumes 6–10 mm long, usually apiculate, rachilla hairs 6–10 mm long, first lemma 9–13 mm long, and anthers of uppermost floret 3.

Easily confused with *Neyraudia arundinacea* (L.) Henrard, which grows in dry places. The culms are solid, rachilla glabrous, and lemmas 3.5–4.2 mm long, pilose.

45. POGONATHERUM P.Beauv.

(Greek, *pogon*- = beard, *-atherum* = spike; referring to the long awns)

Ess. Agrostogr. (1812) 56, 172, 176, 177, pl. 11: fig. 6; Sur, J. Econ. Tax. Bot. 6 (1985) 663; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 306. **Synonym:** *Homoplitis* Trin., Fund. Agrost. (1820) 166, nom. illeg. superfl. **Type:** *Pogonatherum saccharoideum* P.Beauv., nom. illeg. superfl. (= *Pogonatherum crinitum* (Thunb.) Kunth).

Perennial. **Culms** tufted. **Ligule** a ciliolate membrane. **Inflorescence** composed of racemes; terminal and axillary; racemes solitary, straight or arcuate, espatheate; rachis fragile at the nodes, villous on margins, joints linear. **Spikelets** in pairs, sessile and pedicelled, deciduous, similar, laterally compressed. **Glumes** dissimilar; lower glume elliptic, cartilaginous, without keels, pubescent, obtuse; upper glume elliptic, apex notched, awned. **Callus** white-pilose. **Lemmas** with or without a palea; lower lemma absent or sterile; upper lemma bisexual, apex 2-fid; awn from the sinus, flexuous. **Anthers** 1 or 2. **Pedicels** of pedicelled spikelets linear, villous.

Distribution. A genus of 3 or 4 taxa in Southeast Asia, Malesia, the Pacific and Australia. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Germainiinae* Clayton

Pogonatherum crinitum (Thunb.) Kunth

(Latin, *crinitus* = having tufts of long weak hair; referring to the long hair-like awns)

Enum. Pl. 1 (1833) 478; Burkill, Dict. Econ. Prod. Malay Penins. 2 (1935) 1811; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 178, fig. 284; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 114, fig. 116, pl. 26; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 71, 170, 230. **Basionym:** *Andropogon crinitus* Thunb. in Murray, Syst. Veg., ed. 14 (May–Jun 1784) 903, as ‘*crinitum*’; Thunberg, Fl. Jap. (Aug 1784) 40, t. 7, as ‘*crinitum*’. **Synonyms:** *Homoplitis crinita* (Thunb.) Trin., Fund. Agrost. (1820) 166. – *Ischaemum crinitum* (Thunb.) Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 2 (1832) 298. – *Pogonatherum saccharoideum* P.Beauv. var. *crinitum* (Thunb.) F.N. Williams, Bull. Herb. Boissier, sér. 2, 4 (1904) 221, nom. inval. – *Pogonatherum panicum* (Lam.) Hack. var. *crinitum* (Thunb.) Roberty, Boissiera 9 (1960) 395, nom. inval. **Type:** *Thunberg s.n.*, Japan (lectotype UPS-THUNB [Herb. Thunberg 23880] [V-143127], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 5). **Fig. 57C, 59A.**



Figure 59. *Pogonatherum crinitum* (Thunb.) Kunth. **A.** Two inflorescences. *Setaria barbata* (Lam.) Kunth. **B.** Three inflorescences. (From Singapore, A from MacRitchie, *Duistermaat* 188; B from Cluny Road, *Duistermaat* 130. Photos: H. Duistermaat).

Saccharum paniceum Lam., *Encycl.* 1, fasc. 2 (1785) 595. **Synonyms:** *Perotis polystachya* Willd., *Sp. Pl.*, ed. 4, 1(1) (1797) 324, nom. illeg. superfl. – *Pogonatherum saccharoideum* P.Beauv., *Ess. Agrostogr.* (1812) 176, pl. 11: fig. 7, nom. illeg. superfl.; Henderson, *Malay. Wild Fls.*, *Monocot.* (1954) 348, fig. 198d,e. – *Pogonatherum polystachyum* Roem. & Schult., *Syst. Veg.*, ed. 15 bis, 2 (1817) 497, nom. illeg. superfl. – *Tripsacum paniceum* (Lam.) Rasp., *Ann. Sci. Nat. (Paris)* 5 (1825) 306. – *Pogonatherum saccharoideum* P.Beauv. var. *genuinum* Hack. in De Candolle & De Candolle, *Monogr. Phan.* 6 (1889) 193, nom. inval. – *Pogonatherum paniceum* (Lam.) Hack., *Allg. Bot. Z. Syst.* 12 (1906) 178; Gilliland, *Rev. Fl. Malaya* 3 (1971) 251, t. 55, pl. 30b; Turner, *Gard. Bull. Singapore* 45 (1993) 101; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 71, 170, 255. – *Pogonatherum paniceum* (Lam.) Hack. var. *polystachyum* Roberty, *Boissiera* 9 (1960) 395, nom. inval. **Type:** Indes Orientales, *Sonnerat s.n.* (holotype P-LA [IDC microfiche 6207: 686/20]).

Andropogon monandrus Roxb., [*Hort. Bengal.* (1814) 82, nom. nud.] *Fl. Ind.* 1 (1820) 264. **Synonyms:** *Pollinia monandra* (Roxb.) Spreng., *Syst. Veg.* (ed. 16) 1 (1824 [‘1825’]) 288. – *Pogonatherum saccharoideum* P.Beauv. var. *monandrum* (Roxb.) Hack. in De Candolle & De Candolle, *Monogr. Phan.* 6 (1889) 193; Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 154; Ridley, *Fl. Malay Penins.* 5 (1925) 195. **Type:** [Unpublished illustration] *Icones Roxburghianae* no. 875 (lectotype K, designated by Turner et al., *Gard. Bull. Singapore* 71 (2019) 8).

Culms wiry, with a small lumen, 10–60 cm long, root system strongly developed, shallow, especially branched in the upper part; nodes pilose. **Ligules** 0.4–0.5 mm long. **Leaf** blades

inrolled when young, 1–8 cm by 1–7.5 mm, scaberulous on both sides, pilose behind the ligule. **Racemes** terminal, 1–4 cm long; common axis pilose, joints 1–2 mm long. **Spikelets** 1.3–3 × 0.4–0.5 mm; callus hairs 0.5–1.5 as long. Upper **glume** awn 8–22 mm long, brown. **Lemmas** with or without a palea; lower floret neuter; upper lemma 1–3 mm long, awn 8–23 mm long. **Anthers** 1 or 2, 1–1.8 mm long. **Pedicels** of pedicelled spikelets 1–1.5 mm long. **Spikelets** as the sessile, slightly smaller, 1-flowered, female.

Distribution. Bhutan, northeastern India and Sri Lanka to China, through continental Southeast Asia and Malesia to Australia (Queensland) and Pacific islands. Native in Singapore and widely although infrequently collected, including from Bukit Timah (*Maxwell 76-750*, 7 Dec 1976, SINGU), Lermmit Road (*Sinclair SF 39013*, 14 Oct 1950, SING [SING0201737]), Mandai Quarry (*Duistermaat & Hillier 41*, 12 Mar 2002, K, L, SING [SING0059656]), MacRitchie (*Duistermaat 188*, 27 Sep 2003, SING [SING0072731]) and Pulau Ubin (*Lai SING2014-183*, 4 Jun 2014, SING [SING0205586]).

Ecology. Facultative rheophyte, exposed walls and quarry sites.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Uses. Sometimes cultivated as a pot-plant, along ponds, rock gardens, and sometimes with variegated blades, as ‘*variegatum*’.

Vernacular names. *Bamboo grass* (English), *rumput sembor batu* (Malay).

Notes. In Singapore *Pogonatherum paniceum* is sometimes recognised separately from *Pogonatherum crinitum* (e.g. Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 71, 170) but here they are treated as synonyms.

46. POLYTRIAS Hack.

(Greek, *poly-* = many, *-trias* = threes; a reference to the triads of spikelets)

in Engler & Prantl, Nat. Pflanzenfam. 2(2) (1887) 24; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 295. **Synonyms:** *Eulalia* Kunth sect. *Polytrias* (Hack.) Pilg. in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 14e (1940) 120, t. 69. – *Eulalia* Kunth subg. *Polytrias* (Hack.) Ohwi, Bull. Tokyo Sci. Mus. 18 (1947) 2. – *Pogonatherum* P.Beauv. sect. *Polytrias* (Hack.) Roberty, Boissiera 9 (1960) 393. **Type:** *Polytrias praemorsa* (Nees ex Steud.) Hack., nom. illeg. superfl. (= *Polytrias indica* (Houtt.) Veldkamp).

Perennials. **Culms** hollow. **Ligules** collar-shaped, membranous, ciliolate. **Leaf** blades flat, inrolled when young. **Racemes** solitary, rarely subdigitate, espatheate, spike-like, rachis disarticulating obliquely. **Spikelets** in threes, 1 pedicelled, deciduous from the pedicel, 2 subsessile, deciduous with the joint; dorso-ventrally compressed, 1-flowered, bisexual, the pedicelled ones sometimes male. **Callus** hairy. **Glumes** subequal, as long as the spikelet, scarious, muticous; lower glume with incurved margins, 2-keeled, 4- or 5-nerved, apex

truncate with protruding marginal veins; upper glume 1- or 3-nerved, apex obtuse to truncate, erose. **Spikelets** 1-flowered. **Sessile** bisexual. **Lemma** small, 2-lobed, awn from the sinus, geniculate. **Anthers** 3. **Pedicelled spikelet** subequal to the sessile ones, bisexual or male.

Distribution. A genus of 1 species, perhaps originally endemic to Java, although now widely introduced in the tropics as a fodder- and lawn grass.

Taxonomy. The genus belongs to the *Panicoideae* – *Saccharinae* Griseb.

Notes. Aberrant specimens with branched inflorescences occur and the lowermost spikelets are often paired.

Technically speaking, the spikelets are 2-flowered, but the lower floret is absent. The lemma that is present is found next to the upper glume where the upper lemma of a 2-flowered spikelet would be. A similar situation is found in e.g. *Microstegium fasciculatum* (L.) Henrard.

Polytrias indica (Houtt.) Veldkamp (from the Indies)

Blumea 36(1) (1991) 180; Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 179, fig. 285; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 114, fig. 117. **Basionym:** *Phleum indicum* Houtt., Hist. 2(13) (1782) 198, t. 90: fig. 2. **Synonym:** *Ischaemum indicum* (Houtt.) Merr., J. Arnold Arbor. 19 (1938) 320. **Type:** *Collector unknown s.n.*, [Indonesia], Java (lectotype G-PREL [G00096222]), designated by Veldkamp in Wijnands et al., Candollea 72 (2017) 184. **Fig. 57D.**

Andropogon amaurus Buse, Gram. (Feb 1854) 20, nom. illeg. superfl.; Buse in Miquel, Pl. Jungh., fasc. 3 (Aug 1854) 360. – *Polytrias amaaura* Kuntze, Revis. Gen. Pl. 2 (1891) 788, nom. illeg. superfl.; Henderson, Malay. Wild Fls., Monocot. (1954) 348, fig. 198a,c; Gilliland, Rev. Fl. Malaya 3 (1971) 244, t. 53, pl. 30c. **Synonyms:** *Andropogon diversiflorus* Steud. in Zollinger, Syst. Verz. 1 (June 1854) 58, nom. nud.; Steudel, Syn. Pl. Glumac. 1, fasc. 4–5 (Jul 1854) 370, nom. illeg. superfl. – *Polytrias diversiflora* Baill., Hist. Pl. 12[2] (1893) 319, nom. illeg. superfl.; Nash, Torreya 5 (1905) 110, isonym. – *Eulalia amaaura* (Buse) Ohwi, Bull. Tokyo Sci. Mus. 18 (1947) 2. – *Pogonatherum amaaurum* (Buse) Roberty, Boissiera 9 (1960) 393. **Type:** *Zollinger 539*, Java (lectotype L [L0050026], designated by Veldkamp, Blumea 36(1) (1991) 180; isolectotypes G, K, P [×3]).

Pollinia praemorsa Nees [Hooker's J. Bot. Kew Gard. Misc. 2 (1850) 98, nom. inval.] ex Steud., Syn. Pl. Glumac. 1, fasc. 6 (1854) 409. **Synonyms:** *Polytrias praemorsa* (Nees ex Steud.) Hack. in Engler & Prantl, Nat. Pflanzenfam. 2(2) (1887) 24; Hackel in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 189, t. 1: fig. 13; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 164. – *Eulalia praemorsa* (Nees ex Steud.) Stapf ex Ridl., Fl. Malay Penins. 5 (1925) 197; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 991. **Type:** *Collector unknown* (probably Zollinger), 'Java' (not traced).

Perennial. **Culms** densely to loosely mat-forming, geniculate, rooting at the nodes, 10–40 cm long; nodes glabrous or bearded. **Sheaths** rounded. **Ligules** 0.2–0.5 mm long. **Leaf** blades 1.5–7 cm by 2–7 mm, stiffly pilose with hairs with bulbous bases on both sides to glabrous.

Racemes 2–8 cm long; joints 2–3 mm long, densely long, brown to yellow or golden pilose. **Sessile spikelets** 3–5 × 0.8–1 mm. **Glumes** long-hairy, the lower one villous. **Lemma** 1.25–2.5 mm long, lobes acute. **Awns** geniculate, 8–13 mm long, puberulous. **Anthers** 2–3 mm long. **Stigmas** apically exerted. **Pedicels** of pedicelled spikelets 4–4.25 mm long.

Distribution. Perhaps endemic to Java but now introduced and naturalising throughout the tropics. In Singapore it was formerly fairly widespread, including at the Chasseriau Estate (*Ridley 6109*, 1894, SING [SING0017811]), Changi (*Ridley s.n.*, 1890, SING [SING0017814]), Tanjong Balai Hotel (*Sinclair 25*, Apr 1950, L) and University grounds (*Jumali 944*, 31 Oct 1963, SINU).

Ecology. Elsewhere reported to prefer seasonal climates, sunny areas and land close to the sea. It was likely introduced as a lawn grass and escaped but has not been collected in Singapore since 1963.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Brown-top grass* (English).

47. ROTTBOELLIA L.f.

(Christen Friis Rottbøll, 1727–1797, Danish botanist, student of the elder Linnaeus)

Suppl. Pl. (1782 [‘1781’]) 13, 114, nom. cons., non Scop. (1777); Veldkamp et al., *Blumea* 31(2) (1986) 281; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 300. **Synonyms:** *Rottboellia* L.f. sect. *Eurottboellia* Honda, *J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot.* 3 (1930) 368, nom. inval. **Type:** *Rottboellia exaltata* L.f., typ. cons. (= *Rottboellia cochinchinensis* (Lour.) Clayton).

Stegosia Lour., *Fl. Cochinch.* (1790) 51. **Synonym:** *Rottboellia* L.f. sect. *Stegosia* (Lour.) Pilg. in Engler & Prantl, *Nat. Pflanzenfam.*, ed. 2, 14e (1940) 138, nom. inval. **Type:** *Stegosia cochinchinensis* Lour. (= *Rottboellia cochinchinensis* (Lour.) Clayton).

Annuals. **Culms** solid. **Ligule** a membranous collar. **Leaf** blades inrolled when young. **Ligule** a ciliate membranous collar. **Inflorescence** composed of spatheate partial inflorescences with solitary transversally disarticulating racemes. **Joints** with a basal ‘knob’, more or less inflated. **Spikelets** paired, very heteromorphous, secund, dorsoventrally compressed; the sessile ones partially embedded in the rachis, 2-flowered. **Glumes** 9–13-nerved; lower glume indurate, two-keeled, smooth; upper glume boat-shaped, dorsally keeled. Lower **floret** paleate, male; upper floret bisexual. Upper **lemma** muticous. **Pedicels** free or adnate to the joint. **Pedicelled spikelet** variously reduced, dorso-ventrally flattened.

Distribution. A genus of 5 species in the tropics of the Old World. In Singapore 1 naturalised species.

Taxonomy. The genus belongs to the *Panicoideae* – *Rottboelliinae* J.Presl

Rottboellia cochinchinensis (Lour.) Clayton
(of Cochinchina)

Kew Bull. 35 (1981) 817; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 115, fig. 118; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 75, 170, 268. **Basionym:** *Stegosia cochinchinensis* Lour., Fl. Cochinch. (1790) 51. **Type:** *Loureiro s.n.*, [Vietnam] (lectotype BM [BM000513692], designated by Merrill, Trans. Amer. Philos. Soc. 25(2) (1935) 71). **Fig. 60A.**

Rottboellia exaltata L.f., Suppl. Pl. (1782 [‘1781’]) 114, nom. illeg. non L.f. (1779). **Synonyms:** *Manisuris exaltata* Kuntze, Revis. Gen. Pl. 2 (1891) 779. – *Rottboellia exaltata* L.f. var. *genuina* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 294, nom. inval. – *Stegosia exaltata* (Kuntze) Nash in Britton, N. Amer. Fl. 17 (1909) 84, nom. illeg. superfl. **Type:** *Thunberg s.n.* (lectotype LINN [Herb. Linn. no. 101.5], designated by Clayton, Kew Bull. 35 (1981) 817).

Culms tufted, with stilt roots, 0.5–3 m long, glabrous or with scattered bristles with bulbous bases; nodes glabrous. **Sheaths** setose (sparsely to densely, probably never glabrous), margin glabrous. **Ligule** 1–1.5 mm long. **Leaf** blades inrolled when young, flat, 20–80 cm by 8–45 mm, margins at base glabrous (very scabrous), glabrous to hairy on both sides, setose behind the ligule, scaberulous. **Peduncles** 1–8 together, glabrous. **Spatheoles** up to 10 cm long, blade absent or present. **Racemes** 7–15 cm (distal 2–4 cm with abortive spikelets) by 2–3.5 mm. **Joints** 5.5–8 mm long, glabrous, smooth. **Sessile spikelets** 4.5–7 × 1.7–4 mm, shorter than to about as long as the joint. Lower **glume** convex, ovate-oblong, glabrous, coriaceous, smooth, green, 9–13-nerved, lower part of keel smooth, apex rounded, not winged or minutely winged, callus glabrous; upper glume boat-shaped, ovate-oblong, 4–5.5 mm long, glabrous, 9-nerved, nerves anastomosing, margin flat, apex acute. Lower **lemma** 3.5–5.2 mm long, 3-nerved; second lemma 5-nerved. **Anthers** 2–3 mm long. **Pedicels** of pedicelled spikelets free from to adnate to the joint, 3–4 mm long, glabrous or margins ciliolate. **Pedicelled spikelets** 2.5–4.5 mm long. **Anthers** c. 1.75 mm long (when present).

Distribution. Old World tropics, widely introduced elsewhere. In Singapore likely not native as only first discovered in 1995 on reclaimed land at Marina East (*Chua & Tan 1074*, 3 Mar 1995, SINU) and also found on Pulau Tekong (*Samsuri et al. 315*, 14 Jan 2002, SING [SING0039985]).

Ecology. In Singapore on reclaimed land.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. Distally the inflorescence has a ‘tail’ of reduced spikelets. The lower floret of the sessile spikelet becomes sterile, epaleate to absent, the upper one male or reduced to only the upper lemma. There are no terminal triads as is usual in the *Andropogoneae*.

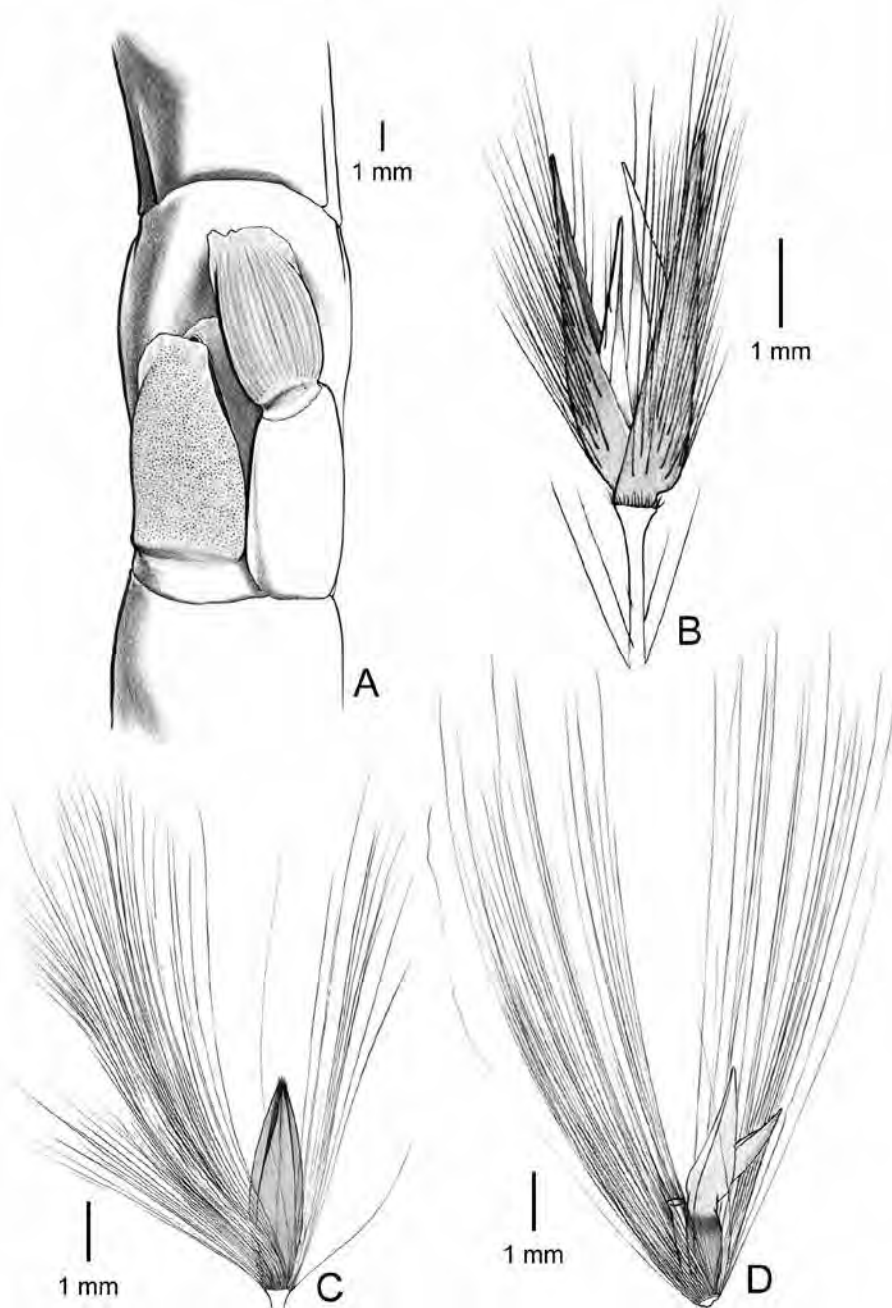


Figure 60. *Rottboellia cochinchinensis* (Lour.) Clayton. **A.** Part of the rachis with a pair of spikelets. *Saccharum arundinaceum* Retz. **B.** Spikelet, lateral view. *Saccharum officinarum* L. **C.** Spikelet, lateral view. *Saccharum spontaneum* L. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

48. SACCHARUM L.

(Greek, *sakcharon* = originally bamboo sugar, later transferred to sugarcanes)

Sp. Pl. 1 (1753) 54; Whalen, *Baileya* 23 (1991) 109; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 306. **Synonyms:** *Saccharifera* Stokes, *Bot. Mat. Med.* 3 (1812) 209, nom. illeg. superfl. – *Saccharum* L. subg. *Eusaccharum* Hack. in De Candolle & De Candolle, *Monogr. Phan.* 6 (1889) 10, nom. inval. **Type:** *Saccharum officinarum* L., lectotype designated by Nash in Britton, *N. Amer. Fl.* 17 (1909) 89.

Ripidium Trin., *Fund. Agrost.* (1820) 169, nom. illeg. non Bernh. (1800), nec *Rhipidium* Cornu (1871), nom. cons. **Synonyms:** *Saccharum* L. sect. *Ripidium* Roberty, *Boissiera* 9 (1960) 362. – *Tripidium* H.Scholz, *Willdenowia* 36 (2006) 664. **Type:** *Ripidium ravennae* (L.) Trin., lectotype designated here (= *Saccharum ravennae* (L.) Murr.).

Perennials. **Culms** tufted, rhizomatous, and/or stoloniferous, with root-eyes, solid; nodes glabrous or bearded. **Sheaths** auriculate. **Ligule** a membranous collar. **Leaf** blades flat, inrolled when young, midrib white. **Panicle** terminal, large, lax, silkily hairy, axis elongated, racemes fragile. **Joints** filiform, apex cupuliform. **Callus** short, obtuse, silkily bearded surrounding the spikelets. **Spikelets** homomorphous, 2-flowered, bisexual, paired, one sessile and one pedicelled, falling together, equal. **Glumes** membranous, cartilaginous to coriaceous, flat to convex, more or less 2-keeled; upper glume boat-shaped. **Lemmas** hairy; lower lemma as long as to slightly shorter than the glumes, sterile; upper lemma rarely absent, entire, muticous to awned, awns not geniculate. **Stamens** 2 or 3. Styles fused at base.

Distribution. A genus of 35–40 species in tropical Asia to the southern Pacific. In Singapore 1 native species and 2 naturalised or casual species.

Taxonomy. The genus belongs to the *Panicoideae* – *Saccharinae* Griseb.

Notes. The species concept in the genus has been greatly complicated by possibly thousands of hybridisations and selection in the cultivated plants. There is a wide body of literature on its cultivation. Recently it has been suggested that *Tripidium* H.Scholz be recognised as a distinct genus (Soreng et al., *J. Syst. Evol.* 55 (2017) 288; Evans et al., *BMC Evol. Biol.* 19:33 (2019) 1–20; Welker et al., *Taxon* 68 (2019) 246–267) which, in Singapore, would include *Saccharum arundinaceum*, the only native species.

Key to *Saccharum* species

1. Root-eyes in 2–9 rows above the node; callus with up to 12 mm long silky hairs; lower glume glabrous or with ciliate margin or apex 2
 Root-eyes in 1 row above the node; callus with c. 1 mm long hairs; lower glume with c. 3 mm long silky hairs **1. S. arundinaceum**
2. Stolons long; sheaths persistent; blades 2–30 mm wide; peduncle and main axis densely hairy, hairs c. 2.5 mm long; culms 3–15 mm diam. **3. S. spontaneum**

Stolons absent; sheaths deciduous; blades 30–100 mm wide; peduncle and main axis glabrous or sparsely hairy, hairs up to 0.5 mm long; culms 20–45 mm diam.
 **2. *S. officinarum***

1. *Saccharum arundinaceum* Retz.

(Latin, *arundin-* = pertaining to *Arundo* L., *-aceum* = resembling, having nature of; similar to *Arundo*, the reed genus)

Observ. Bot. 4 (1786) 14; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 153; Ridley, Fl. Malay Penins. 5 (1925) 193; Henderson, Malay. Wild Fls., Monocot. (1954) 344, fig. 195c,d; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1958; Gilliland, Rev. Fl. Malaya 3 (1971) 226, pl. 28c; Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 179, fig. 286; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 118, fig. 119, pl. 28; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 76, 170, 273. **Synonyms:** *Erianthus arundinaceus* (Retz.) Jeswiet, Arch. Suikerindustr. Ned.-Indië (1925) 399. – *Saccharum officinarum* L. subvar. *arundinaceum* (Retz.) Roberty, Boissiera 9 (1960) 368. – *Ripidium arundinaceum* (Retz.) Grassl, Proc. 14th Congr. Int. Soc. Sugar Cane Technologists 1971 (1972) 244. – *Tripidium arundinaceum* (Retz.) Welker, Voronts. & E.A.Kellogg, Taxon 68 (2019) 255, fig. 4. **Type:** *König s.n.*, India, Pee Carumbo (lectotype LD [LD1227677]), designated by Fischer, Bull. Misc. Inform. Kew 1932 (1932) 72; possible isolectotypes C [×4]. **Fig. 60B, 61A.**

Culms tufted, with short rhizomes, stolons absent, erect to ascending, (0.7–)1–7 m tall, 1–2.5 cm diam. Root eyes in 1 row above the node. **Sheaths** more or less persistent, glabrous to pubescent. **Ligules** 0.1–2.5 mm high, abaxially setose. **Leaf** blades 30–250 cm by 10–75 mm, base cuneate, there pilose above, otherwise glabrous. **Peduncle** glabrous below the panicle. **Panicles** rather lax, contracted after anthesis, 30–100 × 6–30 cm; common axis glabrous except for the nodes; longest branch 9–45 cm long; joints 3–6.5 mm long, 1–1.5 times as long as the spikelet, mostly at base with up to 2.5 mm long silky hairs; pedicels 2.5–3 mm long, sparsely hairy, hairs up to 2.5 mm long. **Spikelets** 2.5–4.2 × c. 1.5 mm, callus hairs c. 1 mm long, 0.3 times as long as the spikelet, hairs whitish grey. Lower **glume** acuminate, with c. 3 mm long silky hairs, 2–5-nerved; upper glume subglabrous, 3-nerved. Both **lemmas** present; arista of upper lemma 0.3–3 mm long, not exserted. **Lodicules** glabrous. **Anthers** 1.2–2 mm long. **Pedicelled spikelets** glumes 1-nerved; lower glume, glabrous; upper glume dorsally long-pilose.

Distribution. Bhutan, northeastern India and Sri Lanka to southern China, and through continental Southeast Asia and Malesia. Native in Singapore but infrequently collected, including from Kallang (*Ridley 10800*, 12 Mar 1900, SING [SING0058876]), Queensway (*Duistermaat 281*, 10 Mar 2004, SING [SING0059654]), Seletar (*Yeo 220*, 29 Aug 2000, SINU), Singapore Zoological Gardens (*Tan et al. KZOOO 38*, Jul–Aug 2001, SINU) and Sungei Sawa/Sungei Jelutong (*Tan et al. SAJE 9*, Jul – Aug 2001, SINU).

Ecology. Moist places, along watercourses, often gregarious.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore likely also to be Least Concern despite the few collections. The few collections are likely to be an artefact of the plant being large and collectors not knowing what parts must be collected.

Vernacular name. *Tebu salah* (Malay).

2. *Saccharum officinarum* L.

(Latin, *officin-* = pharmacy, *-arum* = of, available in pharmacies)

Sp. Pl. 1 (1753) 54, as '*officinaram*'; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 1563, in nota; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1959; Gilliland, Rev. Fl. Malaya 3 (1971) 227; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 179; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 118, fig. 121, pl. 29; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 76, 170, 263. **Synonyms:** *Arundo saccharifera* Sloane, Voy. Jamaica 1 (1707) t. 66, nom. inval. – *Saccharum officinale* Salisb., Prodr. Stirp. Chap. Allerton (1796) 17, nom. illeg. superfl. – *Saccharum officinarum* L. var. *commune* Kunth, Enum. Pl. 1 (1833) 474, nom. inval. – *Saccharum officinarum* L. var. *genuinum* Hack. & subvar. *commune* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 112–113, nom. inval. **Type:** [Published illustration] '*Arundo saccharifera* C.B.', Sloane, Voy. Jamaica (1707) t. 66, lectotype designated by Reveal, Taxon 38 (1989) 96. **Epitype:** Sloane Herb. vol. 2: fol. 14 (epitype BM, designated by Reveal, Taxon 38 (1989) 96). **Fig. 60C, 61B.**

Culms tufted, sometimes with short rhizomes, without stolons, erect, 2–6 m tall, 2–5 (or more) cm diam., many-coloured. **Sheaths** deciduous, mouth hairy. **Ligules** collar-shaped to linear, 0.5–3 mm high. **Leaf** blades 50–200 cm by 30–100 mm, base cuneate, usually glabrous. **Peduncle** glabrous below the panicle. **Panicles** rather lax, 25–100 × 14–17 cm; main axis glabrous or sparsely hairy, pilose at the nodes; longest branch 10–50 cm long; **joints** 3–6.5 mm long, 1–2 times as long as the spikelet, (sub)glabrous; pedicels 2.5–3 mm long. **Sessile spikelets** callus hairs up to 15 mm long, 2–3.3 times as long as the spikelet, 3–4.5 × 0.8–1 mm. Lower **glume** glabrous, 2-keeled, 2–4(–7)-nerved; upper glume of sessile spikelet glabrous, 1–3-nerved. Lower **lemma** slightly shorter than lower glume; upper lemma usually absent, when present much reduced, mucous. **Lodicules** glabrous. **Anthers** 3.

Distribution. Widely cultivated from pre-historic times but probably originally from New Guinea, where it is most diverse. In Singapore it has been collected as an escape on Bukit Timah Road (*Wong s.n.*, Sep 1959, SINGU) and Kranji (*Samsuri et al. KJ 4*, 20 May 2003, SING [SING0044601]).

Ecology. In Singapore rarely flowering. Noted as a 'casual' by Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 76, 170, 263).

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Uses. It is the most important species in hybridisation and breeding for commercial sugar cane. Other products include cane syrup, ethanol, molasses and rum. The fibrous residue (bagasse) can be used for fuel and pulp for paper and a wax may be extracted from it. See Burkill (Dict.



Figure 61. *Saccharum arundinaceum* Retz. **A.** Detail of culm with root-eyes. *Saccharum officinarum* L. **B.** Detail of culm with root-eyes. (From Singapore, A from Queensway, *Duistermaat 281*; B from Mount Sinai Drive, cultivated. Photos: H. Duistermaat).

Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1959) for an extensive summary.

Vernacular names. *Sugar cane* (English), *tebu* (Malay).

Notes. A very variable complex of forms, many of interspecific and intergeneric origin, propagated vegetatively.

3. *Saccharum spontaneum* L.

(Latin, *spontaneus* = growing in the wild; not cultivated)

Mant. Pl. Altera (1771) 183; Gilliland, Rev. Fl. Malaya 3 (1971) 224, t. 49, pl. 28a,b; Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 180; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 118, fig. 120; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 76, 170, 268. **Synonyms:** *Imperata spontanea* (L.) P.Beauv., Ess. Agrostogr. (1812) 165; Roemer & Schultes, Syst. Veg., ed. 15 bis, 2 (1817) 289, isonym. – *Saccharum spontaneum* L. subsp. *indicum* Hack. & var. *genuinum* Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 114, nom. inval. – *Saccharum officinarum* L. subvar. *spontaneum* Roberty, Boissiera 9 (1960) 369, nom. inval. **Type:** *König s.n.*, Malabariae aquosis [India] (lectotype LINN [Herb. Linn. no. 77.1], designated by Cope, Fl. Pakistan 143 (1982) 263). **Fig. 60D.**

Culms erect, tufted with long stolons, 1–6 m tall, 0.3–1.5 cm diam.; nodes bearded, **Sheaths** persistent, glabrous but for the margin and mouth, sometimes with tuberculate-based hairs all over. **Ligules** 1.5–8 mm high. **Leaf** blades 40–200 cm by 2–30 mm, base cuneate, there pilose, otherwise glabrous. **Panicles** rather lax, 20–80 × c. 5 cm; peduncle long-hairy below the panicle; common axis silky hairy, hairs white or purple, longest branch 4–17 cm long; joints 2.5–5 mm long, 1–2 times as long as the spikelet, silky pilose; pedicels 1.2–1.6 mm long, sparsely hairy. **Spikelets** 3–7 × c. 0.7 mm, callus hairs 2–4 times as long as the spikelet. **Glumes** with ciliate margins; lower glume 2(–4)-nerved; upper glume 1-nerved. Lower **lemma** well-developed; upper lemma usually present, sometimes well-developed, 3–4 mm long, usually filiform, muticous. **Lodicules** ciliate. **Anthers** 1.4–2 mm long.

Distribution. Eastern and northern Africa, Asia from the Mediterranean to Japan, and through Malesia, to Australia (Northern Territory) and the Solomon Islands, most diverse in India; introduced in Mesoamerica. In Singapore it is likely not native but in the past had naturalised at Kampung Bahru Road (*Kiah SF 38442*, 14 Aug 1948, SING [SING0058881]), Geylang (*Yok Chye SF 37779*, 3 Jun 1946, SING [SING0058880]) and Tampines Road (*Sinclair SF 40184*, 10 Jan 1954, L, SING [SING0058879]). It has not, however, been collected in Singapore since 1954.

Ecology. Elsewhere in not too dry areas, sunny to slightly shaded, along watercourses, secondary forest, sometimes vegetation-forming and forming impenetrable thickets (blade margins very sharp), occasionally cultivated.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore and now apparently no longer found.

Vernacular name. *Wild cane* (English).

49. SACCIOLEPIS Nash

(Greek, *saccio-* = bag, *-lepis* = scale; referring to the gibbous fertile floret)

in Britton, *Man. Fl. N. States* (1901) 89; De Gennaro & Scataglini, *Darwiniana* 50 (2012) 81; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 326. **Type:** *Sacciolepis gibba* (Elliott) Nash (= *Sacciolepis striata* (L.) Nash).

Panicum L. ser. *Myuroideae* Benth., *Fl. Austral.* 7 (1878) 465. **Type:** *Panicum myuros* Lam. (= *Sacciolepis myuros* (Lam.) Chase).

Annuals or perennials. **Culms** hollow; nodes glabrous. **Ligules** collar-shaped, membranous, ciliolate. **Leaf** blades linear, inrolled when young. **Panicles** densely contracted, spike-like. **Spikelets** quaquaversal, solitary, dorsally compressed, asymmetrical, gibbous or nearly so, 2-flowered. **Glumes** unequal, prominently nerved; lower glume 0.25–0.75 times as long as the spikelet, 3–5-nerved, base clasping; upper glume as long as the spikelet, saccate or nearly so, 7–11-nerved. **Lemmas** muticous; lower lemma paleate, sterile or male, as the upper glume,

5–9-nerved, acuminate; upper lemma deciduous, cartilaginous to thinly coriaceous, very faintly 3–5-nerved. **Stamens** 3.

Distribution. A pantropical genus of approximately 30 species, mainly African. In Singapore 2 native species.

Taxonomy. The genus perhaps belongs to the *Panicoideae* – *Paniceae* R.Br., subtribe uncertain.

Key to *Sacciolepis* species

1. Spikelets 2–3.4 mm long; anthers 0.7–1 mm long **1. *S. indica***
 Spikelets 1.3–2 mm long; anthers 0.3–0.5 mm long **2. *S. myosuroides***

1. *Sacciolepis indica* (L.) Chase (from the Indies)

Proc. Biol. Soc. Wash. 21 (1908) 8; Ridley, Fl. Malay Penins. 5 (1925) 232; Henderson, Malay. Wild Fls., Monocot. (1954) 334, fig. 191a,d; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1975; Gilliland, Rev. Fl. Malaya 3 (1971) 152, pl. 18b (var. *indica*); Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 180, fig. 287; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 119, fig. 122, pl. 31; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 76, 170, 273. **Basionym:** *Aira indica* L., Sp. Pl. 2 (1753) errata [2]. **Synonyms:** *Aira spicata* L., Sp. Pl. 1 (1753) 63, nom. inval. (non *Aira spicata* L., Sp. Pl. 1 (1753) 64). – *Panicum indicum* (L.) L., Mant. Pl. Altera (1771) 184, nom. illeg. non Mill. (1768); Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185. – *Panicum conglomeratum* L., Mant. Pl. Altera (1771) 324. – *Hymenachne indica* (L.) Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 37 [(Aug 1854) 377]. – *Panicum indicum* (L.) L. var. *normale* Kuntze, Revis. Gen. Pl. 2 (1891) 784, nom. inval. **Type:** *Davidse 7871*, Sri Lanka, Sabaragamuwa Province, Ratnapura District, 11 miles E. of Daniyaya along Highway 17 to Ratnapura, near mile post 62, 22 October 1974 (neotype K [K000245262], designated by Renvoize in Cafferty et al. (ed.), Taxon 49 (2000) 244; isoneotypes L, MO [MO-1410733]). **Fig. 62A, 63.**

Panicum angustum Trin., Sp. Gram. 3(28) (1835) t. 334. **Synonyms:** *Panicum indicum* (L.) L. var. *angustum* (Trin.) Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 42. – *Sacciolepis angusta* (Trin.) Stapf, Fl. Trop. Afr. 9(4) (1920), 763; Ridley, Fl. Malay Penins. 5 (1925) 232; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1974. **Type:** *Wallich s.n.*, Nepal (lectotype LE [Herb. Trinius 578.1], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 23).

Sacciolepis turgida Ridl., Fl. Malay Penins. 5 (1925) 231; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1975. **Synonyms:** *Sacciolepis indica* (L.) Chase var. *turgida* (Ridl.) Gilliland, Gard. Bull. Singapore 20(4) (1964) 314; Gilliland, Rev. Fl. Malaya 3 (1971) 154, fig. 29. **Type:** *Ridley 1708*, [Malaysia], Malay Peninsula, Johor, Tana Merah Road, 1890 (lectotype SING [SING0054509], designated by Veldkamp, Gard. Bull. Singapore 71 (2019) 40).

Annuals. **Culms** erect to decumbent at base, (0.1–)0.3–0.6(–1.5) m high. **Ligule** 0.2–1 mm high. **Leaf** blades linear, 3–20 cm by 2–6(–8) mm. **Inflorescence** 0.8–15 cm by 4–7 mm.

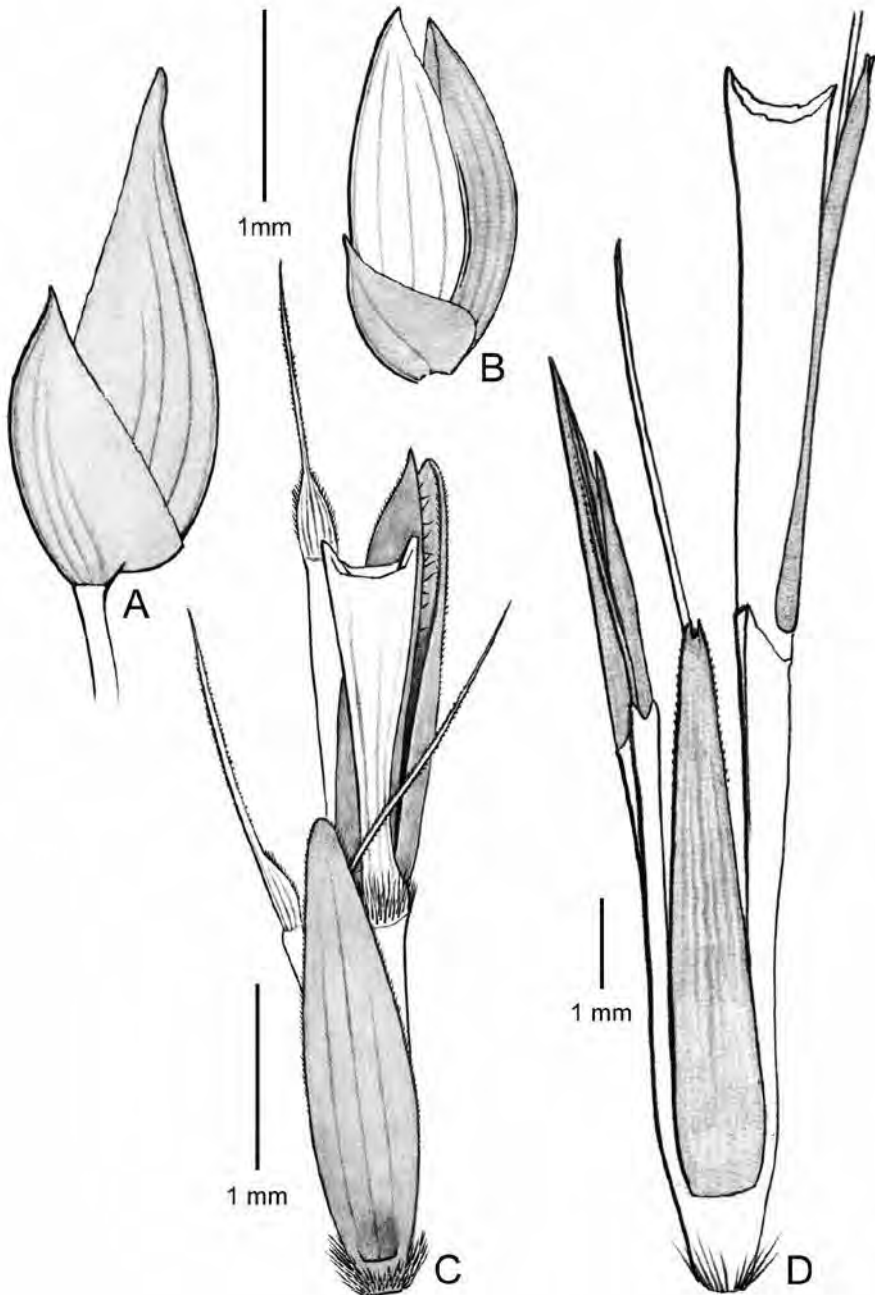


Figure 62. *Sacciolepis indica* (L.) Chase. **A.** Spikelet, lateral view. *Sacciolepis myosuroides* (R.Br.) Chase ex E.G.Camus & A.Camus. **B.** Spikelet, lateral view. *Schizachyrium brevifolium* (Sw.) Nees. **C.** Rachis with two pairs of spikelets. *Schizachyrium sanguineum* (Retz.) Alston. **D.** Rachis with a pair of spikelets on basal internode and one sessile spikelet on the upper internode. (Drawn by J.J. Vermeulen).



Figure 63. *Sacciolepis indica* (L.) Chase. **A.** Habit. **B.** Inflorescence. **C.** Detail of inflorescence. **D.** Detail of leaf sheath and blade. (From Singapore, Bishan Park, *Chen SING2017-765*. Photos: L.M.J. Chen).

Spikelets elongate ovoid, 2–3.4 × 0.7–1.5 mm, obtuse to acuminate. Lower **glume** 0.5–1.7 mm long, 0.25–0.5 times as long as the spikelet, 3–7-nerved; upper glume 7–11-nerved, obtuse to cuspidate, glabrous to distally hispid. Lower **lemma** like the upper glume, sterile or male, 1.7–3 mm long, acute to truncate, 7–9-nerved; upper lemma 1–1.5 mm long, hyaline to indurate. **Anthers** 0.7–1 mm long.

Distribution. Tropical Africa to India, China and Japan, through continental Southeast Asia and Malesia to Australia. Native in Singapore and widely collected, including from Bishan-Ang Mo Kio Park (*Chen SING2017-765*, 12 Dec 2017, SING [SING0255913]), Singapore Botanic Gardens (*Burkill SF 6649*, 1 Oct 1921, SING [SING0229931]), Bidadari Cemetery (*Turner et al. BC 4*, 3 Apr 2002, SING [SING0044893]), MacRitchie (*Duistermaat et al. 190*, 27 Sep 2003, SING [SING0059649]) and Pulau Tekong (*Samsuri et al. PT52*, 31 Oct 2001, SING [SING0039729, SING0039730]).

Ecology. Grasslands, road sides, open grassland, old fields, stream sides, marshy places, sea shore.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Short-spiked saccolepis* (English).

Notes. The wide variability in this species has led to the recognition of a number of varieties and segregate species which are here included in synonymy. Gilliland (Rev. Fl. Malaya 3 (1971) 151) suggested that both the length of the culm and leaf blade can be used to distinguish *Sacciolepis indica* from *S. myosuroides*. However, the most reliable character to differentiate these species is the size of the spikelet (Bor, Grasses Burma, Ceylon, India & Pakistan (1960) 356).

2. *Sacciolepis myosuroides* (R.Br.) Chase ex E.G. Camus & A. Camus

(Latin, *myosur-* = pertaining to *Myosurus* L., *-oides* = like, resembling;
referring to the appearance of the plant)

Fl. Indo-Chine 7, fasc. 4 (1922) 460; Hughes, Bull. Misc. Inform. Kew 1923 (1923) 330, isonym; Ridley, Fl. Malay Penins. 5 (1925) 232, isonym; Henderson, Malay. Wild Fls., Monocot. (1954) 335; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1975; Gilliland, Rev. Fl. Malaya 3 (1971) 152; Turner, Gard. Bull. Singapore 45 (1993) 101; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 180; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 120, fig. 123; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 76, 170, 273. **Basionym:** *Panicum myosuroides* R.Br., Prodr. Fl. Nov. Holland. (1810) 189; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 134. **Type:** *Banks & Solander s.n.*, New Holland [Australia], Endeavour River, 1770 (lectotype, BM [BM000793678]), first step designated by Webster, Austral. Paniceae (Poaceae) 202 (1987), second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 28; possible isolectotypes BM [BM000793679], CANB [×2]). **Fig. 62B.**

Annual or perennial. **Culms** tufted, erect to decumbent at base, 0.15–1 m high. **Ligules** 0.5–1.5 mm high. **Leaf** blades linear, 3–25 cm by 1–6 mm. **Inflorescences** 2–20 cm by 2–6 mm. **Spikelets** ovoid to subglobose, 1.3–2 × c. 0.9 mm, obtuse to acute. Lower **glume** 0.4–1 mm long, 0.3–0.67 times as long as the spikelet, 3–5-nerved; upper glume 5–9-nerved, glabrous, obtuse. Lower **lemma** sterile, as the upper glume, 7–9-nerved; upper lemma c. 1.3 mm long, indurate. **Anthers** 0.3–0.5 mm long.

Distribution. India to Malesia, the western Pacific and Australia. Likely native in Singapore but outside of cultivation in Singapore Botanic Gardens only collected in Kranji (*Ridley s.n.*, 8 Jan 1890, SING [SING0017823]) and MacRitchie (*Jumali 503*, 13 Sep 1961, SINU).

Ecology. Temporarily inundated places and shallow water.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Vernacular name. *Long-spiked saccolepis* (English).

50. SCHIZACHYRIUM Nees

(Greek, *schiza-* = split, *-achyrium* = chaff; referring to the bifid upper lemma)

in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 331; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 313. **Synonyms:** *Andropogon* L. sect. *Schizachyrium* (Nees) Benth., Fl. Austral. 7 (1878) 535. – *Andropogon* L. subg. *Schizachyrium* (Nees) Hack. in Martius, Fl. Bras. 2(3), fasc. 90 (1883) 296. – *Schizachyrium* Nees sect. *Pseudantherum* Robery, Boissiera 9 (1960) 228, nom. inval. **Type:** *Schizachyrium condensatum* (Kunth) Nees, lectotype designated by Pfeiffer, Nomencl. Bot. 2(2) (1874–1875 [‘1874’]) 1077.

Annuals or perennials. **Ligule** membranous. **Inflorescence** spatheate, racemes solitary, fragile. **Joints** flattened, without a longitudinal, translucent furrow. **Spikelets** dorsoventrally compressed, secund, 2-flowered, paired, dissimilar, one sessile, one pedicelled. **Callus** inserted into the joint apex, obconical, short, hairy. **Glumes** more or less equal; lower glume two-keeled, convex to flattened on the back, 3–13-nerved; upper glume 1–3-nerved. Upper **lemma** 2-lobed to 2-fid, shortly awned, awns glabrous. **Stamens** 3; pedicels free of the rachis. **Pedicelled spikelets** sterile or male.

Distribution. A genus of approximately 60 species in (sub)tropical regions. In Singapore 1 native species and 1 of uncertain status.

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoninae* J.Presl

Key to *Schizachyrium* species

1. Annual; culms 0.3–0.75 m long; blades 1–4 cm long, obtuse; racemes 1–2.5 cm long, sessile spikelets 2–3.5 mm long **1. *S. brevifolium***
 Perennial; culms 0.6–1.5 m long; blades 15–30 cm long, acute; racemes 8–12 cm long; sessile spikelets 7–8 mm long **2. *S. sanguineum***

1. *Schizachyrium brevifolium* (Sw.) Nees

(Latin, *brevi-* = short, *-folium* = leaved; with short leaves)

in Martius, Fl. Bras. Enum. Pl. 2(1) (1829) 332; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 210; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2010; Gilliland, Rev. Fl. Malaya 3 (1971) 291, fig. 62. **Basionym:** *Andropogon brevifolius* Sw., Prodr. Mus. Bot. Vindob. 1 (1788) 26; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 210; Henderson, Malay. Wild Fls., Monocot. (1954) 346, fig. 196e,f. **Synonyms:** *Pollinia brevifolia* (Sw.) Spreng., Pl. Min. Cogn. Pug. 2 (1815) 13. **Type:** Swartz *s.n.*, Jamaica (lectotype M [M-0090295], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 143, excluding the portion which is *Andropogon leucostachyus* Kunth; isoelectotypes BM, S). **Fig. 62C.**

Schizachyrium paradoxum Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 19 [(Aug 1854) 359]. **Synonyms:** *Schizachyrium brevifolium* (Sw.) Nees subsp. *paradoxum* (Buse) Henrard, Blumea 1(2) (1935) 308. – *Schizachyrium brevifolium* (Sw.) Nees var. *paradoxum* (Buse) Ohwi, Bot. Mag. (Tokyo) 55 (1941) 550. – *Andropogon brevifolius* Sw. var. *paradoxus* (Buse) Ohwi, Acta Phytotax. Geobot. 11 (1942) 169. **Type:** Junghuhn *s.n.*, Indonesia, Sumatra, Padang (lectotype L [L0819911], first step designated by Jansen, Reinwardtia 2 (1953) 337, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 40; isoelectotypes BRI, L [L0050060]).

Annual. **Culms** delicate, erect or trailing, 0.3–0.75 m tall; nodes glabrous. **Ligule** 0.5–0.8 mm long, ciliolate. **Leaf** blades linear-lanceolate, 1–4 cm by 2–5 mm, flat or folded, apex obtuse, glabrous. **Racemes** 1–2.5 cm long. **Joints** flattened. **Sessile spikelets** 2–3.5 × c. 0.4 mm. **Callus** short, blunt. **Glumes** dissimilar; lower glume two-keeled, apex minutely 2-toothed, flattened on the back, indistinctly 4–5-veined; upper glume 1-keeled. Lower **lemma** sterile; upper lemma incised. **Awns** absent or geniculate, up to 16 mm long, glabrous. **Pedicels** c. 2 mm long, glabrous or ciliate. **Pedicelled spikelet** reduced to 1 or 2 glumes, up to 0.5 mm long. Lower **glume** awn 3–5 mm long.

Distribution. America (Mexico to Argentina), Africa, Madagascar, Bhutan and northern India to southern China, through continental Southeast Asia and Malesia to Micronesia. In Singapore it might be native but has only once been collected from Sungei Gedong Road (*Sinclair s.n.*, 13 Nov 1949, L [L.1333123]).

Ecology. Elsewhere in open grasslands, waste places, and on sandy and stony soil.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore possibly not native but in any event nationally extinct.

2. *Schizachyrium sanguineum* (Retz.) Alston

(Latin, *sanguineus* = blood red; referring to the whole plant)

in Trimen, *Handb. Fl. Ceylon* 6 (1931) 334; Gilliland, *Rev. Fl. Malaya* 3 (1971) 289, pl. 35c, colour pl. 22; Turner, *Gard. Bull. Singapore* 45 (1993) 102; Keng et al., *Concise Fl. Singapore*, vol. 2, *Monocot.* (1998) 181; Duistermaat, *Gard. Bull. Singapore* 57, *Suppl.* (2005) 120, fig. 124; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 78, 170, 197. **Basionym:** *Rottboellia sanguinea* Retz., *Observ. Bot.* 3 (1783) 25. **Synonyms:** *Thelepogon sanguineus* (Retz.) Spreng., *Syst. Veg.* (ed. 16) 1 (1824 [‘1825’]) 299. – *Andropogon sanguineus* (Retz.) Merr., *Philipp. J. Sci.*, C 12 (1917) 101. **Type:** *Bladh s.n.*, China (lectotype LD [LD1224426], designated by Clayton & Renvoize, *Fl. Trop. E. Africa, Gramineae* (Pt 3) (1982) 756). **Fig. 62D.**

Schizachyrium semiberbe Nees in Martius, *Fl. Bras. Enum. Pl.* 2(1) (1829) 336; Ridley, *Fl. Malay Penins.* 5 (1925) 210; Burkill, *Dict. Econ. Prod. Malay Penins.* 2 (1935) 2010. **Synonyms:** *Andropogon semiberbis* (Nees) Kunth, *Enum. Pl.* 1 (1833) 489. – *Schizachyrium sanguineum* (Retz.) Alston subvar. *semiberbe* (Nees) Roberty, *Boissiera* 9 (1960) 222. **Type:** *Sellow s.n.*, Brazil (lectotype B [B100383436], designated by Judziewicz, *Fl. Guianas, ser. A, Phanerogams* 8 (1990) 579; isolectotypes BR [×2], HAL, K, LE, MVFA (fragment), P, US, W [×2]).

Andropogon pseudograya Steud., *Syn. Pl. Glumac.* 1, fasc. 4–5 (1854) 365; Ridley, *J. Straits Branch Roy. Asiat. Soc.* 33 (1900) 186. **Type:** *Arnott*, Ceylon [Sri Lanka] (not traced).

Andropogon hirtiflorus auct. non (Nees) Kunth: Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 166.

Perennial. **Culms** tufted, erect, 0.5–1.5 m tall; nodes glabrous. **Ligule** 1–1.2 mm long. **Leaf** blades folded lengthwise when young, linear, 5–30 cm by 1–6 mm, flat, acute, glabrous. **Racemes** spike-like, slender, 3–12 cm long. **Joints** flattened. **Sessile spikelets** 5–8 × 0.5–0.6 mm. **Callus** short, blunt, hairs up to 1.5 mm long. **Glumes** more or less equal; lower glume two-keeled, apex bifid, convex to flattened on the back, 3–13-nerved; upper glume 1–3-nerved. Lower **lemma** sterile; upper lemma 2-fid. **Awns** geniculate, 10–16 mm long, glabrous. **Pedicels** c. 5 mm long, flattened, hairy on one margin. **Pedicelled spikelet** reduced to 1 or 2 glumes, 2.8–5 mm long. Lower **glume** awn 0.5–3 mm long.

Distribution. Madagascar, Africa, India to southern China, continental Southeast Asia and Malesia. Native in Singapore but infrequently collected, including from Changi (*Ridley 1756*, Oct 1890, SING [SING0035115]), Geylang (*Ridley 8950*, 1897, SING [SING0035117]), Loyang (*Holttum 13 Mar 1949*, L), Pulau Tekukor (*Tan et al. 111*, 22 Oct 1996, SINU) and Tampines Road (*Kassim & Wong s.n.*, 7 Aug 1959, SINU).

Ecology. Open slopes, grassy places, sandy places near the sea.

Provisional conservation assessment. Globally Least Concern (LC). Erroneously listed as Nationally Extinct in Singapore by Tan et al. (in Davison et al. (ed.), *Singapore Red Data Book*, ed. 2 (2008) 238) and Chong et al. (*Checkl. Vasc. Pl. Fl. Singapore* (2009) 78, 170, 197), presumably because the specimen collected on Pulau Tekukor in 1996 was not included in their assessments. It is likely to be present in Singapore in extremely small numbers so is assessed here as Critically Endangered (CR/D).

Vernacular name. *Crimson bluestem* (English).

51. SCROTOCHLOA Judz.

(Greek, *scroto-* = scrotum, *-chloa* = grass; referring to the utricles)

Phytologia 56 (1984) 299; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 136. **Type:** *Scrotochloa urceolata* (Roxb.) Judz.

Perennials, monoecious. **Culms** rhizomatous, branching intra- and extravaginally at base, hollow or solid. **Ligules** membranous, rim-like. **Leaf** blades twisted, the lower surface facing upwards, pseudo-petiolate, pinnately- and cross-veined. **Inflorescences** subumbellate to paniculate, articulating from the peduncle; common axis usually short, branches 3–8(–11) together, upper ones solitary. **Spikelets** unisexual, 1-flowered, heteromorphous, in the same inflorescence, paired, or the female solitary, muticous. **Glumes** caducous, very dissimilar, obtuse to acute. **Female spikelets** sometimes subtended by a bracteole, in fruit inflated to a hairy utricle. **First glume** obovate, 7–9-nerved; second glume as long as the spikelet at anthesis, obovate, 5–7-nerved. **Lemma** with fused margins, at maturity urceolate with a conical beak with an apical pore, 11–13-nerved, with both viscosly glandular and uncinat hairs, with a terminal pore. **Styles** fused, stigmas 3. **Male spikelets** laterally flattened, herbaceous, deciduous. Lower **glumes** 0-nerved; upper glumes 3–7-nerved. **Lemmas** more or less tubular, 7-nerved. **Stamens** 6.

Distribution. A genus of 2 species in the Old World tropics, from southern India and Sri Lanka to Vietnam, Malesia, Australia (Queensland) and the Solomon Islands. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Pharoideae* L.G.Clark & Judz.

Scrotochloa urceolata (Roxb.) Judz.

(Latin, *urceolatus* = pitcher-shaped; referring to the female spikelets)

Phytologia 56 (1984) 300; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 181, fig. 288; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 122, fig. 125; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 224. **Basionym:** *Pharus urceolatus* Roxb., [Hort. Bengal. (1814) 104, nom. nud.] Fl. Ind., ed. 2, 3 (1832) 611. **Synonym:** *Leptaspis urceolata* (Roxb.) R.Br. in Bennett, Pl. Jav. Rar. (1838) 23, t. 6; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 150; Ridley, Fl. Malay Penins. 5 (1925) 255; Henderson, Malay. Wild Fls., Monocot. (1954) 307, fig. 176; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1355; Gilliland, Rev. Fl. Malaya 3 (1971) 47, fig. 2, pl. 9a; Turner, Gard. Bull. Singapore 45 (1993) 99. **Type:** *Roxburgh s.n.*, [Malaysia], Pulo Pinang [Penang] (lectotype BM [BM000959309], designated by Soderstrom et al., Smithsonian Contr. Bot. 65 (1987) 3). **Fig. 64A, 65.**

Culms rhizomatous, single or tufted, 0.3–1 long, hollow, glabrous, becoming puberulous upward. **Sheaths** with transverse veinlets. **Ligules** c. 0.3 mm long. **Pseudopetiole** 1.1–5(–6)

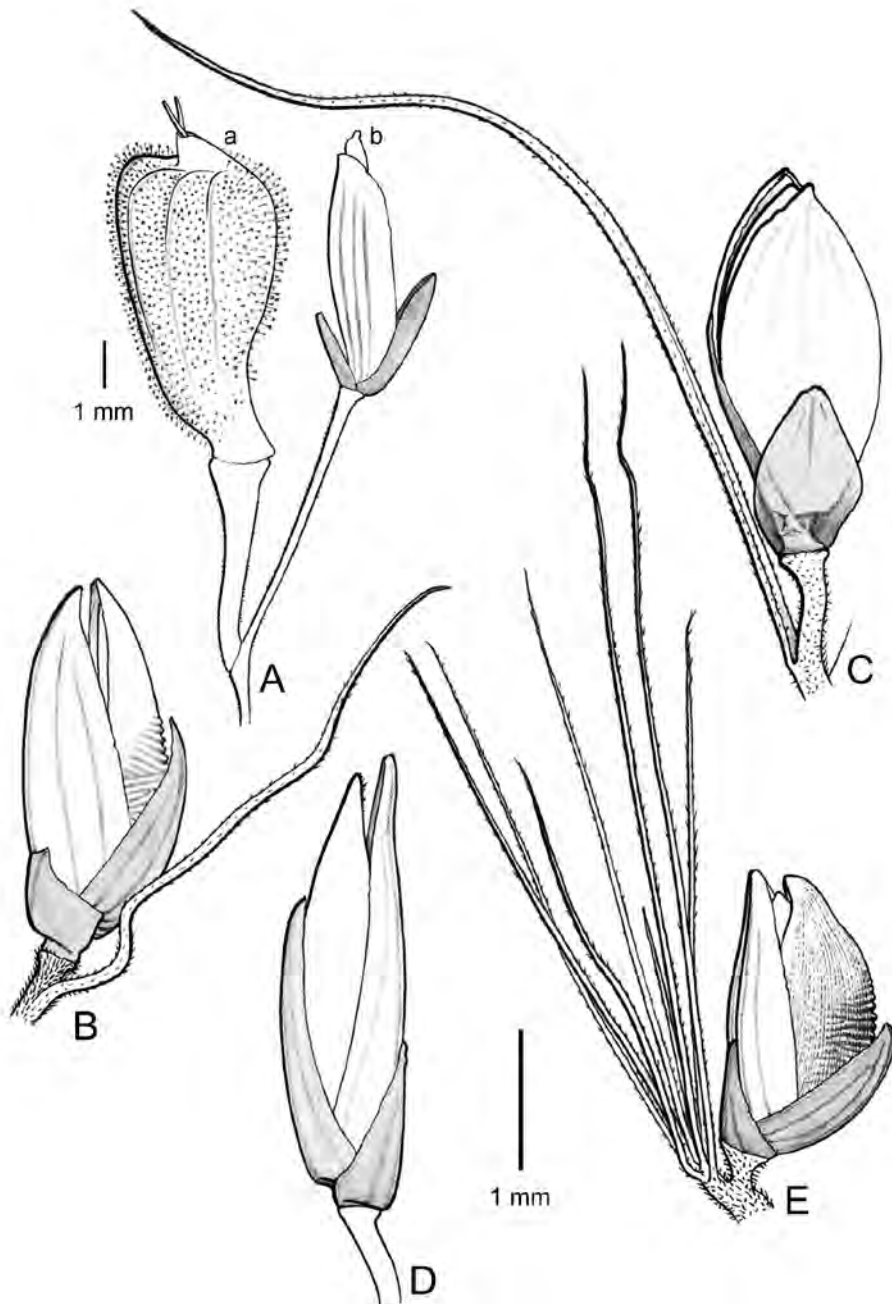


Figure 64. *Scrotochloa urceolata* (Roxb.) Judz. **A.** Pair of spikelets: **a.** female spikelet, **b.** male spikelet. *Setaria barbata* (Lam.) Kunth. **B.** Spikelet, lateral view. *Setaria italica* (L.) P.Beauv. **C.** Spikelet, facing lower glume. *Setaria palmifolia* (J.Koenig) Stapf. **D.** Spikelet, lateral view. *Setaria parviflora* (Poir.) Kerguélen. **E.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).



Figure 65. *Scrotochloa urceolata* (Roxb.) Judz. **A.** Habit. **B.** Detail of inflorescence. **C.** Two female spikelets. **D.** Detail of inflorescence. (From Singapore, MacRitchie. Photos: J. Leong-Škorničková).

cm long, glabrous. **Leaf** blades ovate-oblong to lanceolate, inrolled when young, 8–32(–37) × 3–7(–8.3) mm, lower surface glabrous. **Inflorescence** common axis up to 11 cm long, branches 5–15(–25), in 1 or 2 (or 3) whorls, solitary upward, at maturity stiffly spreading to reflexed, densely hairy. **Female spikelets** globose. First **glume** 4.5–6(–7.5) × 4–4.5 mm. **Lemmas** at maturity up to 8(–10) mm long. **Paleas** protruding through the apical pore at tip of lemma, thin herbaceous, glabrous, apex bifid, 0.5–1.0 mm. **Male spikelets** ellipsoid, 3–6 × 0.7–2.3 mm. Lower **glume** triangular to lanceolate, 1–1.5 mm long, obtuse, 1-nerved, glabrous; upper glume obovate, 2–2.8 mm long, obtuse. **Lemma** lanceolate, c. 5 mm long. **Anthers** 2.5–5 mm long.

Distribution. From southern India and Sri Lanka to Vietnam, Malesia, Australia (Queensland) and the Solomon Islands. Native in Singapore but infrequently collected, including from Bukit Timah (*Ridley s.n.*, 1894, SING [SING0201743]), Chan Chu Kang (*Ridley 1707*, 1889, SING [SING0201742]), MacRitchie (*Boo & Chen 235*, 11 Jun 1998, SING [SING0042822]; *Duistermaat et al. 195*, 27 Sep 2003, SING [SING0059695]) and Pulau Ubin (*Ridley 369*, 5 Mar 1890, SING [SING0201741]).

Ecology. Primary and secondary shady rain forest on a range of soil types.

Provisional conservation assessment. Globally Least Concern (LC). Listed as Vulnerable (VU/D) in Singapore by Tan et al. (in Davison et al. (ed.), Singapore Red Data Book, ed. 2 (2008) 238) and Chong et al. (Checkl. Vasc. Pl. Fl. Singapore (2009) 78, 170, 224).

Vernacular names. *Shield grass* (English), *rumpul babi* (Malay).

52. SETARIA P.Beauv.

(Latin, *setarius* = bearing bristles; referring to the pedicels bearing at least 1 long bristle)

Ess. Agrostogr. (1812) 51, 178, pl. 13: fig. 3, nom. cons.; Veldkamp, *Blumea* 39 (1994) 373; Morrone et al., *Syst. Bot. Monogr.* 96 (2014) 1; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 335. **Synonyms:** *Panicum* L. sect. *Setaria* (P.Beauv.) Nees in Martius, *Fl. Bras. Enum. Pl.* 2(1) (1829) 237, as ‘*Setarieae*’; Steudel, *Syn. Pl. Glumac.* 1, fasc. 1 (1853) 49, isonym; Döll in Martius, *Fl. Bras.* 2(2), fasc. 72 (1877) 156, isonym. – *Chaetochloa* Scribn., *Bull. Div. Agrostol. U.S.D.A.* 4 (1897) 38. **Type:** *Setaria viridis* (L.) P.Beauv., typ. cons.

Panicum L. subg. *Ptychophyllum* A.Braun, *Index Sem.* (Berlin), App. (1855) 18. **Synonym:** *Setaria* P.Beauv. sect. *Ptychophyllum* (A.Braun) Ridl., *Mat. Fl. Malay. Penins.* 3 (1907) 131. **Type:** *Panicum plicatum* Lam., lectotype designated by Hitchcock, *Contr. U.S. Natl. Herb.* 22 (1920) 156 (= *Setaria palmifolia* (J.Koenig) Stapf var. *blepharoneuron* (A.Braun) Veldkamp).

Annuals or perennials. **Culms** branching intra- and extra-vaginally at base. **Ligule** a row of hairs or a membranous collar. **Inflorescence** a lax panicle to a densely contracted raceme, ultimate branches indeterminate, i.e. without a terminal spikelet, but with a more or less bristle-like extension, or spikelets subtended by 1 or more bristles (‘involucre’) persistent on the main axis, the spikelets deciduous from it. **Spikelets** solitary, paired, or clustered,

quaquaversal to biseriate and secund, sessile to pedicelled, dorso-ventrally compressed, abaxial, falling from the involucre or from the axis, 2-flowered; callus truncate, glabrous. **Glumes** very unequal, retuse to mucronate, herbaceous; lower glume usually up to half as long as the spikelet, 0–7-nerved, base more or less clasping; upper glume 0.15–1 times as long as the spikelet, 0–9(–11)-nerved. Lower **lemma** herbaceous, epaleate to paleate, sterile to male, 3–7-nerved; upper lemma indurate, usually more or less striate or rugose, 0–5-nerved, germination flap present, apex thickened to mucronate.

Distribution. A genus of approximately 150 species, mainly tropical, some temperate. In Singapore 1 native species and 3 naturalising.

Uses. The genus contains a number of species which are ancient cereals (e.g. *Setaria italica* (L.) P.Beauv. and *S. parviflora* (Poir.) Kerguelén) or pasture grasses (e.g. *S. sphacelata* (Schumach.) Stapf & C.E.Hubb.). For an extensive historical survey see Austin (Econ. Bot. 60 (2006) 143–158).

Taxonomy. The genus belongs to the *Panicoideae* – *Cenchrinae* Dumort.

Notes. A very polymorphic genus apparently close to *Cenchrus* L., which differs mainly in the deciduous involucre in which the spikelets are retained.

The mature spikelets of the ‘bottle-brush’ species are apparently harvested by ants which cut up the inflorescence to its basal branches. This needs further observation.

The cultivated *Setaria sphacelata* (Schumach.) Stapf & C.E.Hubb. is included in the key in italics because it is known to escape elsewhere although there is no evidence this has happened in Singapore.

Key to *Setaria* species

1. Blades plicate; inflorescence a lax panicle, longest branch 1–16 cm long 2
 Blades flat; inflorescence dense and bottle-brush-shaped, branches absent or up to 0.8 cm long 3
2. Culms geniculate and rooting at base, branching intra-vaginally at base, cataphylls absent; blade margin at base with bulbous-based bristles; panicle common axis and branches pilose; branches stiffly patent; lower glume 0.7–1 mm long; upper lemma easily deciduous from the spikelet, transversally rugose; anthers 0.7–1 mm long **1. *S. barbata***
 Culms erect, branching extra-vaginally at base, cataphylls present; blade margin at base glabrous; panicle common axis and branches glabrous, scaberulous; branches drooping; lower glume 1.1–2 mm long; upper lemma persistent, transversally rugulose; anthers 0.9–1.75 mm long **3. *S. palmifolia***
3. Inflorescence common axis puberulous, branches with the axis not elongated; involucre consisting of 6–15 bristles; spikelets ellipsoid; glumes without a distinctly developed internode; lower glume hemi-amplexicaul; upper glume rounded or apiculate; lower lemma acute or apiculate; upper lemma persistent 4

Inflorescence common axis pilose, branches with an elongated axis; involucre consisting of 1 bristle; spikelets ellipsoid and apparently stipitate; glumes with a distinctly developed internode; lower glume amplexicaul; upper glume obtuse or acute; lower lemma obtuse; upper lemma easily detachable from the spikelet **2. *S. italica***

4. Annual or short-lived perennial; culms 0.05–1 m long; involucre with 1 well-developed spikelet; anthers 0.75–1 mm long; leaf blades 2.5–8 mm wide; inflorescences 0.8–11.5 cm long **4. *S. parviflora***
 Perennial; culms 1–3 m long; involucre with 1–4 spikelets; anthers 1.35–1.65 mm long; leaf blades 5–20 mm wide; inflorescences 7–50 cm long *S. sphacelata*

1. *Setaria barbata* (Lam.) Kunth

(Latin, *barbatus* = bearded; referring to the hairy culms and sheaths)

Révis. Gramin. 1 (1829) 47; Turner, Gard. Bull. Singapore 45 (1993) 102; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 182; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 124, fig. 126, pl. 32; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 79, 170, 268. **Basionym:** *Panicum barbatum* Lam., Tabl. Encycl. 1, fasc. 1 (1791) 171. **Synonyms:** *Panicum viaticum* Salzm. ex Döll in Martius, Fl. Bras. 2(2), fasc. 72 (1877) 155, nom. illeg. non Griff. (1851). – *Chamaeraphis viatica* (Salzm. ex Döll) Kuntze, Revis. Gen. Pl. 2 (1891) 770, nom. illeg. superfl. – *Chaetochloa barbata* (Lam.) Hitchc. & Chase, Contr. U.S. Natl. Herb. 18 (1917) 348. **Type:** *Commerson s.n.* (lectotype P-LA [P00307246]), designated by Veldkamp, Blumea 39 (1994) 375; isolectotype US (fragment). **Fig. 59B, 64B.**

Perennial. **Culms** rhizomatous, tufted, geniculate and rooting at the decumbent nodes, branching intra-vaginally at base, 0.2–1(–2) m long, cataphylls absent; nodes bearded. **Ligule** a scarious setose collar, 0.3–3 mm long. **Leaf** blades folded along the midrib when young, later flat, plicate, 6–45 cm by (6–)10–45 mm, pilose above, base somewhat pseudo-petiolate, margin at base with bulbous-based bristles, apex gradually acute. **Panicles** lax, 5–60 × 1–5 cm (incl. bristles); common axis pilose; branches with an elongated axis, filiform, 1–3(–8) cm long, patent, with 2–more, not distinctly secund spikelets, the lower as long as to longer than the adjoining internode of the common axis, pilose, apex ending in a bristle. **Involucre** absent or consisting of 1 bristle with 1 well-developed spikelet; bristles 4–10(–20) mm long, antrorsely scaberulous. **Spikelets** ellipsoid, moderately plano-convex, 2.25–3(–4) × 1.1–1.3 mm. **Glumes** glabrous; lower glume shorter than the upper glume, ovate, 0.7–1 mm long, 0.25–0.4 times as long as the spikelet, 3-nerved, acute; upper glume 1.25–2 mm long, 0.5–0.75 times as long as the spikelet, obtuse to acute, (5–)7-nerved. Lower **lemma** usually paleate, sterile to male, acuminate, 7-nerved; upper lemma deciduous, transversally rugose, acuminate to apiculate. **Anthers** 0.7–1 mm long.

Distribution. Originally probably from West Africa, now introduced throughout the tropics. In Singapore widely collected, including from Bukit Timah (*Ali Ibrahim & Chin AI233*, 2 Sep 1994, SING [SING0058874]), Cluny Road (*Duistermaat 130*, 26 Mar 2003, SING [SING0059644]), Kallang Riverside (*Chen SING2018-013*, 31 May 2018, SING [SING0254016]), Mandai Quarry (*Duistermaat & Hillier 56*, 12 Mar 2002, L, SING [SING0059645]) and Pulau Hantu (*Chua et al. H 59*, 28 Jan 1993, SINU).

Ecology. Moist, preferably moderately shady localities, waste areas, gardens.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. Easily recognisable from a distance by the short patent branches of the panicle.

2. *Setaria italica* (L.) P.Beauv. (of Italy)

Ess. Agrostogr. (1812) 51, 178; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 144; Ridley, Fl. Malay Penins. 5 (1925) 234; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2034; Gilliland, Rev. Fl. Malaya 3 (1971) 156; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 182; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 124, fig. 128. **Basionym:** *Panicum italicum* L., Sp. Pl. 1 (1753) 56. **Synonyms:** *Panicum glomeratum* Moench, Methodus (1794) 207, nom. illeg. superfl. – *Panicum elongatum* Salisb., Prodr. Stirp. Chap. Allerton (1796) 18, nom. illeg. superfl. – *Pennisetum italicum* (L.) R.Br., Prodr. Fl. Nov. Holland. (1810) 195. – *Penicillaria italica* (L.) Oken, Allg. Naturgesch. 3 (1841) 406. – *Chamaeraphis italica* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 767. – *Ixophorus italicus* (L.) Nash, Bull. Torrey Bot. Club 22 (1895) 423. – *Chaetochloa italica* (L.) Scribn., U.S.D.A. Bull. Agrostol. 4 (1897) 39. – *Panicum viride* L. subsp. *italicum* (L.) Asch. & Graebn., Syn. Mitteleur. Fl. 2 (1899) 77. – *Panicum viride* L. var. *italicum* (L.) Backer, Handb. Fl. Java 2 (1928) 142. – *Setariopsis italica* (L.) Sampaio, Anais Fac. Sci. Porto 19 (1934) 69. **Type:** *Collector unknown s.n.* (lectotype L [Herb. van Royen sheet no. 912.356-242], designated by Veldkamp in Cafferty et al. (ed.), Taxon 49 (2000) 253). **Fig. 64C.**

Annuals. **Culms** tufted or solitary, erect, 0.25–1.8 m long; nodes sometimes with adventitious roots, glabrous. **Ligule** a scarious setose collar, 0.5–0.7(–3) mm long. **Leaf** blades inrolled when young, later flat, not plicate, (5–)20–50 cm by 4–30 mm, glabrous above, base truncate, margin at base glabrous, apex gradually acute. **Inflorescences** lobed at base to densely contracted, (0.5–)6–30(–40) × 1–3.5(–5) cm (incl. bristles); common axis pilose; branches filiform, with an elongated axis, branched, with many not distinctly secund spikelets, the lower branches as long as to longer than the adjoining internode of the common axis, pilose, apex ending in a bristle. **Involucre** consisting of 1(–3) bristles with 1 well-developed spikelet; bristles 2–12 mm long, antrorsely scaberulous. **Spikelets** ellipsoid, strongly plano-convex, (1.5–)1.9–3 × 0.9–1.3 mm. **Glumes** glabrous with a distinct internode; lower glume shorter than the upper glume, ovate, 0.7–1.35 mm long, 0.28–0.5 times as long as the spikelet, (1–)3(–5)-nerved, acute; upper glume 1.5–2.4 mm long, 0.78–0.9 times as long as the spikelet, obtuse to acute, faintly 5(–9)-nerved. Lower **lemma** paleate, sterile, obtuse, faintly 5–7(–9)-nerved; palea inconspicuous, much shorter than lemma; upper lemma deciduous, faintly longitudinally striate to transversally rugulose, faintly apiculate. **Anthers** 0.45–0.7(–0.9) mm long.

Distribution. Formerly widespread as a cultivated cereal and previously casual or naturalised in Singapore with collections from an unspecified locality (*Jumali s.n.*, 12 Jul 1962, SINU) and in the University of Singapore (*Jumali 1029*, 3 Jul 1962, K, L, SING [SING0041473]). It now appears to be extinct in Singapore except in cultivation.

Ecology. Formerly widely cultivated and escaping to dry fields, disturbed areas, and old clearings.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore but nevertheless now nationally extinct.

Uses. The oldest remnants date from 7000 years ago in China where it was found in jars suggesting the plants were cultivated but it may have originated anywhere from western Europe to Japan. It was widely cultivated across southern Eurasia until the twentieth century but has since been replaced by wheat, maize and rice. It is still of importance in parts of India and China. Elsewhere it is cultivated as a bird seed, a famine crop, or for ancestor rituals, and as fodder, thatching and straw.

Vernacular names. *Italian millet* (English), *sekoi* (Malay).

Notes. Supposed to have been derived from *Setaria viridis* (L.) P.Beauv., with which it may hybridise naturally (Darmency et al., *Genetica* 95 (1987) 103), and the two are kept separate here for traditional reasons. It is very polymorphic due to its ancient cultivation, but rather uniform in the Malesian region.

3. *Setaria palmifolia* (J.Koenig) Stapf

(Latin, *palmi*- = palm, *-folia* = leaves; referring to the palm-like plicate leaves)

in Gibbs, *J. Linn. Soc., Bot.* 42 (1914) 186; Henderson, *Malay. Wild Fls., Monocot.* (1954) 324, fig. 186d,f; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 2035; Gilliland, *Rev. Fl. Malaya* 3 (1971) 157, fig. 30; Turner, *Gard. Bull. Singapore* 45 (1993) 102; Keng et al., *Concise Fl. Singapore*, vol. 2, *Monocot.* (1998) 182, fig. 289; Duistermaat, *Gard. Bull. Singapore* 57, *Suppl.* (2005) 126, fig. 127. **Basionym:** *Panicum palmifolium* J.Koenig, *Naturforscher (Halle)* 23 (1788) 208, as '*palmaefolium*'. **Type:** *Collector unknown s.n.*, 'Penins. Indiae orientalis' (neotype K [K000245334], designated by Turner et al., *Gard. Bull. Singapore* 71 (2019) 28). **Fig. 64D.**

Panicum plicatum auct. non Lam.: Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 136.

Setaria plicata auct. non (Lam.) T.Cooke: Ridley, *Fl. Malay Penins.* 5 (1925) 235.

Perennial. **Culms** rhizomatous, tufted, more or less erect, branching extra-vaginally at base (note cataphylls), 0.75–2 m long; nodes puberulous. **Ligule** a scarious setose collar, 1.5–3 mm long. **Leaf** blades more or less folded along the midrib when young, later flat, plicate, 15–70 cm by 14–100 mm, setulose to glabrous above, base somewhat pseudo-petiolate, margin at base glabrous, apex gradually acute. **Inflorescences** lax, 13–70 × 2.5–10 cm (incl. bristles); common axis glabrous, scaberulous; branches drooping, filiform, with an elongated axis, 6–20 cm long, with many, not distinctly secund spikelets, the lower as long as to longer than the adjoining internode of the common axis, scaberulous, apex ending in a bristle. **Involucre** absent or present, consisting of 1 bristle, with 1 well-developed spikelet. **Bristles** 2–15 mm long, antrorsely scaberulous. **Spikelets** ellipsoid, moderately plano-convex, 3–4 × 1.1–1.2 mm.

Glumes glabrous; lower glumes shorter than the upper glume, hemi-amplexicaul, ovate, 1.1–2 mm long, 0.33–0.5 times as long as the spikelet, obtuse to acute, 3–5-nerved; upper glume 1.9–3.25 mm long, 0.5–0.85 times as long as the spikelet, (5–)7-nerved, acute to acuminate. Lower **lemma** epaleate to paleate, sterile, often distinctly longer than the upper lemma, apex acuminate, often somewhat incurved, 5(–)7-nerved; upper lemma persistent, transversally rugulose, acuminate to falcate. **Anthers** 0.9–1.75 mm long.

Distribution. India to China and Japan, through continental Southeast Asia and Malesia to New Guinea, not in Australia; introduced elsewhere. Formerly naturalised in Singapore and collected from an unknown locality (*Ridley s.n.*, 1904, SING [SING0017841]), Cluny Road (*Jumali 936*, 22 Oct 1963, SINU), Lermite Road (*Jumali s.n.*, 23 Nov 1962, SINU) and University grounds (*Kassim 2607*, 1 May 1959, SINU).

Ecology. Elsewhere in moist places under thickets, stream banks, forest paths, coffee plantations, sometimes in tea plantations, locally abundant, indicator of fertile soils.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore but nevertheless now nationally extinct.

Vernacular name. *Broad-leaved bristle grass* (English).

Notes. The species was probably cultivated in Singapore Botanic Gardens and later in the University Gardens from one or both of which it escaped but did not long persist.

4. *Setaria parviflora* (Poir.) Kerguelén

(Latin, *parvi-* = small, *-flora* = flowers; with small flowers, i.e. spikelets)

Lejeunia, new ser., 120 (1987) 161; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 183; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 126, fig. 129; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 79, 170, 230. **Basionym:** *Cenchrus parviflorus* Poir. in Lamarck, Encycl. 6, fasc. 1 (1804) 52. **Synonyms:** *Pennisetum parviflorum* (Poir.) Trin., Gram. Panic. (1826) 65. – *Setaria ventenatii* Kunth, Révis. Gramin. 1 (1830) 251, t. 37, nom. illeg. superfl. – *Panicum ventenatii* Steud., Nomencl. Bot., ed. 2, 1 (1840) 317, nom. nov., non *Panicum parviflorum* R.Br. (1810). – *Chamaeraphis ventenatii* (Steud.) Beal, Grass. N Amer. 2 (1887) 153, nom. illeg. superfl. – *Chaetochloa corrugata* (Ell.) Scribn. var. *parviflora* (Poir.) Scribn. & Merr., Bull. Div. Agrostol. U.S.D.A. 21 (1900) 24, fig. 12. – *Chaetochloa parviflora* (Poir.) Scribn. ex Millsp., Publ. Field Mus. Nat. Hist., Bot. Ser. 2 (1900) 26. – *Chaetochloa ventenatii* (Steud.) Nash in Kearney, Contr. U.S. Natl. Herb. 5 (1901) 515, nom. illeg. superfl. – *Pennisetum indicum* Kuntze subvar. *parviflora* (Poir.) Leeke, Z. Naturwiss. 79 (1907) 19. **Type:** *Ventenat s.n.* (Riedlé?), Puerto Rico (holotype P-LA [P00564021]; isotype US). **Fig. 64E.**

Panicum pallidifusum Schumach., Beskr. Guin. Pl. (1827) 58. **Synonyms:** *Setaria pallidifusca* (Schumach.) Stapf & C.E.Hubb., Bull. Misc. Inform. Kew 1930 (1930) 259, as ‘*pallidifusca*’; Gilliland, Rev. Fl. Malaya 3 (1971) 159, pl. 20b, colour pl. 9. – *Setaria glauca* (L.) P.Beauv. var. *pallidifusca* (Schumach.) T.Koyama, J. Jap. Bot. 37 (1962) 237. – *Setaria pumila* (Poir.) Roem. & Schult. subsp. *pallidifusca* (Schumach.) B.K.Simon, Austrobaileya 2 (1984) 248. **Type:** *Thonning 344*, Guinea [Ghana] (lectotype C [C10004269], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 28; isolectotypes C [×4], K (fragment)).

Panicum rubiginosum Steud., Syn. Pl. Glumac. 1, fasc. 1 (1853) 50. **Synonyms:** *Setaria rubiginosa* (Steud.) Steud. ex Miq., Fl. Ned. Ind. 3, fasc. 3 (1857) 467; Ridley, Fl. Malay Penins. 5 (1925) 234. – *Setaria aurea* A.Braun var. *rubiginosa* (Steud.) Peter, Repert. Spec. Nov. Regni Veg., Beih. 40 (1931) 233. **Type:** *Cuming 551*, Philippines (lectotype P [P00642103], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 30; isolectotypes BM, CGE, G [$\times 3$], K, L, MO, P [$\times 2$], W).

Setaria geniculata auct. non P.Beauv.: Henderson, Malay. Wild Fls., Monocot. (1954) 323, fig. 186a–c; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2035.

Setaria glauca auct. non (L.) P.Beauv.: Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 144.

Setaria pumila auct. non (Poir.) Roem. & Schult.: Turner, Gard. Bull. Singapore 45 (1993) 102; Tan, Threat. Pl. Singapore (1995) 147.

Annual or short-lived perennial. **Culms** sometimes rhizomatous and with cataphylls, tufted to shortly rhizomatous, erect to geniculate and rooting at base, branching intra- and extra-vaginally at base, 0.05–1 m long; nodes glabrous. **Ligule** a fringe of hairs to a scarious setose collar, 0.8–1.5 mm long. **Leaf** blades inrolled when young, later flat to usually involute, not plicate, 3.5–65 cm by 2.5–8 mm, above glabrous to pilose, base truncate, margin at base glabrous (but usually with a tuft of hairs in the throat), apex gradually acute. **Inflorescences** densely contracted, 0.8–11.5(–15) \times 0.5–1.4(–1.7) cm (incl. bristles); common axis puberulous, branches filiform, axis not elongated, up to 4 mm long, spikelets not secund. **Involucre** consisting of 4–14 bristles with 1 well-developed spikelet; bristles 1.8–10(–17) mm long, antrorsely scaberulous. **Spikelets** ellipsoid, 1.8–2.5(–3.2) \times 0.9–1.1 mm. **Glumes** glabrous; lower glume shorter than the upper glume, ovate, (0.6–)0.8–1(–1.7) mm long, (0.32–)0.42–0.53(–0.62) times as long as the spikelet, acute to apiculate, 3(–5)-nerved; upper glume 1–1.35(–2.55) mm long, 0.47–0.69(–0.92) times as long as the spikelet, apiculate, 5-nerved. Lower **lemma** paleate, sterile to male (rarely), apiculate, 5-nerved (sometimes slightly indurate and transversally rugulose); upper lemma persistent, transversally rugulose to rugose, apiculate (with 1–3 small tubercles). **Anthers** 0.75–1(–1.5) mm long.

Distribution. Throughout the tropics and subtropics. Native in Singapore and quite widespread but infrequently collected, including from Ang Mo Kio (*Ridley s.n.*, 1889, SING [SING0017842]), Bidadari Cemetery (*Turner et al. BC 3*, 3 Apr 2002, SING [SING0044892]), Cluny Road (*Ridley 5767*, 1892, SING [SING0017843]), Neo Tiew (*Duistermaat & Ali Ibrahim 198*, Oct 2002, SING [SING0059685]) and Pasir Ris (*Keng 4280*, 24 May 1966, SINU).

Ecology. Road-sides, wasteland, open forest, sandy beaches.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Uses. Only useful as fodder when young.

Vernacular names. *Foxtail, knotroot bristle grass* (English), *rumpit jolong-jolong* (Malay).

Notes. Conspicuous due to its glaucous foliage and golden to purplish-reddish inflorescences. A very polymorphic species with an intricate nomenclature.

53. SORGHUM Moench

(believed to refer to the Italian *sorgo*,
the medieval name for *Sorghum bicolor* (L.) Moench)

Methodus (1794) 207, nom. cons.; Snowden, Bull. Misc. Inform. Kew 1935 (1935) 221; Garber, Univ. Calif. Publ. Bot. 23 (1950) 283; Snowden, J. Linn. Soc., Bot. 55 (1955) 191; Lazarides et al., Austral. Syst. Bot. 4 (1991) 591; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 303. **Synonym:** *Andropogon* L. subg. *Sorghum* (Moench) Hack. in Engler & Prantl, Nat. Pflanzenfam. 2(2) (1887) 28. **Type:** *Sorghum bicolor* (L.) Moench, typ. cons.

Annuals or perennials. **Culms** tall, erect, solid. **Ligule** membranous, margin ciliate. **Leaf** blades inrolled when young, later flat, above at least at base with a conspicuous white midrib. **Panicle** large, of short, dense racemes, sometimes reduced to triads; rachis fragile (tenacious in cultivated taxa). **Callus** obtuse to pungent, hairy. **Spikelets** paired (the terminal ones in triads), dissimilar. **Sessile spikelets** inserted in the hollow apex of the joint, 2-flowered, dorsally compressed. **Glumes** subequal, usually hairy; lower glumes herbaceous to coriaceous, rounded on the back, apically 2-keeled to -winged; upper glumes boat-shaped. Lower **floret** reduced to the lemma; upper floret bisexual. Upper **lemma** muticous or bidentate and awned. **Pedicels** flattened, margins hairy. **Pedicelled spikelets** variously developed, muticous.

Distribution. A genus of approximately 31 species in the Old World (sub)tropics. In Singapore 1 species is naturalised.

Taxonomy. The genus belongs to the *Panicoideae* – *Saccharinae* Griseb.

Notes. *Sorghum bicolor* (L.) Moench is included in the key in italics as there are a number of older specimens with no habitat data but it is likely they were only ever in cultivation (Fig. 66A).

Key to *Sorghum* species

1. Culms tufted; spikelets nearly spherical at maturity, sometimes awned *S. bicolor*
Culms long stoloniferous; spikelets oblong-lanceolate, dorsoventrally flattened, not much enlarged at maturity, unawned **S. propinquum**

Sorghum propinquum (Kunth) Hitchc.

(Latin, *propinquus* = similar; referring to being similar to
Andropogon decolorans Kunth = *Sorghum halepense* (L.) Pers.)

Lingnan Sci. J. 7 (1931) 249; Gilliland, Rev. Fl. Malaya 3 (1971) 229, fig. 50, pl. 33d; De Wet, Amer. J. Bot. 65 (1978) 478; Turner, Gard. Bull. Singapore 45 (1993) 102; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 184; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 127, fig. 131; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 80, 170, 268. **Basionym:** *Andropogon propinquus* Kunth, Enum. Pl. 1 (1833) 502. **Synonyms:** *Andropogon affinis* J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 343, nom. illeg. non R.Br. (1810). – *Andropogon halepensis* (L.) Brot. var. *propinquus* (Kunth) Hack., Bot. Jahrb. Syst. 6 (1885) 239; Merrill, Philipp. J. Sci. 1, Suppl. 5 (1906) 336, isonym. – *Andropogon sorghum* (L.) Brot. var. *propinquus* (Kunth) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 503. – *Sorghum affine* A.Camus, Fl. Indo-Chine 7, fasc. 3 (1922) 321, nom. illeg. non Kuntze (1891). – *Sorghum halepense* (L.) Pers. var. *propinquum* (Kunth) Ohwi, Bot. Mag. (Tokyo) 55 (1941) 550. – *Sorghum halepense* (L.) Pers. subvar. *affine* Roberty, Boissiera 9 (1960) 302. – *Sorghum bicolor* (L.) Moench ‘race *propinquum*’ (Kunth) J.R.Harlan & De Wet, Crop. Sci. 12 (1972) 173. **Type:** *Haenke s.n.* (lectotype PR [sheet no. 612301], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 4; isolectotypes PRC [PRC450151], US (fragment)). **Fig. 66B.**

Sorghum affine auct. non A.Camus: Ridley, Fl. Malay Penins. 5 (1925) 195; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2092.

Perennials. **Culms** rhizomatous, stoloniferous, 0.9–3 m long; nodes puberulous. **Sheaths** glabrous or with a pilose collar. **Ligules** 0.5–3 mm long. **Leaf** blades 15–90 cm by 11–60 mm, glabrous. **Panicles** 20–60 × 5–10(–15) cm; common axis with hair-like spicules, branches solitary to whorled, 1–7 together, slender, branched, lowermost longest, 8–35 cm long; racemes in whorls of 3–6, 1–2 cm long, 1–7-jointed; joints and pedicels white-hairy. **Sessile spikelets** ellipsoid to ovate, 3.7–5 × 1.5–1.8 mm, becoming brown, dark red, or black. **Glumes** coriaceous at base; callus obtuse; lower glume acute, apiculate, or 3-dentate, obscurely 9–13-nerved, with transverse veins, variably pilose; upper glume 5-nerved, sparsely hairy in the lower part. Lower **lemma** 3.2–4.5 mm long; upper lemma 2–3.2 mm long, obtuse to notched; awns usually absent. **Anthers** 1.5–2.5 mm long. **Pedicelled spikelets** reduced, male, rarely sterile, lanceolate, 4–5.5 mm long.

Distribution. Southern India and Sri Lanka to southern China, through continental Southeast Asia and Malesia to Palau Island. Probably naturalised rather than native in Singapore and collected from Bukit Timah Road (*Jumali 934*, 22 Oct 1963, SINU), Commonwealth Road (*Duistermaat 127*, 18 Mar 2003, L, SING [SING0059819]), Duncan Road (*Sinclair SF 40373*, 24 Sep 1954, SING [SING0201745]), Jalan Kedal (*Chua 1051*, 5 Oct 1994, SINU) and Pulau Tekong (*Samsuri et al. 134*, 15 Nov 2001, SING [SING0039810]).

Ecology. Sunny to lightly shaded, barren localities in thickets, wastelands and roadsides.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Tebu tikus* (Malay).

54. SPHAEROCARYUM Nees ex Hook.f.

(Greek, *sphaero-* = orbicular, *-caryum* = nut; referring to the subglobose spikelets)

Fl. Brit. India 7, fasc. 22 (1896) 246; Prakash & Jain, Fasc. Fl. India 14 (1984) 38; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 401. **Synonyms:** *Graya* Arn. ex Steud. [Nomencl. Bot., ed. 2, 1 (1840) 705, as ‘*Grayia*’, nom. nud.] Syn. Pl. Glumac. 1, fasc. 2 (1854) 119, nom. illeg. non *Grayia* Hook. & Arn. (1840), nec *Graya* Endl. (1841). – *Isachne* R.Br. sect. *Graya* Kuntze in Post & Kuntze, Lex. Gen. Phan. (1903 [‘1904’]) 301. – *Steudelella* Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 258, nom. illeg. superfl. **Type:** *Sphaerocaryum elegans* (Nees ex Steud.) Nees ex Hook.f. (= *Sphaerocaryum malaccense* (Trin.) Pilg.).

Annuals. **Culms** cushion-forming, hollow. **Ligule** a row of hairs. **Leaf** blades ovate to ovate-oblong, base cordate, amplexicaul (*Commelina*-like). **Panicles** lax. **Branches and pedicels** glandular. **Spikelets** 1-flowered, quaquaversal, abaxial, solitary, disarticulating above the early caducous glumes, ovoid to subglobose, callus absent. **Glumes** deciduous, unequal, shorter than the spikelet, obtuse; lower glume 0-nerved; upper glume 1-nerved. **Rachilla** internode present, process absent. **Lemma** 1, similar in texture to the glumes, smooth, membranous at maturity, 1- or 2-nerved, callus absent, dorsally rounded, germination flap absent, puberulous, margins lying flat on the palea, apex entire, muticous. **Stamens** 3.

Distribution. A genus of 1 species from Sri Lanka and northeastern India to China and Malesia, including Singapore.

Taxonomy. The genus belongs to the *Micrairoideae* – *Isachneae* Benth.

Notes. Contrary to reports in the literature the leaves are not cross-veined.

Sphaerocaryum malaccense (Trin.) Pilg.

(of Malacca, now Melaka)

Repert. Spec. Nov. Regni Veg. 45 (1938) 2; Henderson, Malay. Wild Fls., Monocot. (1954) 317, fig. 182c,d; Gilliland, Rev. Fl. Malaya 3 (1971) 126, fig. 23; Turner, Gard. Bull. Singapore 45 (1993) 102; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 184, fig. 291; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 128, fig. 132; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 170, 198. **Basionym:** *Panicum malaccense* Trin., Gram. Panic. (1826) 204. **Type:** *Klein 715*, [Malaysia] (lectotype LE [Herb. Trinius 806.1] (fragment), designated by Prakash & Jain, Fasc. Fl. India 14 (1984) 39; isolectotypes B-W [B-W01737010], HAL (fragment)). **Fig. 66C.**

Graya elegans Nees ex Steud., Syn. Pl. Glumac. 1, fasc. 2 (1854) 119. **Synonyms:** *Sphaerocaryum elegans* (Nees ex Steud.) Nees ex Hook.f., Fl. Brit. India 7, fasc. 22 (1896) 246; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 170; Ridley, Fl. Malay Penins. 5 (1925) 241. **Type:** *Wight 2033*, Sri Lanka [Ceylon] (lectotype LE [Herb. Trinius 691.1] (fragment), designated by Turner et al., Gard. Bull. Singapore 71 (2019) 16).

Culms slender, delicate, rooting at the decumbent nodes, 0.10–0.30(–0.85) cm long; nodes bearded, sometime with a glandular ring underneath. **Sheaths** sparsely pilose with hairs

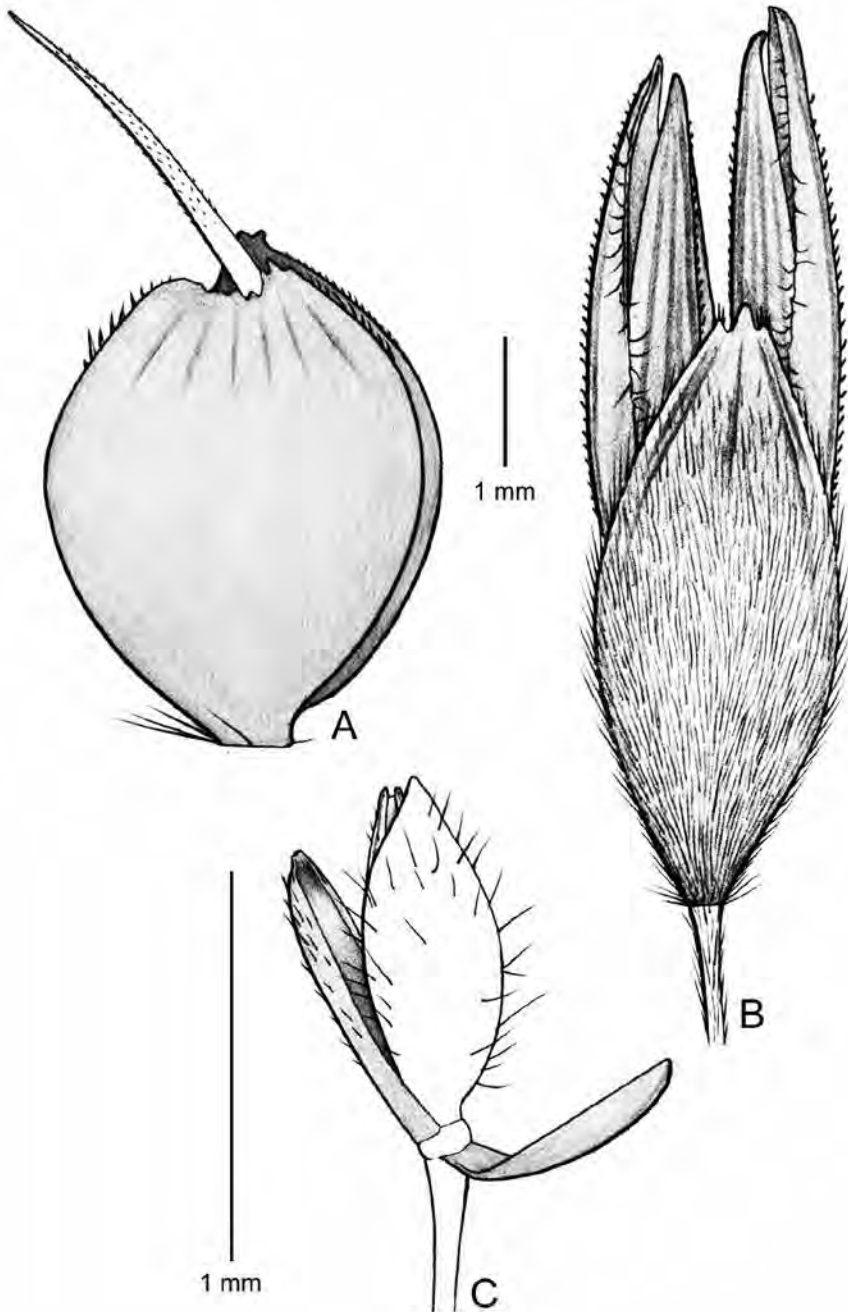


Figure 66. *Sorghum bicolor* (L.) Moench. **A.** Sessile spikelet. *Sorghum propinquum* (Kunth) Hitchc. **B.** A group of one sessile and two pedicelled spikelets. *Sphaerocaryum malaccense* (Trin.) Pilg. **C.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).

with bulbous bases. **Ligular hairs** 0.7–2 mm long. **Leaf** blades stiff, 0.6–2.5(–5.5) cm by 3–10(–20) mm, margins pectinate. **Panicles** terminal and axillary, shortly exerted from the uppermost sheath, 1–5(–11) × 1–2.5(–5) cm long, branches and pedicels glandular; longest branch 1–2.5 cm long. **Spikelets** 0.7–1.5 × 0.5–1 mm. Lower **glume** 0.4–1 mm long, obtuse. **Lemma** 0.7–1.5 mm long, hairy on the back. **Anthers** c. 0.3 mm long.

Distribution. Sri Lanka and northeastern India to (sub)tropical southern China, Taiwan and Malesia. Likely native in Singapore and formerly known from Ang Mo Kio (*Ridley 110*, 8 Mar 1889, SING [SING0017849]; *Ridley 162*, Apr 1889, SING [SING0017846]) and Kranji (*Ridley 459*, 7 Dec 1889, SING [SING0017848]).

Ecology. Elsewhere in damp, swampy places in forests or fields.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it has not been collected or recorded since the nineteenth century and is presumed Nationally Extinct.

Vernacular name. *Elegant roundseed* (English).

Notes. Vegetatively very variable, possibly due to environmental factors. The glandular patches in the inflorescence are reminiscent of those found in species of *Eragrostis* Wolf, *Isachne* R. Br., *Panicum brevifolium* L., and *Sporobolus* R. Br.

55. SPOROBOLUS R.Br.

(Greek, *sporo-* = seed, *-bolus* = thrower;
referring to the seeds being ejected from the pericarp)

Prodr. Fl. Nov. Holland. (1810) 169, nom. cons.; Baaijens & Veldkamp, *Blumea* 35(2) (1991) 393; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 371. **Type:** *Sporobolus indicus* (L.) R.Br., lectotype designated by Pfeiffer, *Nomencl. Bot.* 2(2) (1874-1875 [‘1874’]) 1247.

Annuals or perennials. **Culms** tufted, sometimes with creeping rhizomes or stolons, hollow to solid; nodes glabrous. **Ligule** membranous, margin ciliolate. **Leaf** blades inrolled when young. **Panicles** lax to contracted, branches ending in spikelets. **Spikelets** pedicelled, abaxial, solitary, 1-flowered, muticous, articulating above the glumes, laterally flattened to subglobose, glabrous. **Callus** glabrous, blunt. **Glumes** usually unequal, usually shorter than the spikelet, thin, glabrous; the lower one 0-nerved, the upper one up to as long as the spikelet, 1-nerved. **Rachilla** not produced. **Lemmas** similar to the glumes, 1–3-nerved; callus obtuse, glabrous. **Stamens** 2 or 3. **Pericarp** free, expelling the seed; testa smooth, not grooved.

Distribution. Throughout the tropics and subtropics with more than 160 species of which there are 1 introduced and 2 native species in Singapore, one of which has two native varieties.

Taxonomy. The genus belongs to the *Chloridoideae* – *Sporobolinae* Benth.

Key to *Sporobolus* taxa

Note. When checking dimensions in spikelets several ought to be inspected. For the seed the pericarp must be removed.

1. Culms tufted; lower glume 0.2–0.5 times as long as spikelet; upper glume up to 0.67 times as long 2
Culms stoloniferous and rhizomatous; lower glume 0.75–0.9 times as long as spikelet; upper glume 0.8–1 times as long **3. *S. virginicus***
2. Pedicel 0.3–0.7 mm long; spikelets 1.4–1.9 mm long; lemma and palea herbaceous 3
Pedicel 2–6 mm long; spikelets 0.8–1.25 mm long; lemma and palea hyaline **2. *S. tenuissimus***
3. Panicle usually lax and spikelets well-spaced; spikelets usually 1.4–1.6 mm long; anthers usually 2; seed 0.6–0.9 mm long **1a. *S. indicus* var. *flaccidus***
Panicle usually contracted and spikelets crowded; spikelets usually 1.8–1.9 mm long; anthers usually 3; seed 0.9–1.1 mm long **1b. *S. indicus* var. *major***

1. *Sporobolus indicus* (L.) R.Br.

(from the Indies)

Prodr. Fl. Nov. Holland. (1810) 170; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 171; Ridley, Fl. Malay Penins. 5 (1925) 244; Henderson, Malay. Wild Fls., Monocot. (1954) 318, fig. 182e,f.; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 184; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 130. **Basionym:** *Agrostis indica* L., Sp. Pl. 1 (1753) 63. **Synonyms:** *Agrostis elongata* Lam., Tabl. Encycl. 1, fasc. 1 (1791) 162, nom. illeg. superfl. – *Vilfa elongata* P.Beauv., Ess. Agrostogr. (1812) 16, 181, nom. illeg. superfl. – *Sporobolus lamarckii* Desv. ex Ham., Prodr. Pl. Ind. Occid. (1825) 4, nom. illeg. superfl. – *Vilfa indica* (L.) Trin. ex Steud., Nomencl. Bot., ed. 2, 1 (1840) 41. **Type:** [*Clayton*] 460-B, India (lectotype LINN [Herb. Linn. no. 84.36], designated by Hubbard, Agron. Lusit. 28 (1967) [67]).

Vilfa berteriana Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 6, 4 (1840) 100. **Synonym:** *Sporobolus berterianus* (Trin.) Hitchc. & Chase, Contr. U.S. Natl. Herb. 18 (1917) 370; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2106. **Type:** *Bertero s.n.*, Dominican Republic, Santo Domingo (lectotype LE [Herb. Trinius 1682.1], designated by Baaijens & Veldkamp, Blumea 35(2) (1991) 422; possible isoelectotypes B, MO).

Long-living annuals or perennials. **Culms** solitary or tufted, 0.2–2 m high. **Ligule** 0.2–0.5 mm long. **Leaf** blades folded to flat, 4–15(–50) cm by 2–7 mm. **Panicles** contracted, spiciform to lax, 7–60 cm long, branches appressed to patent, not in whorls, the lowermost 1–3 together, eglandular, lowest, longest branch 1.5–12 cm long; pedicels 0.3–0.7 mm long. **Spikelets** 1.3–2.6 mm long. Lower **glumes** 0.35–1 mm long, 0.2–0.5 times as long as the spikelet; upper glumes 0.7–1.65 mm long, 0.4–0.67 times as long as the spikelet, apex acute to obtuse, often erose. **Lemmas** 1.2–2.6 mm long. **Lodicules** 0.25–0.45 mm long. **Anthers** 2 or 3, 0.5–1.1 mm long. **Seeds** 0.6–1.25 mm long, compressed and angular in transverse section.

Distribution. Pantropical. A very polymorphous species.

Notes. *Sporobolus indicus* is a very widespread species containing perhaps as many as 16 forms, many of which have been recognised as distinct varieties or even species (see Baaijens & Veldkamp, *Blumea* 35(2) (1991) 421, for an extensive discussion).

The hyphomycetous ‘smut’ fungus *Curvularia ravenelii* (M.A.Curtis) Manamgoda may infect the ovaries. Hyphae mass within the host cells which are soon completely absorbed. The ovary is replaced by a sclerotoid, pseudo-parenchymatous fungus stroma. Hyphae arising from this emerge between the lemma and palea to form black sticky mats of long, branched conidiophores, which may glue parts of the inflorescence together. The American name ‘smutgrass’ refers to this. An extensive discussion on the life cycle of the smut is given by Luttrell (*Phytopathology* 66 (1976) 260-268).

a. var. *flaccidus* (Roth) Veldkamp

(Latin, *flaccidus* = flaccid; referring to the flaccid panicle branches)

Blumea 35(2) (1991) 433; Turner, *Gard. Bull. Singapore* 45 (1993) 103; Keng et al., *Concise Fl. Singapore*, vol. 2, Monocot. (1998) 184; Duistermaat, *Gard. Bull. Singapore* 57, Suppl. (2005) 130, fig. 136, pl. 34; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 81, 170, 231. **Basionym:** *Agrostis elongata* (R.Br.) Roth var. *flaccida* Roth in Roemer & Schultes, *Syst. Veg.*, ed. 15 bis, 2 (1817) 368; Roth, *Nov. Pl. Sp.* (1821) 41. **Synonym:** *Sporobolus humilis* J.Presl var. *flaccidus* (Roth) Veldkamp ex A.A.Khan et al., *J. Econ. Taxon. Bot.* 33 (2009) 582. **Type:** *Roth 80β*, ‘India orientali’ (lectotype BM [BM000959534], designated by Baaijens & Veldkamp, *Blumea* 35(2) (1991) 433; possible isoelectotype LE [Herb. Trinius 1699.1]). **Fig. 67A, 68A.**

Agrostis diandra Retz., *Observ. Bot.* 5 (1788 [‘1789’]) 19. **Synonyms:** *Sporobolus diandrus* (Retz.) P.Beauv., *Ess. Agrostogr.* (1812) 26, 178; Ridley, *Mat. Fl. Malay. Penins.* 3 (1907) 170; Ridley, *Fl. Malay Penins.* 5 (1925) 244, as ‘*diander*’; Henderson, *Malay. Wild Fls.*, Monocot. (1954) 318, fig. 182g; Burkill, *Dict. Econ. Prod. Malay Penins.*, ed. 2, 2 (1966) 2106; Gilliland, *Rev. Fl. Malaya* 3 (1971) 106, fig. 18, pl. 14c, as ‘*diander*’. – *Vilfa diandra* (Retz.) Trin., *Gram. Unifl. Sesquifl.* (1824) 154. – *Vilfa retzii* Steud., *Nomencl. Bot.*, ed. 2, 1 (1840) 40, nom. illeg. superfl. – *Sporobolus indicus* (L.) R.Br. var. *diandrus* (Retz.) Jovet & Guédès, [*Bull. Centr. Études Rech. Sci.* 7 (1968) 65, t. 5b, nom. inval.] *Taxon* 22 (1973) 163. **Type:** *König s.n.*, India [annot. ‘*Cinna diandra* N.’] (lectotype LD [LD1215317], designated by Fischer, *Bull. Misc. Inform. Kew* 1932 (1932) 73; possible isoelectotypes BM [×2], C [×5]).

Culms tufted, erect, 0.2–1 m long. **Panicles** contracted to lax, 7–35 × 1.5–3.5 cm, branches appressed to patent, the lowermost 1.5–9 cm long. **Spikelets** fairly well-spaced, (1.2–)1.4–1.6(–1.8) mm long. Lower **glumes** 0.3–0.55(–0.6) mm long, 0.25–0.33 times as long as the spikelet; obtuse to truncate; upper glumes 0.5–1 mm long, 0.4–0.67 times as long as the spikelet, apex acute, often denticulate. **Lodicules** 0.25–0.3 mm long. **Anthers** 2 (or 3), 0.5–0.8 mm long. **Seeds** 0.6–0.9(–0.95) mm long.

Distribution. Mauritius, Pakistan, India and Sri Lanka, through continental Southeast Asia and Malesia to Polynesia and Australia. Native in Singapore and widely collected, including from Balestier Plain (*Hose* 85, Jan 1904, SING [SING0041274]), Jalan Kampong Chantek (*Duistermaat* 022, 18 Feb 2002, K, L, SING [SING0059820]), Raffles Lighthouse (*Ridley s.n.*, 3 Jan 1889, SING [SING0041272]), Sungei Buloh (*Chua et al. SB* 3092, 13 Oct 1993, SINU) and the Western Catchment (*Samsuri et al. WC* 30, 20 Apr 2004, SING [SING0054290]).

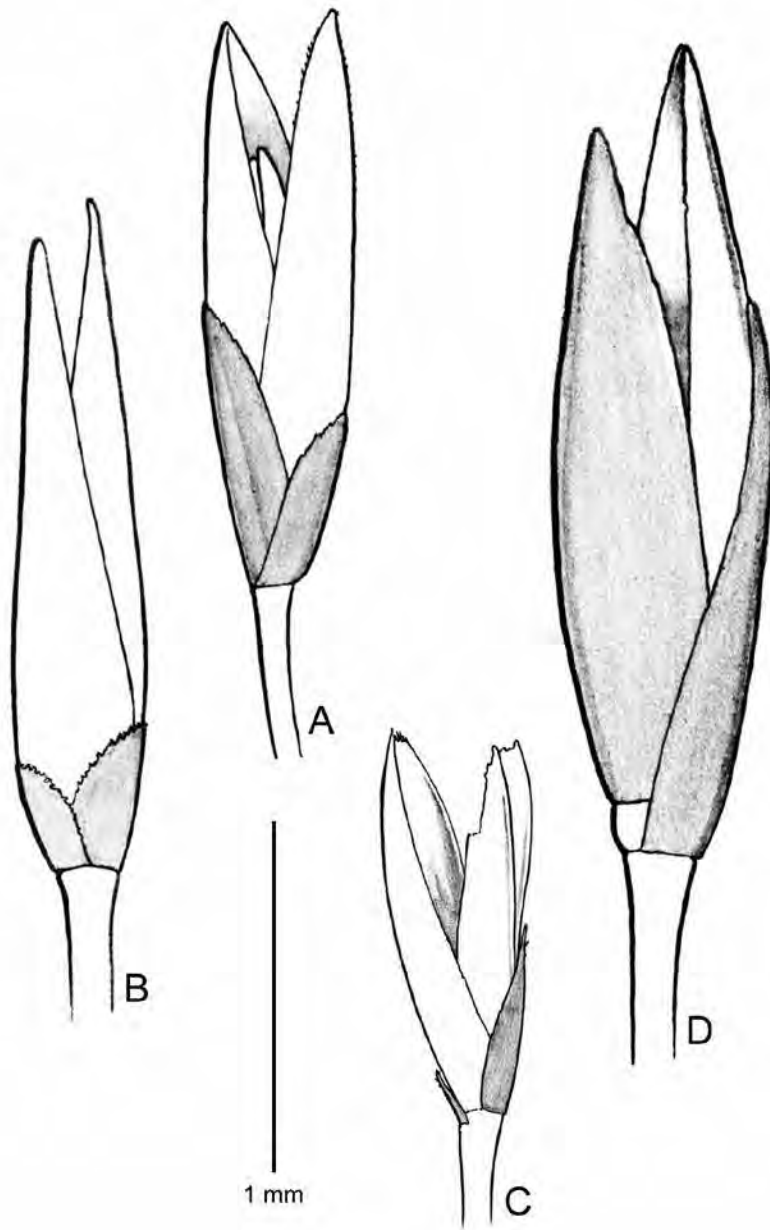


Figure 67. *Sporobolus indicus* (L.) R.Br. var. *flaccidus* (Roth) Veldkamp. **A.** Spikelet, lateral view. *Sporobolus indicus* (L.) R.Br. var. *major* (Buse) Baaijens. **B.** Spikelet, lateral view. *Sporobolus tenuissimus* (Mart. ex Schrank) Kuntze. **C.** Spikelet, lateral view. *Sporobolus virginicus* (L.) Kunth. **D.** Spikelet, lateral view. (Drawn by J.J. Vermeulen).



Figure 68. *Sporobolus indicus* (L.) R.Br. var. *flaccidus* (Roth) Veldkamp. **A.** Inflorescence. *Sporobolus tenuissimus* (Mart. ex Schrank) Kuntze. **B.** Inflorescence. (From Singapore, A exact locality uncertain; B from Bukit Timah Campus, *Duistermaat* 223. Photos: H. Duistermaat).

Ecology. Sunny to lightly shaded, more or less disturbed, dry to slightly moist but not soggy, preferably hard to stony ground, on beaches, along roads or in grass fields.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Lesser dropseed* (English).

b. var. major (Buse) Baaijens

(Latin, *major* = greater, when being compared to *Sporobolus diandrus* (Retz.) P.Beauv., now a synonym of *Sporobolus indicus* var. *flaccidus*)

Blumea 35(2) (1991) 437; Turner, Gard. Bull. Singapore 45 (1993) 103; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 184; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 130; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 170, 231. **Basionym:** *Sporobolus diandrus* (Retz.) P.Beauv. var. *major* Buse in Miquel, Pl. Jungh., fasc. 3, prepr. (Feb. 1854) 3 [(Aug 1854) 343]. **Type:** *Junghuhn s.n.*, Indonesia, Java, Tjibogo, [June] (lectotype L [L0050184], designated by Baaijens & Veldkamp, Blumea 35(2) (1991) 437). **Fig. 67B, 69.**

Agrostis fertilis Steud., Syn. Pl. Glumac. 1, fasc. 3 (1854) 170. **Synonyms:** *Sporobolus fertilis* (Steud.) Clayton, Kew Bull. 19 (1965) 291; Gilliland, Rev. Fl. Malaya 3 (1971) 106, pl. 161. – *Sporobolus indicus* (L.) R.Br. var. *fertilis* (Steud.) Jovet & Guédès, [Bull. Centr. Études Rech. Sci. 7 (1968) 50, nom. inval.] Taxon 22 (1973) 163. **Type:** *Burger s.n.*, Japan (lectotype L [L0050179], designated by Baaijens, Blumea 35(2) (1991) 437; possible isoelectotypes L [L0050181], P?).

Sporobolus indicus (L.) R.Br. var. *pyramidalis* auct. non (P.Beauv.) Veldkamp: Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 131, fig. 134; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 171, 264.

Culms 0.2–1(–1.2) m long. **Panicles** usually contracted, spiciform, 11–60 × 0.5–1.5 cm long, branches appressed, the lowermost 2–5 cm long. **Spikelets** more or less crowded, (1.7–)1.8–1.9(–2.1) mm long. Lower **glumes** 0.4–0.8 mm long, 0.2–0.4 times as long as the spikelet, obtuse to truncate, erose; upper glumes 0.6–1.3 mm long, 0.5–0.67 times as long as the spikelet, apex usually acutish, to obtuse or denticulate. **Lodicules** 0.25–0.3 mm long. **Anthers** (2 or) 3, 0.7–1 mm long. **Seeds** 0.9–1.2 mm long.

Distribution. Sri Lanka and India to Malesia and the Pacific. Native in Singapore and commonly and widely collected, including from Ang Mo Kio (*Ridley s.n.*, 1894, SING [SING0041279]), Mount Sinai Drive (*Duistermaat 115*, 4 Apr 2003, SING [SING0059687]), Newton (*Teruya 2014*, Nov 1932, KEP, SING [SING0041271]), Pulau Punggol Timor (*Tan & Yeo 1157*, 26 Jun 2003, SINU) and state land near Jalan Lam San (*Chen & Lua SING2018-298*, 27 Mar 2018, SING [SING0254022]).

Ecology. Sunny to lightly shaded, not too dry or soggy, preferably hard or stony areas, especially along roads and paths.



Figure 69. *Sporobolus indicus* (L.) R.Br. var. *major* (Buse) Baaijens. Inflorescence with detail in inset. (From Singapore, Jalan Lam San state land, *Chen & Lua SING2018-298*. Photos: L.M.J. Chen).

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular name. *Common dropseed* (English).

2. *Sporobolus tenuissimus* (Mart. ex Schrank) Kuntze

(Latin, *tenuissimus*, superlative of *tenuis* = slender; referring to the minute spikelets)

Revis. Gen. Pl. 3(3) (1898) 369; Hackel, Bull. Herb. Boissier, ser. 2, 4 (1904) 278, isonym; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 131, fig. 135, pl. 35; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 171, 268. **Basionym:** *Panicum tenuissimum* Mart. ex Schrank, Denkschr. Königl.-Baier. Bot. Ges. Regensburg 2 (1822) 26. **Synonyms:** *Aira tenuissima* (Mart. ex Schrank) Spreng., Syst. Veg. (ed. 16) 1 (1824 [‘1825’]) 276. – *Vilfa tenuissima* (Mart. ex Schrank) Trin. ex Schrad., Index Seminum Hort. Acad. Gotting. 1830 (1830–1831) 5. **Type:** *Martius 5495*, Brazil, ‘in sylvis iter Sebastianopolin et Soteropolin’ (lectotype M [M-0104367], first step designated by Renvoize, Grasses Bahia (1984) 61, second step designated by Turner et al., Gard. Bull. Singapore 71 (2019) 31). **Fig. 67C, 68B.**

Annuals. **Culms** solitary or tufted, 0.15–0.7(–1) m high. **Ligule** 0.1–0.3 mm long. **Leaf** blades flat or folded, 8–20 cm by 1–5 mm. **Panicles** lax, 9–40 × 2–6 cm, branches erecto-patent, solitary or fascicled, the lowermost few together, eglandular, lowest-longest branch 3–4 cm long; pedicels 2–6 mm long. **Spikelets** well-spaced, 0.8–1.25 × 0.5–0.7 mm. Lower **glumes** 0.1–0.4 mm long, 0.2–0.37 times as long as the spikelet, truncate, erose; upper glumes 0.3–0.75 mm long, 0.5–0.62 times as long as the spikelet, acutish to obtuse. **Lodicules** c. 0.25 mm long. **Anthers** 3, 0.1–0.4 mm long. **Seeds** 0.4–0.7 mm long, turbinate, compressed, angular in transverse section.

Distribution. Tropical South America, introduced elsewhere. Naturalised in Singapore and collected from Bukit Timah Campus (*Duistermaat 223*, 3 Nov 2003, K, L, SING [SING0059691]), Cluny Road (*Duistermaat 260*, 22 Jan 2004, L, SING [SING0059693]), Grange Road (*Duistermaat 279*, 2 Mar 2004, SING [SING0059694]) and Waterloo Street (*Duistermaat 259*, 31 Dec 2003, SING [SING0059692]).

Ecology. Disturbed places, e.g. road sides, flower beds, sandy soil with cement and brick debris, along fields.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Notes. It often grows associated with *Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult., which differs in the more ascending to even prostrate habit, the many-flowered spikelets, and the distinctly setose paleas.

3. *Sporobolus virginicus* (L.) Kunth (of Virginia)

Révis. Gramin. 1 (June–July 1829) 67; Brongniart in Duperrey, Voy. Monde, Phan., fasc. 7 (July 1829) 17, isonym; Turner, Gard. Bull. Singapore 45 (1993) 103; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 185; Gilliland, Rev. Fl. Malaya 3 (1971) 108, pl. 14d; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 131, fig. 133; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 171, 231. **Basionym:** *Agrostis virginica* L., Sp. Pl. 1 (1753) 63. **Synonyms:** *Vilfa virginica* (L.) P.Beauv., Ess. Agrostogr. (1812) 16, 182. – *Crypsis virginica* (L.) Nutt., Gen. N. Amer. Pl. 1 (1818) 49. – *Podosemum virginicum* (L.) Link, Hort. Berol. 1 (1827) 85. **Type:** Clayton 507, [U.S.A.], Virginia (lectotype LINN [Herb. Linn. no. 84.30], designated by Hitchcock, Contr. U.S. Natl. Herb. 12 (1908) 119; isolectotypes BM, US (fragment)). **Fig. 67D.**

Perennials. **Culms** erect to decumbent, tufted and stoloniferous, stolons or rhizomes 0.2–0.5 m long. **Ligule** 0.2–0.5 mm long, with some scattered hairs with bulbous bases among the cilia. **Leaf** blades more or less distichous, involute, rarely flat, 3–16 cm by 1–3.5 mm. **Panicles** densely contracted to spiciform, 3–15 × 0.3–1.3 cm, branches appressed, solitary or fascicled, the lowermost 1–3 together, eglandular, lowest-longest branch 0.5–4 cm long; pedicels 0.3–1.5 mm long. **Spikelets** (2–)2.2–2.7(–3) × c. 0.5 mm. Lower **glumes** 1.5–2.2(–2.75) mm long, (0.67–)0.75–0.9(–0.95) times as long as the spikelet; upper glumes 2.1–3 mm long, 0.8–1 times as long as the spikelet, acute to obtuse. **Lodicules** c. 0.3 mm long. **Anthers** 2 or 3, 1–1.65 mm long. **Seeds** usually absent, 0.7–0.9 mm long, broadly ellipsoid, also in transverse section.

Distribution. Throughout the tropics and subtropics. Probably native in Singapore but only known from a single collection from Changi (*Anders SF 37279*, 20 Jul 1941, SING [SING0017850, SING0017851]).

Ecology. Elsewhere on sandy sea beaches above the high water mark, salt marshes, and in river deltas near the coast. All of these habitats are highly impacted in Singapore.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

Vernacular name. *Beach dropseed* (English).

Notes. Across its range, this is a polymorphic species in which several forms may be distinguished, possibly each with a distinct habitat preference and not necessarily linked to ploidy level. Based on the discussion in Baaijens & Veldkamp (*Blumea* 35(2) (1991) 449), the Type 2 form with blades erecto-patent, up to 10 cm long, more than 2 mm wide is the one that has been collected in Singapore.

56. STENOTAPHRUM Trin.

(Greek, *steno-* = narrow, *-taphrum* = canal;
referring to the narrow cavities in which the racemes are sunk)

Fund. Agrost. (1820) 175; Sauer, Brittonia 24 (1972) 202; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 336. **Type:** *Stenotaphrum glabrum* Trin. (= *Stenotaphrum dimidiatum* (L.) Brongn.).

Perennials. **Culms** mat-forming, stoloniferous, solid, rooting at the decumbent nodes. **Ligule** membranous, ciliate. **Inflorescences** terminal, spike-like with small lateral, alternate, appressed racemes, more or less sunk into depressions, branches ending in a point. **Spikelets** solitary, biseriate, alternatingly embedded in the rachis, abaxial, dorso-ventrally compressed, 2-flowered, muticous. Lower **glume** short, 0–7-nerved; upper glume 0–9-nerved. **Lemmas** chartaceous to coriaceous; first lemma epaleate or paleate, sterile or male, 3–7-nerved; second lemma 3–5-nerved, germination flap present, margins lying flat on the palea.

Distribution. A genus of 7 species throughout the tropics and subtropics, mostly along sea shores. In Singapore 1 introduced species.

Taxonomy. The genus belongs to the *Panicoideae* – *Cenchrinae* Dumort.

***Stenotaphrum secundatum* (Walter) Kuntze**

(Latin, *secundatus* = one-sided; referring to the racemes embedded in the rachis)

Revis. Gen. Pl. 2 (1891) 794, as '*secundum*'; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2112; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 132, fig. 137, pl. 33; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 171, 268. **Basionym:** *Ischaemum secundatum* Walter, Fl. Carol. (1788) 249. **Synonym:** *Stenotaphrum dimidiatum* (L.) Brongn. var. *secundatum* (Walter) Domin, Biblioth. Bot. 20 (1915) 332, as '*secundum*'. **Type:** *Ahles 15602*, USA, South Carolina, Beaufort County, Beaufort, roadbank on U.S. Rt. 21, 27 June 1956 (neotype GH [GH00277001], designated by Ward, J. Bot. Res. Inst. Texas 2(1) (2008) 479; isoneotypes GA, NCU, NY). **Fig. 70A, 71.**

Stenotaphrum secundatum Kuntze var. *variegatum* Hitchc. in Bailey, Stand. Cycl. Hort. 6 (1917) 3237. **Type:** Not indicated.

Stenotaphrum dimidiatum auct. non (L.) Brongn.: Sinclair, Gard. Bull. Singapore 14(1) (1953) 37; Gilliland, Rev. Fl. Malaya 3 (1971) 205; Turner, Gard. Bull. Singapore 45 (1993) 103.

Culms 0.1–0.5 m long, compressed; nodes glabrous. **Ligules** c. 0.5 mm long. **Leaf** blades folded along the midrib when young, linear, (0.7–)3–15 cm by 4–15 mm, glaucous, sparsely hairy, apex obtuse. **Panicles** ribbon-shaped, rachis sinuous, corky, alternatingly broadly winged, tardily disarticulating into segments, 4.5–12 cm by 2.5–6 mm, glabrous; racemes in two rows on one side of the rachis, spikelets 1–8, 4–10 mm long. **Spikelets** 4–6 × c. 1.6 mm, acute. Lower **glume** orbicular, 0.75–2 mm long, 0.2–0.32 times as long as the spikelet, glabrous, apex obtuse to truncate, 0-nerved, glabrous; upper glume 4–5 mm long, about as

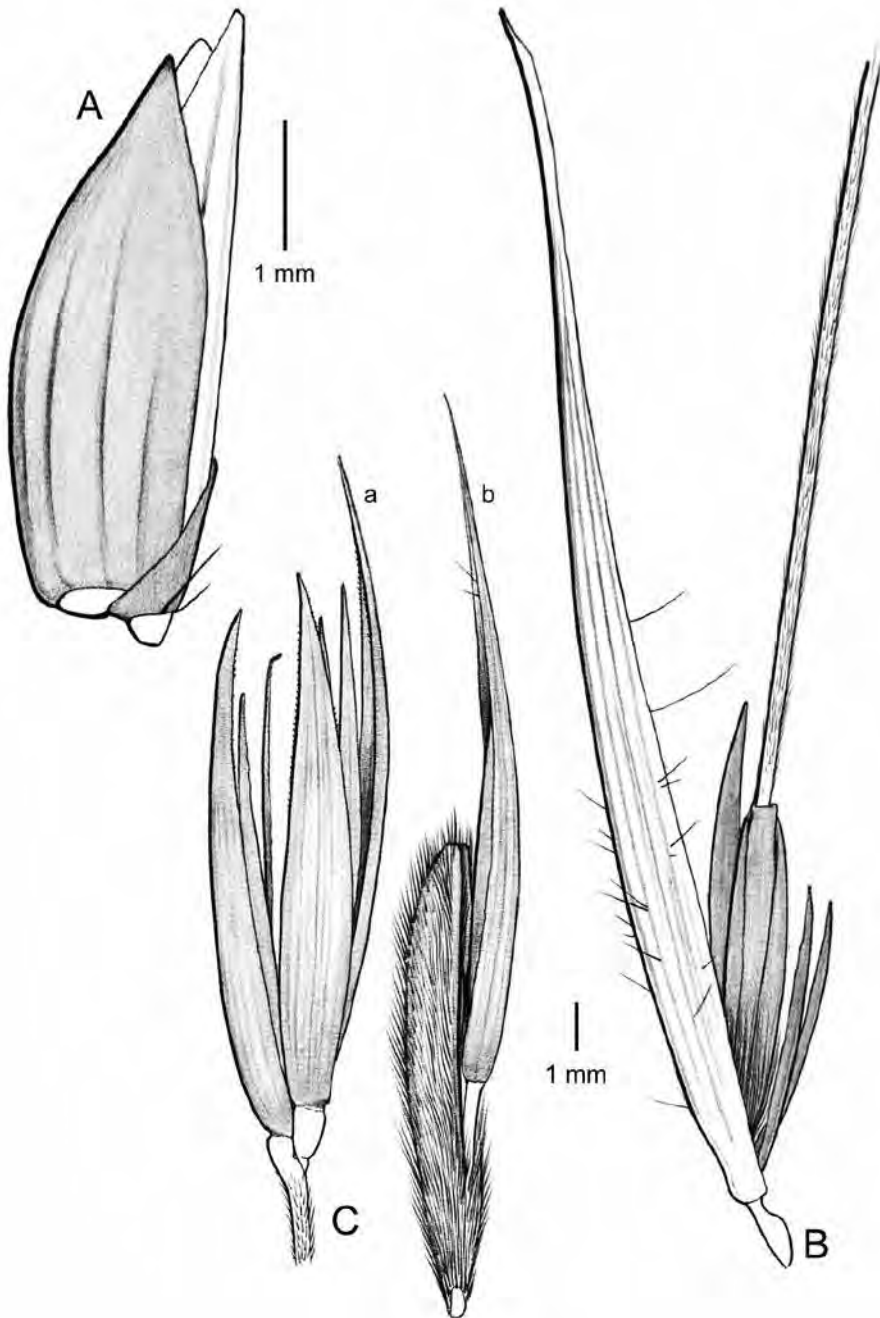


Figure 70. *Stenotaphrum secundatum* (Walter) Kuntze. **A.** Spikelet, lateral view. *Themeda arguens* (L.) Hack. **B.** Inflorescence with spathe. *Themeda villosa* (Poir.) A.Camus. **C.** Detail of inflorescence: **a.** spike-like raceme, **b.** pair of spikelets. (Drawn by J.J. Vermeulen).

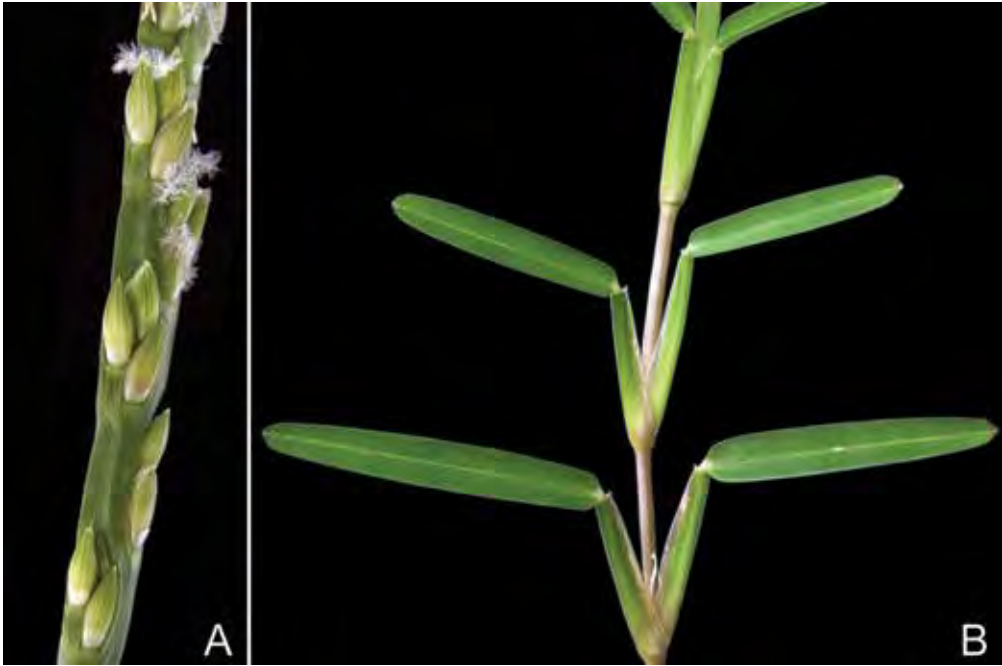


Figure 71. *Stenotaphrum secundatum* (Walter) Kuntze. **A.** Detail of inflorescence. **B.** Culm with leaves. (From Singapore, Mount Sinai Drive, *Duistermaat 132*. Photos: H. Duistermaat).

long as the spikelet, acute, 5–9-nerved. **First lemma** paleate, sterile to male, 4.3–4.6 mm long, very faintly 3–9-nerved, convex, indurate; second lemma 5-nerved, herbaceous. **Anthers** 2.25–3 mm long.

Distribution. Atlantic coasts of America and Africa, possibly spread early elsewhere with sand ballast and later as a lawn grass. Naturalised in Singapore on Cluny Road (*Jumali 326*, 12 Apr 1961, SINU), Dunearn Road (*Duistermaat 264*, 11 Feb 2004, L, SING [SING0059698]), Holland Road (*Duistermaat 039*, 8 Mar 2002, K, L, SING [SING0059696]), Mount Sinai Drive (*Duistermaat 132*, 28 Mar 2003, SING [SING0059697]), Nassim Road (*Nur s.n.*, 29 Sep 1950, KEP, SING [SING0201747]) and elsewhere.

Ecology. In its natural range it is a coastal pioneer, especially on sand, and is also found on the fringes of mangrove swamps and salt marshes. As an introduced exotic it has become weedy in cleared areas and along roads where it propagates vegetatively and rarely flowers.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *St Augustine grass* (English).

57. THEMEDA Forssk.

(Yemeni Arabic, *thamada* = puddle, ditch;
apparently based on a mistranslation of the word 'praise')

Fl. Aegypt.-Arab. (1775) 178; Kellogg in Kubitzki (ed.), *Fam. Gen. Vasc. Pl.* 13 (2015) 310; Veldkamp, *Blumea* 61 (2016) 29. **Type:** *Themeda triandra* Forssk.

Annuals or perennials. **Culms** solid. **Ligule** collar-shaped, membranous. **Inflorescence** paniculate, spatheate, spikelet-bearing axes very much reduced, clustered in capitules supported by a spatheole, usually persistent. **Involucre** formed by 2 homogamous involucreal pairs of male or sterile (sub)sessile spikelets; rachis disarticulating at the base of the fertile spikelets. **Fertile spikelets** 1–4, bisexual, terete, callus pungent, bearded. Lower **glumes** flat on the back, 9–11-nerved; callus hairy, acute to acuminate. Upper **lemmas** stipitiform, usually passing into an awn. **Pedicels** free of the joints. **Pedicelled spikelets** variously reduced.

Distribution. A genus of 33 species in the Old World of which 2 are native in Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Andropogoninae* J.Presl.

Notes. The derivation of the name *Themeda* seems to be based on a misunderstanding: 'thamada' in Yemen is a puddle or a small quantity of water in a ditch (Bor, *Fl. Iraq* 9 (1968) 554), but an Arabic dictionary translated this to 'praise'.

Key to *Themeda* species

1. Sheath at least in upper half sparsely to densely hairy; blades 4–45 cm by 1–8 mm; peduncle of raceme extremely short, 0.5–2 mm long; involucreal spikelets inconspicuous, small, hidden among the spatheoles, inserted at the same level, sterile; lower glumes membranous; fertile spikelets solitary, 4.5–6.5 mm long, dorsally distally hispidulous; awn 35–120 mm long; pedicels glabrous; pedicelled spikelets 6–9 mm long **1. T. arguens**
Sheath glabrous or hairy at margin; blades 70–250 cm by 6.5–20 mm wide; peduncle of raceme 8–15 mm long; involucreal spikelets conspicuous, unequally inserted, male; lower glumes herbaceous; fertile spikelets 2 or 3, dorsally hairy all over; awns absent, or up to 30 mm long; pedicels hairy; pedicelled spikelets 10–19 mm long **2. T. villosa**

1. *Themeda arguens* (L.) Hack.

(Latin, *arguer* = accuse; see notes)

in De Candolle & De Candolle, *Monogr. Phan.* 6 (1889) 657; Ridley, *Fl. Malay Penins.* 5 (1925) 212; Henderson, *Malay. Wild Fls., Monocot.* (1954) 351, fig. 200a,b; Gilliland, *Rev. Fl. Malaya* 3 (1971) 300, pl. 36c,d; Turner, *Gard. Bull. Singapore* 45 (1993) 103; Keng et al., *Concise Fl. Singapore*, vol. 2, *Monocot.* (1998) 185, fig. 292; Duistermaat, *Gard. Bull. Singapore* 57, *Suppl.* (2005) 134, fig. 138; Chong et al., *Checkl. Vasc. Pl. Fl. Singapore* (2009) 81, 171, 273. **Basionym:** *Stipa arguens* L., *Sp. Pl.*,

ed. 2, 1 (1762) 117. **Synonyms:** *Anthistiria arguens* (L.) Willd., Sp. Pl., ed. 4, 4(2) (1806) 901; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 169. – *Anthistiria ciliata* Naezén var. *major* Thwaites, Enum. Pl. Zeyl., fasc. 5 (1864) 366. – *Themeda forskalii* Hack. var. *major* (Thwaites) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 662. – *Anthistiria imberbis* Retz. var. *major* (Thwaites) Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 213. – *Themeda triandra* Forssk. var. *major* (Thwaites) Domin, Biblioth. Bot. 20 (1915) 279. – *Themeda arguens* (L.) Hack. var. *genuina* A. Camus, Bull. Mus. Natl. Hist. Nat. 25 (1919) 671, nom. inval. **Type:** *Burman s.n.*, India (lectotype LINN [Herb. Linn. no. 94.10], designated by Merrill, Interpr. Herb. Amboin. (1917) 89). **Fig. 70B.**

Perennials. **Culms** solitary or tufted, (0.06–)0.25–2 m tall. **Sheaths** at least in upper half sparsely to densely hairy. **Ligules** 1–1.4 mm long. **Leaf** blades folded along the midrib when young, 4–45 cm by 1–8 mm. **Spatheate inflorescence** 15–50 cm long. **Peduncle** of raceme extremely short, 0.5–2 mm long, usually white-hairy. **Involucral spikelets** inconspicuous, hidden among the spatheoles, sterile, inserted at the same level, reduced to 1 (or 2) glumes, 8–10 mm long, glabrous. **Fertile spikelets** solitary, 4.5–6.5 mm long, dorsally distally hispidulous. **Awns** 35–120 mm long. **Pedicels** glabrous. **Pedicelled spikelets** 6–9 mm long.

Distribution. Andamans to northern Vietnam, through continental Southeast Asia and Malesia to northern Australia. Native in Singapore and collected from Ayer Raja Road (*Gilliland s.n.*, 20 Aug 1961, SING [0041630], SINU), Bukit Timah Road (*Wong s.n.*, 1 Aug 1959, SINU), Kranji to Woodlands (*Mhd Shah & Ali MS4204*, 19 Aug 1982, KEP, SING [SING0041475]), Jin Wat Selat (*Chua 665*, 19 Dec 1991, SINU) and Chinese Cemetery (*Ridley s.n.*, 14 Sep 189?, SING [SING0041629]).

Ecology. Road sides and wasteland.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore it is very infrequently collected; there are likely to be fewer than 1000 plants and so it is assessed here as Vulnerable (VU/D).

Vernacular names. *Lesser tassel grass* (English), *rumput misai Adam* (Malay).

Notes. The epithet *arguens* is derived from Rumphius (Herb. Amboin. 6 (1750) 15) who writes ‘The Ternatans have a childish but common use for it. If someone wants to accuse or reproach someone, especially a lover, or a wife her husband, or a husband his wife, saying that one has to endure some trouble, sorrow, or danger, they will send [that person] a small gift wrapped up in the prickly spikes of this plant, thereby informing the other through the name of this herb [‘*Tagalagnana*’: ‘because of you’], that he should withstand some trouble for it’. – Translation by Beekman (The Ambonese Herbal 5 (2011) 27).

2. *Themeda villosa* (Poir.) A. Camus

(Latin, *villosus* = villous, shaggy hairy; referring to the fertile lemmas)

Fl. Indo-Chine 7, fasc. 4 (1922) 364 [incl. var. *typica* A. Camus, nom. inval.]; Ridley, Fl. Malay Penins. 5 (1925) 212, isonym; Henderson, Malay. Wild Fls., Monocot. (1954) 352, fig. 200c; Gilliland, Rev.

Fl. Malaya 3 (1971) 301, fig. 65; Turner, Gard. Bull. Singapore 45 (1993) 103; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 185; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 134, fig. 139, pl. 36; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 81, 171, 231. **Basionym:** *Anthistiria villosa* Poir. in Lamarck, Encycl., Suppl. 1, fasc. 1 (1810) 396. **Synonyms:** *Themeda gigantea* (Cav.) Hack. subsp. *villosa* (Poir.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 675. – *Themeda gigantea* (Cav.) Hack. var. *villosa* (Poir.) Hack. in De Candolle & De Candolle, Monogr. Phan. 6 (1889) 675. – *Anthistiria gigantea* Cav. subsp. *villosa* (Poir.) Hack. ex Hook.f., Fl. Brit. India 7, fasc. 21 (1896) 217. – *Anthistiria gigantea* Cav. var. *villosa* (Poir.) Ridl., J. Straits Branch Roy. Asiat. Soc. 33 (1900) 186, nom. inval. – *Themeda gigantea* (Cav.) Hack. subvar. *villosa* (Poir.) Roberty, Boissiera 9 (1960) 92. **Type:** *Commerson s.n.*, [Indonesia], Java (lectotype P-LA [P00563839], designated by Veldkamp, Blumea 61 (2016) 36). **Fig. 70C, 72A.**

Anthistiria gigantea auct. non Cav.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 169.

Perennial. **Culms** tufted, 1–6 m long; nodes glabrous or pilose. **Ligule** 0.5–2 mm long, margin glabrous to setose. **Leaf** blades 20–250 cm by 3–20 mm. **Uppermost spatheoles** glabrous. **Peduncle** 8–35 mm long, 1/3 to 1/2 times as long as the spatheole, glabrous to golden hairy. **Capitule** long-persistent. **Involucral spikelets** conspicuous, unequally inserted, sterile or male. Lower **glumes** linear-lanceolate to linear, (6–)8–21 × 1–2 mm, acuminate, herbaceous, 11-nerved, glabrous to dorsally with some long hairs or densely brown to golden hirsute (hairs sometimes with a bulbous base); upper glumes 3-nerved. **Fertile spikelets** (1–)2–3(–4), 6–12.5 mm long (incl. callus); callus 1–3 mm long, pilose, hairs white or brown, 1–2 mm long. Lower **glumes** castaneous or brown or yellowish, obtuse to truncate, surface laterally hairy to hairy all over, hairs white or golden, or castaneous. **Awns** absent or very short, 0(–32) mm long, column more or less straight, 0–14 mm long. **Anthers** 2–7.5 mm long, purple or orange in dry specimen. **Pedicels** of pedicelled spikelets glabrous or hairy. **Pedicelled spikelets** 3 or 4, male, 8.5–19 mm long. Lower **glumes** acuminate to aristate, glabrous to minutely puberulous or sparsely pilose.

Distribution. Northeastern India to southern China, through continental Southeast Asia and Malaysia. Native in Singapore and widely but infrequently collected, including from Balestier Plain (*Ridley s.n.*, 189?, SING [SING0041634]), Bedok Corner (*Ali Ibrahim & Chin AI 218*, 19 Aug 1994, SING [SING0041636, SING0041637, SING0041638]), Mandai Quarry (*Duistermaat & Hillier 46*, 12 Mar 2002, L, SING [SING0059821]), Pasir Ris (*Maxwell 80-206*, 25 Nov 1980, SING [SING0041633], SINU) and the Western Catchment (*Samsuri et al. WC 14*, 30 Mar 2004, SING [SING0053916]).

Ecology. Sunny road sides, sandbanks, river banks, abandoned fields, near the sea just above the high tide mark.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Greater tassel grass* (English), *rumpu riong* (Malay).



Figure 72. *Themeda villosa* (Poir.) A.Camus. **A.** Spatheate inflorescence. *Thuarea involuta* (G.Forst.) R.Br. ex Sm. **B.** Two mature inflorescences. *Urochloa subquadripara* (Trin.) R.D.Webster. **C.** Two inflorescences. (From Singapore, A from Singapore Botanic Gardens; B from Pulau Subar Darat, Duistermaat et al. 236; C exact locality uncertain. Photos: H. Duistermaat).

58. THUAREA Pers.

(Louis-Marie Aubert du Petit-Thouars, 1758–1831,
French mariner, explorer, botanist)

Syn. Pl. 1 (1805) 110; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 339. **Synonyms:** *Microthuareia* Thouars, Gen. Nov. Madagasc. (1806) 3, nom. illeg. superfl. **Type:** *Thuarea sarmentosa* Pers. (= *Thuarea involuta* (G.Forst.) R.Br. ex Sm.).

Andromonoecious perennials. **Culms** solid, branching intra-vaginally at base, stoloniferous, mat-forming. **Ligule** a fringe of hairs. **Inflorescence** deciduous, a spatheate, single spike; rachis foliaceous, folded lengthwise, attenuating upward, terminating into a spikelet or an acumen, in fruit forming a corky diaspore. **Spikelets** sessile, solitary, adaxial, dorsoventrally compressed, 2-flowered, heteromorphous, the basal one (or 2) persistent, bisexual, the 2–6 other ones male, deciduous. Lower **glume** 0–3-nerved, sometimes absent; upper glume muticous, 5–7-nerved. **First lemma** in both spikelet types paleate, staminate (often apparently empty), 5–7-nerved; upper lemma of bisexual spikelets indurate, very faintly 5-nerved, germination flap present, muticous.

Distribution. A genus of 2 species, 1 along sandy coasts from Madagascar to the Pacific and 1 inland in Madagascar. In Singapore 1 native species.

Taxonomy. The genus belongs to the *Panicoideae* – *Melinidinae* Stapf.

Notes. After fertilisation the male spikelets usually drop off and the rachis folds over and enlarges into an obtriangular, 3-ridged ('bird's head shaped'), corky, watertight protective box enclosing the basal fertile spikelet. This diaspore is either pushed into the sand or dehisces from the peduncle. As it can also float, and the viability of the seed is considerable, it can be carried to distant shores (Henty, Bot. Bull. Dept. Forests Papua New Guinea 1 (1969) 188, t. 70a).

***Thuarea involuta* (G.Forst.) R.Br. ex Sm.**

(Latin, *involutus* = involute, rolled inwards; referring to the diaspore)

in Rees, Cycl. 35(70) (May 1817) unpagged; Roemer & Schultes, Syst. Veg., ed. 15 bis, 2 (Nov 1817) 808; Eschsch., Mém. Acad. Imp. Sci. St. Pétersbourg Hist. Acad. 10 (1826) 291, as '*involucrata*'; Jackson, Index Kew. 2, fasc. 4 (1895) 1071, isonym; (1895) 1071; Gilliland, Rev. Fl. Malaya 3 (1971) 207, pl. 21b, colour pl. 18; Turner, Gard. Bull. Singapore 45 (1993) 103; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 186; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 134, fig. 141, pl. 37; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 86, 171, 231. **Basionym:** *Ischaemum involutum* G.Forst., Fl. Ins. Austr. (1786) 73. **Type:** *Forster s.n.*, Society Islands (lectotype UPS-THUNB [Herb. Thunberg 23948] [V-143195]), designated by Nicolson & Fosberg, Forsters Bot. Sec. Cook Exped. 139 (2004) 247). **Fig. 72B, 73A.**

Thuarea sarmentosa Pers., Syn. Pl. 1 (1805) 110; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 146; Ridley, Fl. Malay Penins. 5 (1925) 236; Henderson, Malay. Wild Fls., Monocot. (1954) 335, fig. 191e–h; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2196. **Type:** *Du Petit-Thouars s.n.*, Madagascar (lectotype P [P02239717]), designated by Turner et al., Gard. Bull. Singapore 71 (2019) 41; possible isolectotype P [P02239717])

Culms up to 1.5 m long, rooting at the nodes, erect part 0.025–0.25 m long; nodes hairy. **Ligule** hairs 0.5–1 mm long. **Leaf** blades inrolled when young, flat, ovate-lanceolate to linear-lanceolate, 0.8–7 cm by 2–10 mm, base rounded, subglabrous to pilose. **Spikes** 1–3 cm long; rachis 1.5–3.6 mm wide. **Spikelets** puberulous; basal one 4.2–5.4 mm long. **Glumes** acute; lower glume 0–2.5(–3.2) mm long; upper glume slightly shorter than the spikelet. **Lemmas** 5-nerved; upper lemma smooth, shiny, apex puberulous. **Anthers** 2.25–3 mm long. **Male spikelets** 4–5 mm long.

Distribution. Sri Lanka and India to Japan, through continental Southeast Asia and Malesia to the Pacific and northern Australia. Native in Singapore and widely collected, including from Bedok (*Burkill SF 597*, 22 Dec 1914, SING [SING0017854]), Pulau Hantu (*Chua et al. H 55*, 28 Jan 1993, SINU), Pulau Semakau (*Tan & Morgany L 3031*, 11 May 2000, SINU), Pulau Subar Darat (*Duistermaat et al. 236*, 19 Dec 2003, L, SING [SING0059700]) and Rochore (*Ridley s.n.*, Sep 1893, SING [SING0017856]).

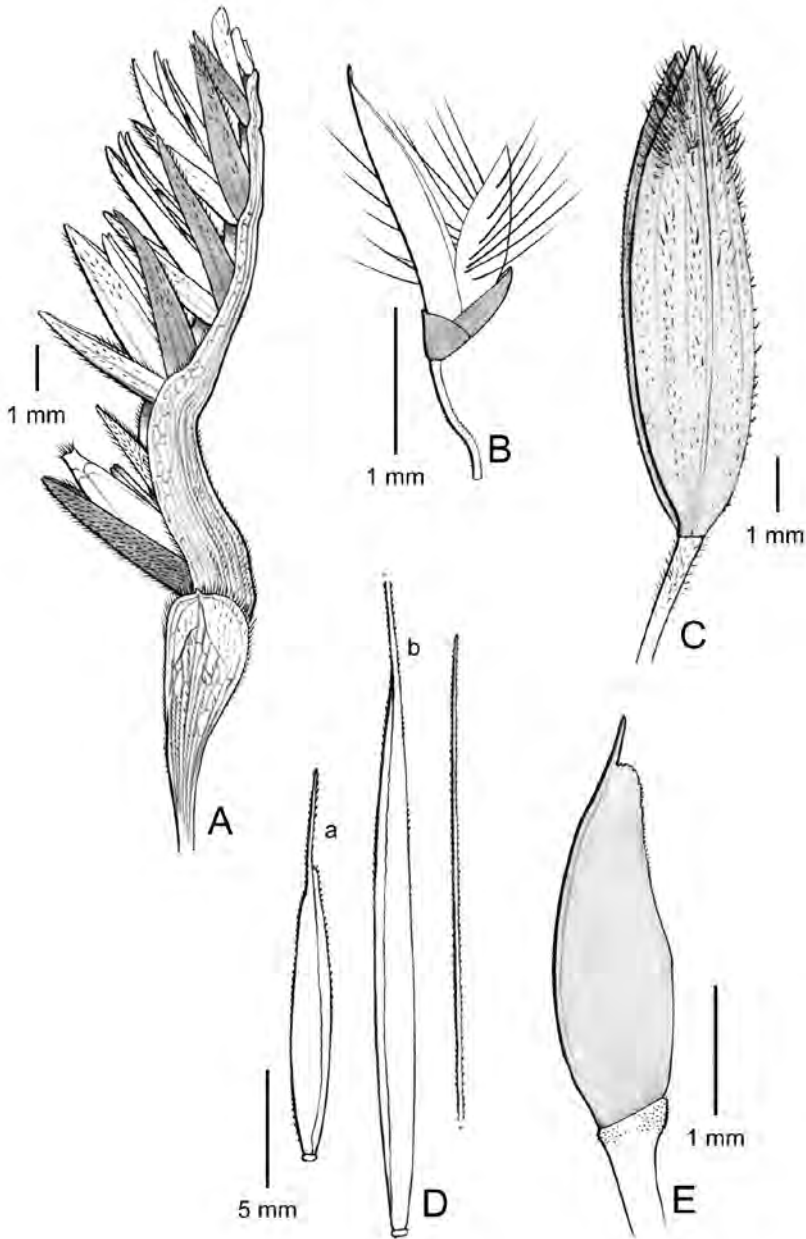


Figure 73. *Thuarea involuta* (G.Forst.) R.Br. ex Sm. **A.** Inflorescence with lower spikelet bisexual and following spikelets male. *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda. **B.** Spikelet, lateral view. *Zea mays* L. **C.** Male spikelet. *Zizania latifolia* (Griseb.) Hance ex F.Muell. **D.** Spikelets: **a.** male spikelet, **b.** female spikelet. *Zoysia matrella* (L.) Merr. **E.** Upper glume lateral view, lemma and palea hidden inside. (Drawn by J.J. Vermeulen).

Ecology. Behind sandy beaches at sea-level, conspicuous for its bright green foliage.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore mostly now only found on the offshore islands with sandy beaches but still to be considered Least Concern (LC).

Vernacular name. *Sea nut grass* (English).

59. THYSANOLAENA Nees

(Greek, *thysano-* = brush, *-laena* from *chlaina* = cloak; referring to the hairy second lemma)

Edinburgh New Philos. J. 18 (1835) 180; Gandoger, Bull. Soc. Bot. France 66 (1920 [‘1919’]) 303, as ‘*Thysanochlaena*’; Janowski, Bot. Arch. 1 (1922) 27; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 287. **Type:** *Thysanolaena agrostis* Nees, nom. illeg. superfl. (= *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda).

Perennials. **Culms** tufted, rhizomatous, stolons absent, branching intra- and extra-vaginally at base, hollow to solid. **Ligule** collar-shaped, membranous. **Leaf** blades inrolled when young, pseudo-petiolate, disarticulating from the sheath, broad, linear-lanceolate to linear, with cross-veins (esp. underneath). **Panicle** large, usually lax, secund. **Spikelets** solitary or paired, falling with the acroscopically scaberulous pedicel, laterally compressed, 2(or 3)-flowered. **Glumes** subequal, much shorter than the spikelet and adjacent lemmas, 0- or 1-nerved. **Rachilla** process terminated by a reduced floret or naked. **Lemmas** acuminate, muticous, callus obtuse, glabrous; first lemma membranous, epaleate, sterile, longer than the second one, 1- or 3-nerved; second lemma indurating, 3-nerved; third floret absent to male. **Stamens** 2 (or 3).

Distribution. A monotypic genus in tropical Asia from India and southern China (Guangdong) to New Guinea, including Singapore.

Taxonomy. The genus belongs to the *Panicoideae* – *Thysanolaeneae* C.E.Hubb.

***Thysanolaena latifolia* (Roxb. ex Hornem.) Honda**

(Latin, *lati-* = broad, *-folia* = leaves; with broad leaves)

J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 312; Turner, Gard. Bull. Singapore 45 (1993) 103; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 186; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 135, fig. 140; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 86, 171, 269. **Basionym:** *Melica latifolia* Roxb. ex Hornem., Hort. Bot. Hafn. Suppl. (1819) 117. **Type:** *Voigt s.n.*, India, Colles Garrow [Garrow Hills] (neotype C [C10017246], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 20; possible isoneotype C [C10017247]). **Fig. 73B.**

Agrostis maxima Roxb., [Hort. Bengal. (1814) 82, nom. nud.] Fl. Ind. 1 (1820) 319. **Synonyms:** *Thysanolaena agrostis* Nees, Edinburgh New Philos. J. 18 (1835) 180, nom. illeg. superfl.; Ridley, Mat.

Fl. Malay. Penins. 3 (1907) 143; Ridley, Fl. Malay Penins. 5 (1925) 241. – *Thysanolaena maxima* (Roxb.) Kuntze, Revis. Gen. Pl. 2 (1891) 794; Henderson, Malay. Wild Fls., Monocot. (1954) 321, fig. 185a–c; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2199; Gilliland, Rev. Fl. Malaya 3 (1971) 45, fig. 1, pl. 10a. **Type:** *Roxburgh s.n.*, India (lectotype G [G00418718], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 3).

Culms reed-like, simple, 1–4(–8) m tall. **Ligules** 1–2.5 mm long. **Leaf** blades broadly linear-lanceolate, 15–65 cm by 4–80(–100) mm, leathery, smooth. **Panicles** 15–125 cm long, many-branched, longest one up to 35 cm long; pedicels scaberulous. **Spikelets** crowded, 1.2–2.1 × c. 0.6 mm. **Glumes** obtuse; lower glumes 0.25–0.75 mm long; upper glumes 0.3–1 mm long. **Lemmas** with an internode; acuminate; first lemma 1.2–2 mm long; second lemma 1.2–1.8 mm long, margins pilose. **Anthers** 0.5–1 mm long.

Distribution. As for genus but apparently not native everywhere within this range. It is widely introduced elsewhere including Singapore where it is likely not native. It has been collected from Bukit Timah (*Amin MS 1192*, 18 Jul 1966, SING [SING0041284]), Lentor Avenue (*Lee et al. LA 35*, 29 May 2003, SING [SING0045050]), Mandai Quarry (*Duistermaat & Hillier 43*, 12 Mar 2002, SING [SING0059701]), Pulau Ubin (*Gwee et al. GAT 345*, 23 Sep 2003, SING [SING0047413]) and University grounds (*Kassim 2329*, 3 Feb 1959, SINU).

Ecology. Sunny to slightly shaded banks of rivers, open areas and rocky places.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular names. *Tiger grass* (English), *bulu tebrau* (Malay).

60. UROCHLOA P.Beauv.

(Greek, *uro-* = tail, *-chloa* = grass; referring to the mucro on the upper lemma)

Ess. Agrostogr. (1812) 52, 181, pl. 11: fig. 1; Veldkamp, Blumea 41 (1996) 413; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 339. **Synonym:** *Panicum* L. sect. *Urochloa* (P.Beauv.) Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 3 (1834) 193, 208; Steudel, Syn. Pl. Glumac. 1, fasc. 1 (1853) 43, isonym; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 133. **Type:** *Urochloa panicoides* P.Beauv.

Panicum L. sect. *Brachiaria* Trin., Gram. Panic. (1826) 51, 125. **Synonyms:** *Brachiaria* (Trin.) Ledeb., Fl. Ross. 4 (1853) 469. – *Panicum* L. subg. *Brachiaria* (Trin.) Honda, J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 3 (1930) 253. **Type:** *Panicum holosericeum* R.Br., lectotype designated by Pfeiffer, Nomencl. 1(1) Bot. (1871–1873 [‘1873’]) 453 (= *Urochloa holosericea* (R.Br.) R.D.Webster).

Panicum L. [subg.] *Maxima* Hitchc., N. Amer. Fl. 17(3) (1915) 200, 203. **Synonyms:** *Panicum* L. sect. *Maxima* (Hitchc.) Stapf, Fl. Trop. Afr. 9(4) (1920) 639, 642, as ‘*Maximae*’; Hitchcock & Chase ex Pilg., Notizbl. Bot. Gart. Berlin-Dahlem 11 (1931) 242, isonym. – *Panicum* L. subg. *Megathyrsus* Pilg., Notizbl. Bot. Gart. Berlin-Dahlem 11 (1931) 242, nom. illeg. superfl. – *Megathyrsus* B.K.Simon & S.W.L.Jacobs, Austrobaileya 6 (2003) 572. **Type:** *Panicum maximum* Jacq. (= *Urochloa maxima* (Jacq.) R.D.Webster).

Annuals or perennials. **Culms** hollow or solid. **Ligule** rim- to collar-shaped with a fringe of hairs. **Leaf** blades inrolled when young. **Inflorescence** a lax panicle of racemes. **Branches** terminated by a spikelet. **Spikelets** secund, adaxial, pedicelled, disarticulating below the glumes, terete or dorsoventrally compressed, solitary, paired, or clustered, 2-flowered; lower floret epaleate to paleate, neuter to male, sometimes even bisexual; upper floret bisexual. Lower **glume** 0–11-nerved; upper glume 5–9-nerved. Lower **lemma** mucicous, 5–7-nerved; upper lemma chartaceous to cartilaginous, faintly 5–7-nerved, dull, variously sculptured, germination flap present, white or yellow in fruit, margins inrolled over the palea, minutely crested to mucronate.

Distribution. A genus of approximately 120 pantropical species. In Singapore 2 native and 3 introduced species.

Taxonomy. The genus belongs to the *Panicoideae* – *Melinidinae* Stapf.

Key to *Urochloa* species

1. Base of lower glumes at most hemi-amplexicaul; lower lemma with cross-veins, apex acuminate or subcaudately crested; upper lemma apex mucronate 2
 Base of lower glumes amplexicaul; lower lemma with or without cross-veins, apex acute; upper lemma apex rounded or acutish 3
2. Culms nodes puberulous, sheaths glabrous; peduncle puberulous below the inflorescence; common axis 0.7–7 cm long; racemes 2–7, axils puberulous, lowermost racemes simple, upper racemes approximate; lower glumes 2.5–4 mm long, 0.7–0.95 times as long as the first lemma, base not amplexicaul, apex acuminate or subcaudate, glumes 5–7-nerved; lower lemma epaleate or paleate, sterile, back flattened; upper lemma 2.4–2.75 mm long **1. U. glumaris**
 Culms nodes and sheaths pilose; peduncle glabrous below the inflorescence; common axis 15–22 cm long; racemes 9–25, axils pilose, lowermost ones branched, upper racemes distant; lower glumes 0.7–1.4 mm long, 0.25–0.37 times as long as the first lemma, base hemi-amplexicaul, apex acute to truncate, glumes 0- or 1-nerved; lower lemma paleate, male, back slightly sulcate; upper lemma 2.1–2.25 mm long **3. U. mutica**
3. Sheaths glabrous or more or less hirsute; racemes 2–9, rachis narrowly ribbon-like; spikelets solitary; glumes remote, upper ones acute; lower lemma back slightly sulcate ..
 4
 Sheaths pilose; racemes numerous, rachis triquetrous; spikelets paired; glumes approximate, upper ones acuminate; lower lemma back flattened **2. U. maxima**
4. Upper glumes with cross-veins, pubescent, apical hairs longest; upper lemma apex acutish **4. U. piligera**
 Upper glumes without cross-veins, glabrous or puberulous; upper lemma apex rounded ..
 **5. U. subquadripara**

1. *Urochloa glumaris* (Trin.) Veldkamp

(Latin, *gluma* = glume; referring to the long lower glumes)

Blumea 41 (1996) 420; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 186; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 138, fig. 147; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 171, 273. **Basionym:** *Panicum glumare* Trin., Gram. Panic. (1826) 143. **Type:** *Collector unknown s.n.*, New Zealand (probably wrongly localised) (lectotype LE [Herb. Trinius 727.1], designated by Veldkamp, Blumea 41 (1996) 420). **Fig. 74A.**

Urochloa paspaloides J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 318; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2252. **Synonyms:** *Panicum ambiguum* Trin., Mém. Acad. Imp. Sci. St. Pétersbourg, sér. 6, Sci. Math. 3 (1834) 243, nom. nov., non *Panicum paspaloides* Pers. (1805). – *Panicum urochloa* Steud., Nomencl. Bot., ed. 2, 2, fasc. 10 (1841) 264, nom. illeg. superfl. – *Brachiaria ambigua* (Trin.) A.Camus, Fl. Indo-Chine 7, fasc. 4 (1922) 433, nom. superfl. – *Brachiaria paspaloides* (J.Presl) C.E.Hubb. in Hooker's Icon. Pl. 34 [ser 5, 4] (1939) t. 3363 (page 2); Henderson, Malay. Wild Fls., Monocot. (1954) 342, fig. 194n–q; Gilliland, Rev. Fl. Malaya 3 (1971) 179, colour pl. 13; Turner, Gard. Bull. Singapore 45 (1993) 93. – *Urochloa ambigua* Pilg. in Engler & Prantl, Nat. Pflanzenfam., ed. 2, 14e (1940) 35, nom. illeg. superfl. **Type:** *Haenke s.n.* [Philippines, Luzon, Sorsogon] (lectotype MO [MO-157629], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 54; isolectotypes PR [sheet no. 194792], W [×2]).

Annual or perennial. **Culms** tufted, not rhizomatous, with short stolons, geniculate at base, rooting at the nodes to decumbent, 0.2–0.75 m high, nodes puberulous. **Sheaths** glabrous, pilose along the margins. **Ligule** with 0.7–1.1 mm long hairs. **Leaf** blades linear, 5–28 cm by 3.5–11 mm, base rounded, margins at base smooth, sometimes pilose, upwards scaberulous, glabrous to pilose below. **Inflorescence** peduncle puberulous below the inflorescence; common axis 0.7–7 cm long; racemes 2–7, alternate, appressed to erecto-patent, rachis triquetrous, 0.7–0.8 mm wide, margins scabrous, glabrous to pilose, axils puberulous; lowermost racemes simple, 1.5–8 cm long, with spikelets dense; upper racemes approximate; pedicels 0.2–2 mm long, puberulous to pilose. **Spikelets** at least in the middle of the raceme paired, ellipsoid, base rounded, (3.15–)3.4–4.75 mm long. **Glumes** approximate; lower glumes 2.5–4 mm long, 0.7–0.95 times as long as the lower lemma, base not amplexicaul, apex acuminate to subcaudate, 5–7-nerved, with or without cross-veins; upper glumes at least as long as the upper lemma, apex acuminate to subcaudately crested, 7-nerved, with cross-veins, glabrous. Lower **lemma** rarely epaleate, usually paleate, sterile (sometimes male?), back flattened, apex acuminate to subcaudately crested, 5-nerved, with cross-veins, palea 0–0.25 times as long; upper lemma 2.4–2.75 mm long, apex mucronate (mucro 0.35–0.65 mm long, puberulous), transversally rugulose, dull. **Anthers** 0.9–1.35 mm long.

Distribution. From India to southern China, through continental Southeast Asia and Malesia to the Pacific islands. Native in Singapore and widely but infrequently collected, including from Bukit Timah Road (*Wong s.n.*, 1 Aug 1959, SINU), Chinese High School (*Chan s.n.*, 20 Aug 1984, SINU), Raffles Lighthouse (*Ridley s.n.*, 2 Jan 1889, SING [SING0035085]), Robinson Road (*Wong s.n.*, 22 Jun 1959, SINU) and Serangoon Road (*Teruya 55b*, 21 Apr 1929, SING [SING0041590]).

Ecology. Elsewhere in moist, not too dry places, sunny to slightly shaded, road sides, lawns, open waste places, clearings, thickets and forest margins.

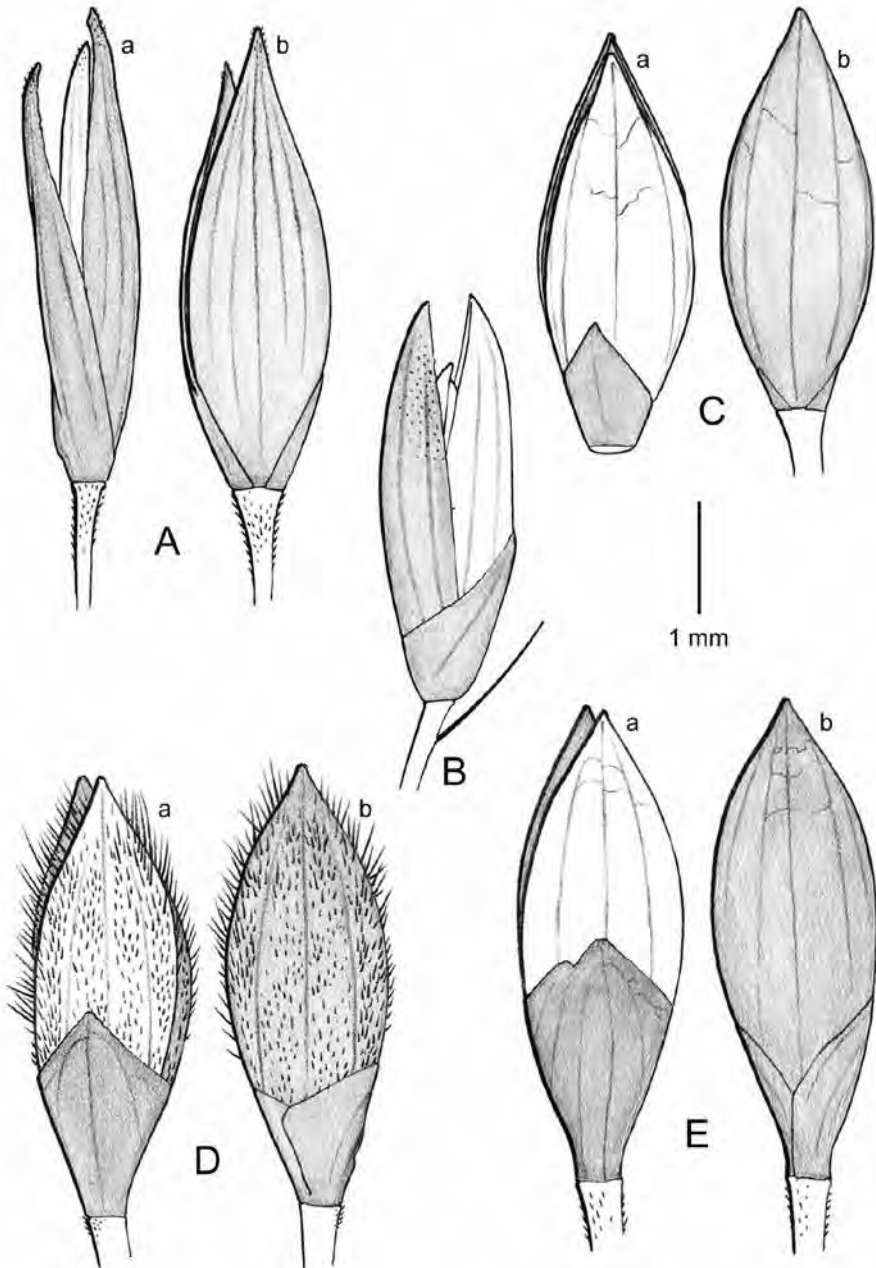


Figure 74. *Urochloa glumaris* (Trin.) Veldkamp. **A.** Spikelets: **a.** lateral view, **b.** facing upper glume. *Urochloa maxima* (Jacq.) R.D.Webster. **B.** Spikelet, lateral view. *Urochloa mutica* (Forssk.)T.Q.Nguyen. **C.** Spikelets: **a.** facing lower glume, **b.** facing upper glume. *Urochloa piligera* (F.Muell. ex Benth.) R.D.Webster. **D.** Spikelets: **a.** facing lower glume, **b.** facing upper glume. *Urochloa subquadripara* (Trin.) R.D.Webster. **E.** Spikelets: **a.** facing lower glume, **b.** facing upper glume. (Drawn by J.J. Vermeulen).

Provisional conservation assessment. Globally Least Concern (LC). In Singapore presumed Nationally Extinct.

2. *Urochloa maxima* (Jacq.) R.D.Webster

(Latin, *maximus* = very large; possibly referring to the inflorescence)

Austral. Paniceae (Poaceae) (1987) 241. **Basionym:** *Panicum maximum* Jacq., Icon. Pl. Rar. 1 (1781) 2, t. 13; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 140; Ridley, Fl. Malay Penins. 5 (1925) 226; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1684; Turner, Gard. Bull. Singapore 45 (1993) 100; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 175, fig. 279; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 102, fig. 101, pl. 18. **Synonym:** *Megathyrsus maximus* (Jacq.) B.K.Simon & S.W.L.Jacobs, Austrobaileya 6 (2003) 572; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 59, 170, 267. **Type:** *Collector unknown s.n.*, Guadeloupe (lectotype W [W·0011326], designated by Zuloaga, Darwiniana 22 (1979) 24; isolectotype BM). **Fig. 74B, 75.**

Perennial. **Culms** shortly rhizomatous, geniculate at base, not rooting at the nodes or erect, 0.6–3 m high, nodes puberulous to pilose. **Sheaths** tuberculately pilose, margins pilose. **Ligule** with 0.3–0.5 mm long hairs. **Leaf** blades linear, (9–)25–50(–105) cm by 6.5–30 mm, base rounded, margins scaberulous, glabrous below. **Inflorescence** peduncle glabrous below the inflorescence; common axis 12–45(–60) cm long; racemes many, erecto-patent to patent; rachis triquetrous, glabrous, axils glabrous to pilose; lowermost racemes branched, 6–32 cm long, spikelets lax; upper racemes distant; pedicels glabrous or pilose under the spikelet. **Spikelets** paired, ellipsoid, base rounded, 3.2–3.75 mm long. **Glumes** approximate; lower glumes 1.3–1.65 mm long, 0.36–0.47 times as long as the first lemma, base amplexicaul, apex rounded to acute, faintly 3–5-nerved, without cross-veins; upper glumes at least as long as the second lemma, apex acuminate, 5-nerved (faintly), without cross-veins, glabrous. Lower **lemma** paleate, male, back flattened, apex acute, faintly 5-nerved, without cross-veins; upper lemma 2.3–2.5 mm long, apex acutish, transversally rugulose, dull. **Anthers** 1–2.2 mm long.

Distribution. Tropical Africa, Mascarenes and Arabia, widely introduced and naturalised throughout the tropics and subtropics. Naturalised in Singapore and widely and frequently collected, including from Bishan-Ang Mo Kio Park (*Chen SING2018-126*, 12 Dec 2017, SING [SING0255843]), Kent Ridge Road (*Firdaus 37*, 7 Dec 2000, SINU), Orchard Road (*Gilliland s.n.*, 6 Apr 1957, SINU), Pulau Ubin (*Duistermaat 229*, 15 Nov 2003, SING [SING0064180]) and Sungei Buloh (*Choong VC 100*, 30 Aug 1991, SINU).

Ecology. Disturbed places, grassy areas and road sides.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular names. *Guinea grass* (English), *rumput benggala* (Malay).



Figure 75. *Urochloa maxima* (Jacq.) R.D.Webster. **A.** Inflorescence. **B.** Detail of inflorescence with spikelet in inset. **C.** Detail of leaf sheath and blade. (From Singapore, Bishan Park, *Chen SING2018-126*. Photos: L.M.J. Chen).

3. *Urochloa mutica* (Forssk.) T.Q.Nguyen

(Latin, *muticus* = blunt, without a point, awnless; referring to the unawned spikelets)

Novosti Sist. Vyssh. Rast. (3) (1966) 13; Webster ex Zon, Wageningen Agric. Univ. Pap. 92 (1992) 264, isonym; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 187; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 138, fig. 144, pl. 38; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 171, 269. **Basionym:** *Panicum muticum* Forssk., Fl. Aegypt.-Arab. (1775) 20; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 133. **Synonyms:** *Brachiaria mutica* (Forssk.) Stapf, Fl. Trop. Afr. 9(3) (1919) 526; Ridley, Fl. Malay Penins. 5 (1925) 219; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 359; Gilliland, Rev. Fl. Malaya 3 (1971) 178, pl. 23b, colour pl. 12; Turner, Gard. Bull. Singapore 45 (1993) 93. **Type:** *Forsskål 86*, Egypt, Rosetta (lectotype C [C10002726], designated by Blake, Proc. Roy. Soc. Queensland 81 (1970) 5; isoclectotype BM). **Fig. 74C, 76.**

Perennial. **Culms** tufted, not rhizomatous, stoloniferous (stolons up to 5 m long), geniculate at base, rooting at the nodes, 1–2 m high, 3–7(–10) mm wide at base, nodes pilose. **Sheaths** pilose. **Ligule** hairs 0.5–1.5 mm long. **Leaf** blades linear, 10–20(–30) cm by 7–10(–25) mm, base rounded to slightly pseudo-petiolate, margins scaberulous, below glabrous to pilose. **Inflorescence** peduncle glabrous below the inflorescence; common axis 15–22 cm long; racemes 9–15(–25), erecto-patent, rachis triquetrous to narrowly ribbon-like, 0.5–1.2 mm wide, glabrous, axils pilose; lowermost racemes branched, 3–12 cm long, spikelets dense; upper racemes distant; pedicels 0.4–1.3 mm long, glabrous to sparsely pilose. **Spikelets** at least in the middle of the raceme paired (or ternate), ellipsoid, base rounded, 2.85–3.3 mm long. **Glumes** approximate; lower glumes 0.7–1.4 mm long, 0.25–0.37 times as long as the lower lemma, base hemi-amplexicaul, apex acute to notched, 0- or 1-nerved; upper glumes at least as long as the upper lemma, apex acuminate, 5–7-nerved, with cross-veins, glabrous. Lower **lemma** paleate, male, back slightly sulcate, apex acuminate, 5-nerved, with cross-veins, palea about as long; upper lemma 2.1–2.25 mm long, apex mucronate, transversally rugulose, dull. **Anthers** 1.2–1.9 mm long.

Distribution. Said to be originally from Africa, introduced and naturalising throughout the tropics, including in Singapore where it is widely distributed and collected, including from Bukit Timah Road (*Nur s.n.*, 8 Feb 1925, SING [SING0035087]), Kallang Riverside (*Chen SING2018-014*, 31 May 2018, SING [SING0254018]), Mandai Quarry (*Duistermaat & Hillier 55*, 12 Mar 2002, L, SING [SING0059702]), Pulau Ubin (*Ali Ibrahim & Lioe SING2012-204*, 18 Apr 2012, SING [SING0174123]) and Sungei Buloh (*Duistermaat et al. 071*, 19 Mar 2002, K, SING [SING0059703]).

Ecology. In a wide variety of wetter places. It flowers rarely, but it is readily recognised by the long and rather stout stolons with patent-hairy nodes and sheaths. Ripe fruits not seen in Singapore.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Para grass* (English).



Figure 76. *Urochloa mutica* (Forssk.) T.Q.Nguyen. **A.** Plant with inflorescence. **B.** Detail of inflorescence. **C.** Detail of culm with node. (From Singapore, Kranji. Photos: P.K.F. Leong).

4. *Urochloa piligera* (F.Muell. ex Benth.) R.D.Webster

(Latin, *piligera* = bearing hairs)

Austral. Paniceae (Poaceae) (1987) 246; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 140, fig. 145. **Basionym:** *Panicum piligerum* F.Muell. ex Benth., Fl. Austral. 7 (1878) 477. **Synonyms:** *Brachiaria piligera* (F.Muell. ex Benth.) Hughes, Bull. Misc. Inform. Kew 1923 (1923) 315. – *Brachiaria subquadripara* (Trin.) Hitch. var. *piligera* (F.Muell. ex Benth.) Reeder, J. Arnold Arbor. 29 (1948) 273. **Type:** *Mueller s.n.*, Australia, Victoria River (lectotype K [K000958892], first step designated by Hughes, Bull. Misc. Inform. Kew 1923 (1923) 315, second step designated by Veldkamp, Blumea 41 (1996) 425; isolectotypes BRI (fragment), MEL). **Fig. 74D.**

Annual. **Culms** tufted, geniculate at base, rooting or not at the nodes, 0.2–0.7 m high; nodes glabrous to sparsely pilose. **Sheaths** glabrous or margins sparsely hirsute. **Ligule** hairs 0.4–1.65 mm long. **Leaf** blades linear, (5–)10.5–25 cm by 5–10 mm, base rounded, margins scaberulous, rarely pilose at base, glabrous below. **Inflorescence** peduncle glabrous below the inflorescence; common axis 2–19 cm long; racemes 2–5, erecto-patent, rachis of racemes narrowly ribbon-like, 0.75–1 mm wide, glabrous; lowermost ones simple, 2.5–5 cm long, spikelets dense to lax; upper ones distant; pedicels 0.3–0.9 mm long, glabrous. **Spikelets** solitary, ellipsoid, 3–3.75 mm long. **Glumes** remote, acute to obtuse; lower glumes 1.2–1.5 mm long, 0.37–0.47 times as long as the lower lemma, base amplexicaul, 7–11-nerved, with cross-veins; upper glumes 7-nerved, pilose, apical hairs longest. Lower **lemma** epaleate to paleate, bisexual (and fruiting!), back slightly sulcate, apex acute, 5-nerved, without cross-veins; palea 0–1 times as long; upper lemma 2.2–2.7 mm long, acutish, transversally rugulose, dull. **Anthers** 1.3–1.7 mm long.

Distribution. Eastern Malesia, Pacific islands and Australia. Naturalised in Singapore but infrequently collected, including from Bahtera Track (*Duistermaat 243*, 20 Dec 2003, K, L, SING [SING0059706]), Singapore Botanic Gardens (*Jumali 613*, 18 Dec 1961, SINU), Bukit Timah Road (*Wong s.n.*, Jul 1959, SINU), Jurong Road (*Wong s.n.*, 17 Jul 1959, SINU) and Sungei Buloh (*Duistermaat et al. 072*, 19 Mar 2002, K, L, SING [SING0059705]).

Ecology. Open sandy places near the sea, swampy areas, canal banks, roadsides etc.

Provisional conservation assessment. Globally Least Concern (LC). Not native in Singapore.

Vernacular name. *Wattle signal grass* (English).

5. *Urochloa subquadripara* (Trin.) R.D.Webster

(Latin, *sub-* = nearly, below, *-quadri-* = four, *-para* = generate;
referring to the more-or-less 4 racemes)

Austral. Paniceae (Poaceae) (1987) 252; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 187; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 140, fig. 146, pl. 39; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 89, 171, 273, as '*subquadrifida*'. **Basionym:** *Panicum subquadriparum* Trin.,

Gram. Panic. (1826) 145. **Synonyms:** *Brachiaria subquadripa* (Trin.) Hitchc., Lingnan Sci. J. 7 (1931) 214. – *Brachiaria subquadrifida* Hitchc. ex Stehl, Notul. Syst. (Paris) 13 (1947) 78, sphalm. **Type:** *Von Eschscholtz & De Chamisso s.n.*, Marianas, insula Guahan [Guam] (lectotype LE [Herb. Trinius 974.1], left-hand specimen, designated by Veldkamp, Blumea 41 (1996) 429). **Fig. 72C, 74E.**

Panicum miliiforme J.Presl in C.Presl, Reliq. Haenk. 1, fasc. 4–5 (1830) 300. **Synonyms:** *Brachiaria miliiformis* (J.Presl) Chase, Contr. U.S. Natl. Herb. 22 (1920) 35. – *Brachiaria subquadripa* (Trin.) Hitchc. var. *miliiformis* (J.Presl) S.L.Chen & Y.X.Jin, Acta Phytotax. Sin. 22 (1984) 472. **Type:** *Haenke s.n.*, Philippines, Luzon (lectotype MO [MO-157631], designated by Lamson-Scribner, Rep. (Annual) Missouri Bot. Gard. 10 (1899) 36, 47; isolectotypes HAL, PR [sheet nos. 194810A and B], US (fragment), W [×3]).

Brachiaria distachya auct. non (L.) Stapf: Ridley, Fl. Malay Penins. 5 (1925) 219; Henderson, Malay. Wild Fls., Monocot. (1954) 342, fig. 194h–m.; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 1 (1966) 359; Gilliland, Rev. Fl. Malaya 3 (1971) 176, fig. 36; Turner, Gard. Bull. Singapore 45 (1993) 93.

Panicum distachyum auct. non L.: Ridley, Mat. Fl. Malay. Penins. 3 (1907) 133.

Annual or perennial. **Culms** tufted, geniculate at base, rooting at the nodes, 0.25–0.9 m high, 1–2.25 mm wide at base, **nodes** glabrous to pilose. **Sheaths** glabrous and more or less hirsute on the margins. **Ligule** with 0.4–1 mm long hairs. **Leaf** blades ovate-linear-lanceolate to linear, 3–15(–27) cm by 3.5–12 mm, base rounded, margins scaberulous and margins pilose at base, glabrous below to sparsely pilose below. **Inflorescence** peduncle glabrous to pilose below the inflorescence; common axis 2.5–9(–22) cm long; racemes 3–6(–9), erecto-patent to reflexed, rachis narrowly ribbon-like, 0.6–1 mm wide, glabrous, scaberulous, axils usually glabrous, rarely puberulous; lowermost ones simple, 2–6.5 cm long, spikelets dense; upper ones distant; pedicels 0.4–0.75 mm long, glabrous, rarely pilose. **Spikelets** solitary, ellipsoid, base usually cuneate, exceptionally rounded, 3.2–4.35 mm long. **Glumes** remote; lower glumes 1.35–1.95 mm long, 0.38–0.5 times as long as the first lemma, base amplexicaul, apex erose, rounded, or acute, 5–7(–11)-nerved, with or without cross-veins; upper glumes at least as long as the second lemma, apex acute, 5–7-nerved, without cross-veins, glabrous, exceptionally puberulous. Lower **lemma** epaleate or paleate, usually sterile, rarely male, back slightly sulcate, apex acute, faintly 5-nerved, with or without cross-veins. **Palea** (when present) 0.67–0.8 times as long. Upper lemma 2.6–2.85 mm long, apex rounded, finely transversally rugulose, dull. **Anthers** 1.1–1.35 mm long.

Distribution. Kashmir to southern China, continental Southeast Asia and Malesia to Australia (Queensland) and the Pacific islands. Native in Singapore and widely and frequently collected, including from Bahtera Track (*Duistermaat* 258, 30 Dec 2003, SING [SING0059711]), Bukit Timah (*Ali Ibrahim & Chen AI* 235, 2 Sep 1994, SING [SING0201750]), Changi (*Ridley* 1755, 7 Oct 1890, SING [SING0201752]), Pulau Ubin (*Duistermaat* 125, 16 Mar 2003, SING [SING0059710]) and the Western Catchment (*Samsuri et al. WC* 29, 20 Apr 2004, SING [SING0054289]).

Ecology. Open wasteland, road sides, damp grassy fields, especially on sandy soils in light to moderate shade.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Arm grass millet, green summer grass, two-spiked panic grass* (English), *rumpu minyak* (Malay).

Notes. *Urochloa subquadripara* is here regarded as distinct from *Urochloa distachya* (L.) T.Q.Nguyen but has been synonymised by some authors, in which case *U. distachya* has priority. The observed variation might be linked to different chromosome numbers (Sosef, Pl. Ecol. Evol. 149 (2016) 360).

61. ZOYSIA Willd.

(Karl von Zois zu Laibach, 1756–1800,
amateur botanist and plant collector]

Neue Schriften Ges. Naturf. Freunde Berlin 3 (1801) 440, nom. cons.; Goudswaard, Blumea 26 (1980) 169; Kellogg in Kubitzki (ed.), Fam. Gen. Vasc. Pl. 13 (2015) 370. **Synonyms:** *Matrella* Pers., Syn. Pl. 1 (1805) 73, nom. illeg. superfl. – *Osterdamia* Neck. [Elem. Bot. 3 (1790) 218, opus rej.] ex Kuntze, Revis. Gen. Pl. 2 (1891) 781, nom. illeg. superfl. **Type:** *Zoysia pungens* Willd. (= *Zoysia matrella* (L.) Merr.).

Perennials. **Culms** mat-forming, stoloniferous, hollow. **Ligule** a dense row of hairs. **Leaf** blades inrolled when young, more or less distinctly pseudo-petiolate. **Racemes** spiciform, terminated by a spikelet, axis not breaking up; pedicels dorso-ventrally flattened, apex occasionally widened and with 1 or 2 persistent appendages. **Spikelets** solitary, quaquaversal, pedicelled, lateral to the rachis, 1-flowered, laterally flattened, deciduous as a whole. **Callus** oblique, glabrous. Lower **glume** usually absent, or much reduced, 0-nerved; upper glume enveloping the floret, (sub)apically shortly awned or mucicous, 1-nerved. **Rachilla** process absent. **Lemma** dorsally rounded, membranous, entire, mucronate, glabrous, 1-nerved. **Palea** absent. **Stamens** 3.

Distribution. A genus of approximately 10 species along the coasts of the Indian and western Pacific Ocean, some species widely cultivated inland. In Singapore 1 native species and 2 that are cultivated.

Taxonomy. The genus belongs to the *Chloridoideae* – *Zoysiinae* Benth.

Notes. The key below includes two cultivated species in italics that may escape but are not known to have done so yet.

Key to *Zoysia* species

1. Pedicels straight, 0–3.3 mm long, usually shorter than the spikelets; spikelets oblong to lanceolate, 3–4 times as long as wide 2

Pedicels more or less curved, up to 5 mm long, often longer than the spikelets; spikelets ovate-oblong, 2–2.5 times as long as wide. – Blades 2–4 mm wide (when expanded), usually patent; peduncle exerted from the uppermost sheath at anthesis, the raceme distinctly exerted above the foliage, 2–4 cm long, with many spikelets; anthers c. 1.5 mm long *Z. japonica*

2. Blades 1–2.8 mm wide (when expanded), usually erecto-patent to patent; peduncle exerted from the uppermost sheath at anthesis, the raceme distinctly exerted above the foliage, 1–4.2 cm long, with 10–20 spikelets; anthers 1–1.5 mm long **Z. matrella**
Blades 0.7–1 mm wide (when expanded), usually erect; peduncle, even in fruit, not or hardly exerted from the uppermost sheath, the raceme therefore not or little exerted above the foliage, 0.8–1.5 cm long, with 6–12 spikelets; anthers 0.6–0.8 mm long
..... *Z. pacifica*

***Zoysia matrella* (L.) Merr.**

(Latin, *matrella*, diminutive of *mater* = mother; not explained by Linnaeus)

Philipp. J. Sci., C 7 (1912) 230; Henderson, Malay. Wild Fls., Monocot. (1954) 318, fig. 183a–c; Burkill, Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 2350; Gilliland, Rev. Fl. Malaya 3 (1971) 109, t. 19, pl. 13d; Turner, Gard. Bull. Singapore 45 (1993) 103; Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 188, fig. 293; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 141, fig. 148; Chong et al., Checkl. Vasc. Pl. Fl. Singapore (2009) 92, 171, 231. **Basionym:** *Agrostis matrella* L., Mant. Pl. Altera (1771) 185. **Synonyms:** *Matrella juncea* Pers., Syn. Pl. 1 (1805) 73, p.p. – *Osterdamia matrella* (L.) Kuntze, Revis. Gen. Pl. 2 (1891) 781, nom. inval. – *Osterdamia zoysia* Honda, Bot. Mag. (Tokyo) 36 (1922) 113, nom. illeg. superfl. [incl. var. *typica* Honda, nom. inval.]. – *Zoysia matrella* (L.) Merr. var. *typica* Sasaki, List. Pl. Formosa (1928) 80, nom. inval. **Type:** *König* 56, [Sri Lanka] (lectotype LINN [Herb. Linn. no. 84.11], designated by Goudswaard, Blumea 26 (1980) 171; possible isolectotypes L [L0050867], LE [Herb. Trinius 396.1]). **Fig. 73E, 77.**

Zoysia pungens Willd., Neue Schriften Ges. Naturf. Freunde Berlin 3 (1801) 441; Ridley, J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; Ridley, Mat. Fl. Malay. Penins. 3 (1907) 149. **Type:** *Klein* 3671, ‘India orientalis’ (lectotype B-W [B-W01514010], designated by Goudswaard, Blumea 26 (1980) 171; isolectotypes LE [Herb. Trinius 396.1, 4 excl. upper left], S [S-6-6510], US (fragment)).

Zoysia malaccensis Gand., Bull. Soc. Bot. France 64 (1920 [‘1919’]) 303. **Type:** *Ridley s.n.*, Singapore (lectotype US [US00141793], designated by Turner et al., Gard. Bull. Singapore 71 (2019) 42; isolectotype LY).

Stolons up to 45 cm long. **Cataphylls** opposite, up to 1.3 cm long. **Culms** up to 0.4 m high. **Sheath** with up to 5 mm long hairs in the throat. **Ligule** 0.2–0.25 mm long. **Leaf** blades erecto-patent to patent, flat or involute, 1.3–9 cm by 1–2.5(–2.8) mm (when expanded), base more or less cordately contracted into a up to 1.2 mm long pseudopetiole. **Racemes** exerted beyond the foliage at anthesis, 1–4.2 cm long, rachis sometimes wavy; pedicels 0–3.3 mm long, apex broadened, occasionally with up to 1 mm long, obtuse to acute scales. **Spikelets** 10–20, ovate-oblong to lanceolate, 2–3.8 × 0.6–1 mm. Lower **glume** usually absent; upper glume with the margins revolutely appressed, equally wide, the outer one smooth at base,



Figure 77. *Zoysia matrella* (L.) Merr. **A.** Habit. **B.** Inflorescence. (From Singapore, Bishan Park, *Chen SING2017-718*. Photos: L.M.J. Chen).

sometimes rough below the apex, not enveloping the inner one, midrib distinct; awn absent or (sub)apical, straight to geniculate, 0–1.3 mm long, smooth. **Lemma** oblong, up 2–2.5 mm long, acute, midrib sometimes excurrent, glabrous. **Anthers** 1–1.5 mm long.

Distribution. Coasts around the Indian Ocean and the South China Sea to the Ryukyu Islands, through continental Southeast Asia and Malesia. Native in Singapore and widely and frequently collected, including from Balestier Plain (*Ridley s.n.*, 1894, SING [SING0201765]), the Central Catchment (*Duistermaat 107*, 9 Aug 2002, SING [SING0059714]), Pulau Seletar (*Loo et al. PS 53*, 10 Sep 1998, SINU), Pulau Ubin (*Lai & Lioe SING2013-216*, 27 Sep 2013, SING [SING0202319]) and Sungei Buloh (*Chua & Wee 540*, 23 May 1991, SINU).

Ecology. Sandy beaches on the landward side, dry salt-marsh pastures, lawns, roadsides and other disturbed areas.

Provisional conservation assessment. Globally Least Concern (LC). In Singapore also Least Concern (LC).

Vernacular names. *Siglap grass* (English), *rumpit zoysia* (Malay).

Excluded species

Cymbopogon calcicola C.E.Hubb., **Cymbopogon citratus** (DC.) Stapf, **Cymbopogon flexuosus** (Nees ex Steud.) Will. Watson, **Cymbopogon martini** (Roxb.) Will. Watson and **Cymbopogon nardus** (L.) Rendle have all been recorded as being in cultivation in Singapore in several publications. There is no evidence that any have become naturalised or casual but they may be long lived and found as remnants from long-since abandoned cultivation (Fig. 16D–G).

Centotheca longilamina Ohwi was first reported for Singapore by Gilliland (Rev. Fl. Malaya 3 (1971) 53) and followed by others, but no material has been found.

Chrysopogon zizanioides (L.) Roberty has been recorded only in cultivation in Singapore (*Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 42*) and there is no evidence that it has become naturalised or casual.

Cyrtococcum oxyphyllum (Hochst. ex Steud.) Stapf was reported for Singapore by Ridley (J. Straits Branch Roy. Asiat. Soc. 33 (1900) 185; *Mat. Fl. Malay. Penins.* 3 (1907) 141, both under the synonym *Panicum pilipes* Nees & Arn. ex Buse) and Keng et al. (*Concise Fl. Singapore*, vol. 2, Monocot. (1998) 161) but no material has been found.

Dichanthium mucronulatum Jansen was recorded once in the nineteenth century from within Singapore Botanic Gardens as a casual. As it has not been recorded again and its status within SBG is uncertain, it is excluded from the account.

Eleusine coracana (L.) Gaertn. is currently only known from old records of plants in cultivation in Singapore but is known to naturalise elsewhere. It is included in the genus key in italics but not otherwise discussed.

Eremochloa ciliaris (L.) Merr. was mistakenly included as occurring in Singapore by Buitenhuis & Veldkamp (Blumea 46 (2001) 407).

Microstegium fasciculatum (L.) Henrard was reported for Singapore by Chen et al. (Blumea 57(2) (2012) 160) but no material has been found.

Miscanthus fuscus (Roxb.) Benth. was reported for Singapore in an unpublished manuscript by Jansen but no specimens have been found and if it ever was in Singapore it was likely only as a cultivated plant.

Oryza rufipogon Griff. was reported for Singapore by Duistermaat (Blumea 32 (1987) 171) but no material has been found.

Paspalum dilatatum Poir. was listed as introduced in Singapore by Burkill (Dict. Econ. Prod. Malay Penins., ed. 2, 2 (1966) 1702), Gilliland (Rev. Fl. Malaya 3 (1971) 183) and Keng et al. (Concise Fl. Singapore, vol. 2, Monocot. (1998) 176) but there is no material from Singapore in K, SING or SINU.

Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. has been collected from cultivation in Singapore and is known to escape elsewhere but there is no evidence that it has in Singapore.

Sorghum bicolor (L.) Moench has been recorded only in cultivation in Singapore (Keng et al., Concise Fl. Singapore, vol. 2, Monocot. (1998) 183; Duistermaat, Gard. Bull. Singapore 57, Suppl. (2005) 127, fig. 130) and there is no evidence that it has become naturalised or casual.

Tripsacum dactyloides (L.) L. was listed as naturalised in Singapore by Turner (Gard. Bull. Singapore 45 (1993) 103) but Keng (Concise Fl. Singapore, vol. 2, Monocot. (1998) 186) reported that it was only in cultivation in Singapore, a view shared by Duistermaat (Gard. Bull. Singapore 57, Suppl. (2005) 136, fig. 142) who stated that it had only been grown in the 1960's in the Botanic Gardens and was last recorded in 1969.

Zea mays L. has been recorded for Singapore by several authors but all of the material collected in Singapore is from cultivated plants and there is no evidence that it has ever escaped (Fig. 73C).

Zizania latifolia (Griseb.) Hance ex F.Muell. has been recorded for Singapore by several authors but all of the material collected in Singapore is likely to be from formerly cultivated plants, rather than escaped ones (Fig. 73D).

Zoysia japonica Steud. was collected only once at Kranji turf nursery and seems to have never escaped.

