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Seed Identification of Eight Urochloa (= *Brachiaria*) Species (Cultivated or Weed)

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Myriam Alvisi

INTRODUCTION

Identification of seeds concerns the various agricultural activities such as seed trade and processing, herbicide production and especially the routine work of a Seed Testing Laboratory.

The seeds of different species can be carried long distances by natural dispersal means (anemochory, explosive fruit dehiscence, in birds' digestive tracts or by attaching to animal hairs), but most species are dispersed by man.

The definition of a 'seed' used in this guide is: the true seed and the dispersal units, such as fruits (caryopses, achenes), spikelets and a fertile floret.

A morphological description accompanied by drawings of the 'seeds' is a great help in the identification of botanical species. Safer and faster identification is carried out when the seed found is compared with a true sample; thus, it is very important to have a certified seed collection. Photos, drawings and dichotomous keys also aid seed identification, helping to separate species of the same genus, separate genera and/or separate species of the same botanical family or from different families.

The description of the 'seeds' for this guide was carried out with well- developed dispersal units, using a stereomicroscope (with magnification of 10, 30, 40 and 45×), taking into account the external morphology, described by Groth (1980, 1984a,b), Groth and Jamardo (1983), Groth *et al*. (1979, 1980, 1983), Groth and Liberal (1988) and Koehn (1977). The terminology used to describe the fruits, seeds and the embryo was based on the work of Barroso (1978), Barroso *et al*. (1999) and Martin (1946).

For the descriptions of external morphology, the following features were observed: the shape, size (longitudinal and transverse axes), the colour and markings of the surface, the hilum location and shape of hilum, funiculus, wing, pappus, spines, awns and the presence or absence of hairs. For the descriptions of internal morphology, all the 'seeds' were boiled (for rehydration and the duration was related to the resistance of the pericarp and/or seed coat) to verify: the layers and texture of the pericarp and integument; texture and type of endosperm and perisperm; embryo (hypocotyl–radicle axis and cotyledons) and its size (total and each of its parts), position (peripheral or axial) and texture (Groth, 1980).

The dispersal units were drawn under the stereoscopic microscope and all drawings are accompanied by a vertical bar indicating the scale used and by relation to actual size.

UROCHLOA P.BEAUV.

(= *Brachiaria* (Trin.) Griseb.)
(Figures 1–4)

COMMON NAMES – [English] African signal grass, Alexander grass, Angola grass, bread grass, Congo grass, Koronivia grass, palisade grass, ruzi grass, signal grass, Scottish grass, Surinam grass, tanner grass; [Brazil] braquiária, braquiária-caída, braquiária-decumbens, braquiária-dictioneura, capim-agulha, braquiária-ruziziensis, braquiária-passo-a-passo, braquiarão, brizantão, capim-braquiária, capim-decumbens, capim-de-São-Paulo, capim-doce, capim-guatemala, capim-itapoã, capim-marandú, capim-marmelada, capim- mimoso, capim-papuã, grama-paulista, kikuiu-da-amazônia, marmelada, papuã, quicuio-da-amazônia.

SPIKELETS – two-flowered, ovate to oblong, more or less plano-convex or biconvex (thickest near the middle point, with dorsal side more or less arched and ventral side more or less flat), with articulation below the glumes and falling entirely at maturity; with two papyraceous and unequal glumes (in form and size); first or lower glume (**fgl**) turned towards the rachis and usually shorter than or rarely as long as the spikelet; second or upper glume (**sgl**) more or less equal to the sterile lemma, 5–7(–9)-nerved and relatively close; rachis between the first and second glume; basal floret sterile or male, membranaceous, with sterile lemma (**sl**) 5–9(–11)-nerved and the lateral nerves slightly further away from the middle nerve; sterile palea (**sp**) hyaline, 2-nerved, as long as the lemma, or sometimes reduced or rudimentary; upper floret fertile, crustaceous and plano-convex; fertile lemma (**fl**) inconspicuously 5-nerved, usually papillose- rugose or striate, apex inconspicuously apiculate or mucronate, with rupture line conspicuous and areole (**are**) depressed, more or less smooth, horseshoe-shaped near the base; fertile palea (**fp**) as long as the fertile lemma, with two conspicuous thickened keels, marginal sides smooth and shiny, finer in texture and convexly curved over the caryopsis.

CARYOPSES – flattened, ovate to rounded in outline; hilar macula (**mh**) sub- basal/ventral, generally point-like, sometimes oblong to obovate; embryo area ovate, sub-basal/dorsal and about ½ to ¾ the length of the caryopsis and with basal radicle, which generally extends beyond the caryopsis; pericarp (**per**) thin, smooth, slightly glossy and with thin longitudinal reticulation (45×); integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, annuals or perennials, erect, decumbent, spreading or stoloniferous grasses, subprostrate, fodder grasses or weeds; native in tropical Africa; some species introduced in Brazil as fodder grass for the formation of artificial pastures and others are weeds.

The seed unit is the spikelet, rarely **the fertile floret** or **caryopsis**.

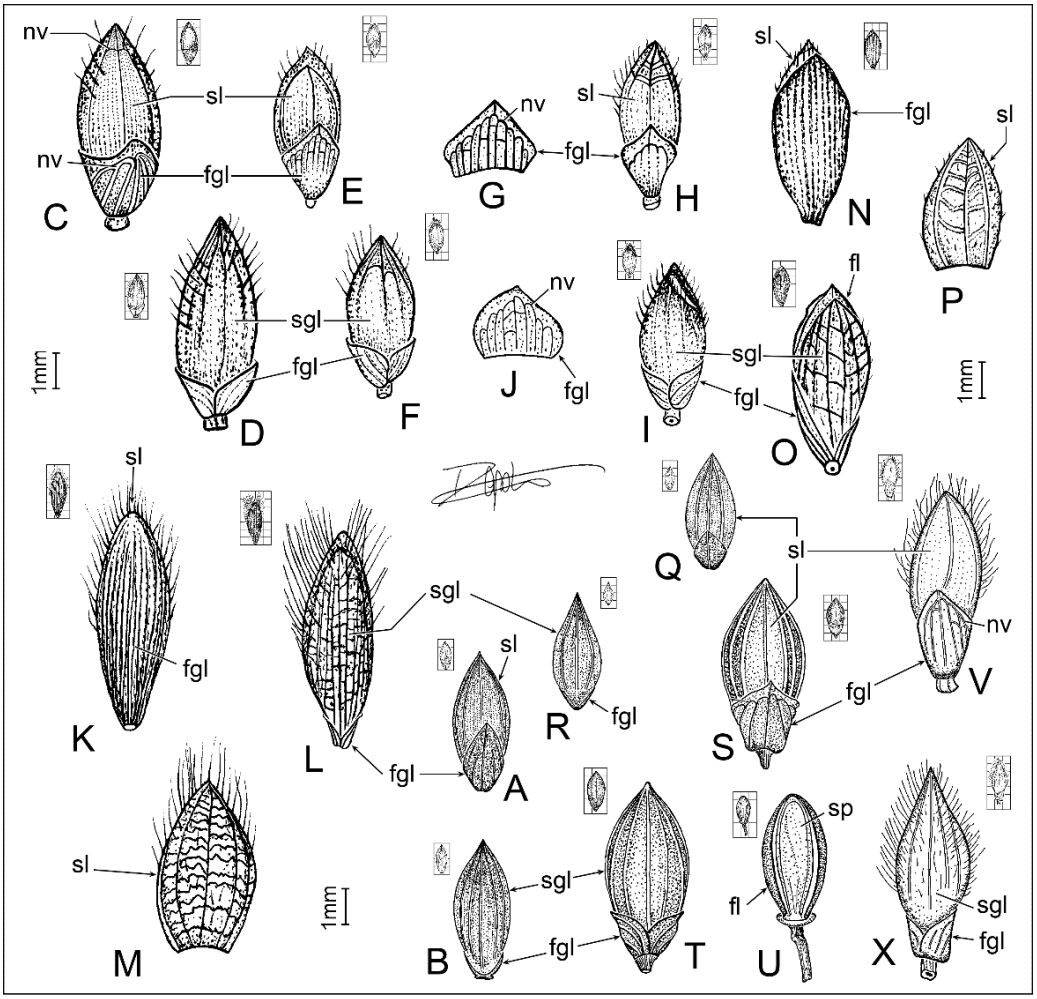

Fig. 1. *Urochloa* spp. spikelets (accompanied by actual size images): *U. arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga (A,B); *U. brizantha* (Hochst. ex A.Rich.) R.D.Webster (C,D); *U. decumbens* (Stapf) R.D.Webster (E–J); *U. dictyoneura* (Fig. & De Not.) Veldkamp (K–M); *U. humidicola* (Rendle) Morrone & Zuloaga (N–P); *U. mutica* (Forssk.) T.Q.Nguyen (Q,R); *U. plantaginea* (Link) R.D.Webster (S–U); *U. ruziziensis* (R.Germ. & C.M.Evrard) Crins (V,X). A,C,E,H,K,N,Q,U,S,V – ventral side; B,D,F,I,L,O,R,T,X – dorsal side.

Abbreviations: fgl – first or lower glume (G–J); sl – sterile or estaminated lemma (P–M); fl – fertile lemma; nv – anastomosing nerve ends; sgl – second or upper glume; sp – sterile palea

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

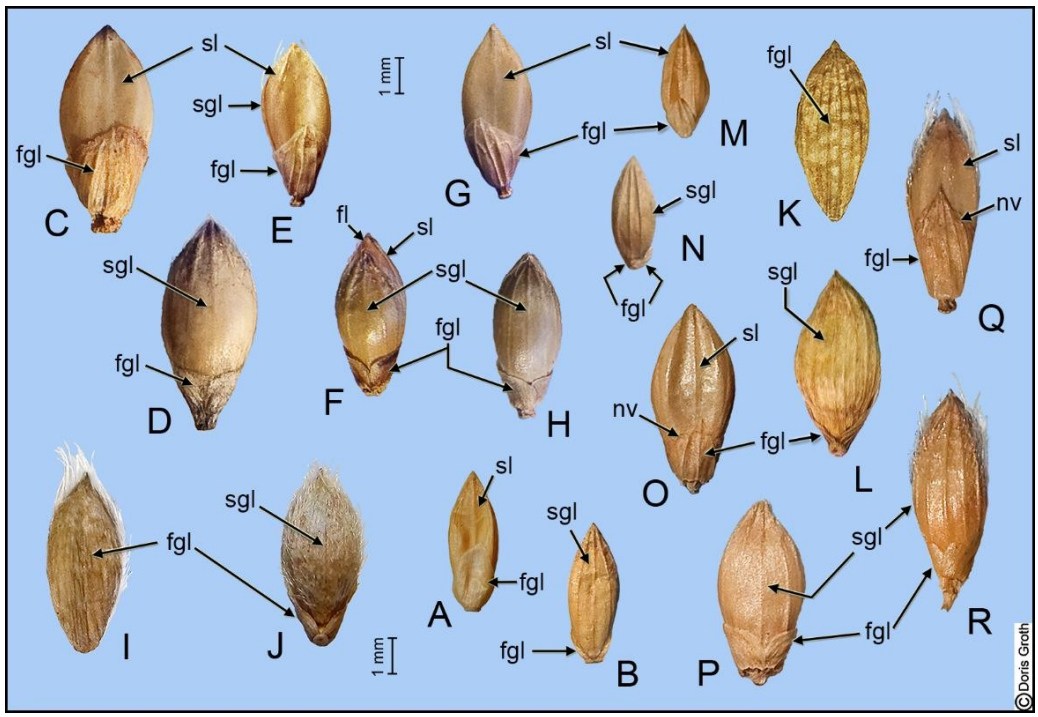

Fig. 2. *Urochloa* spp. spikelets: *U. arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga (A,B); *U. brizantha* (Hochst. ex A.Rich.) R.D.Webster (C,D); *U. decumbens* (Stapf) R.D.Webster (E–H); *U. dictyoneura* (Fig. & De Not.) Veldkamp (I,J); *U. humidicola* (Rendle) Morrone & Zuloaga (K,L); *U. mutica* (Forssk.) T.Q.Nguyen (M,N); *U. plantaginea* (Link) R.D.Webster (O,P); *U. ruziziensis* (R.Germ. & C.M.Evrard) Crins (Q,R). A,C,E,G,I,K,M,O,Q

– ventral side; B-D-F-H-J-L-N-P-R – dorsal side.

Abbreviations: fgl – first or lower glume; fl – fertile lemma; nv – anastomosing nerve ends ; sgl – second or upper glume; sl – sterile or estaminated lemma

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

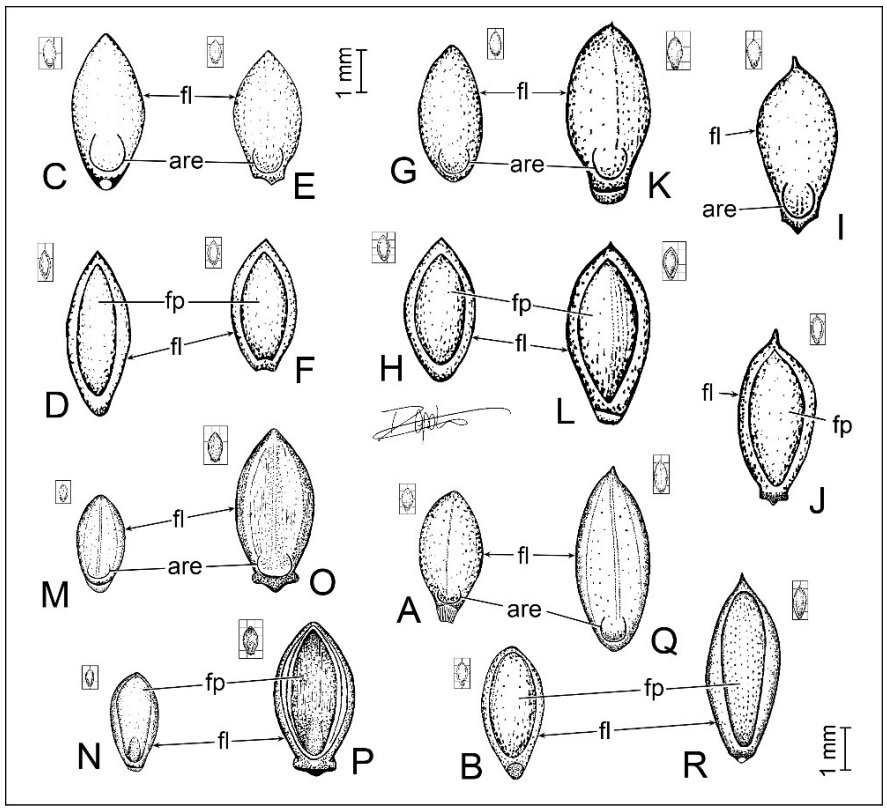

Fig. 3. *Urochloa* spp. fertile florets (accompanied by actual size images): *U. arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga (A,B); *U. brizantha* (Hochst. ex A.Rich.) R.D.Webster (C,D); *U. decumbens* (Stapf) R.D.Webster (E–H); *U. dictyoneura* (Fig. & De Not.) Veldkamp (I,J); *U. humidicola* (Rendle) Morrone & Zuloaga (K,L); *U. mutica* (Forssk.) T.Q.Nguyen (M,N); *U. plantaginea* (Link) R.D.Webster (O,P); *U. ruziziensis* (R.Germ. & C.M.Evrard) Crins (Q,R). A,C,E,G,I,K,M,O,Q – dorsal side; B-D-F-H-J-L-N-P-R – ventral side.

Abbreviations: are – areole; fl – fertile lemma; fp – fertile palea

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

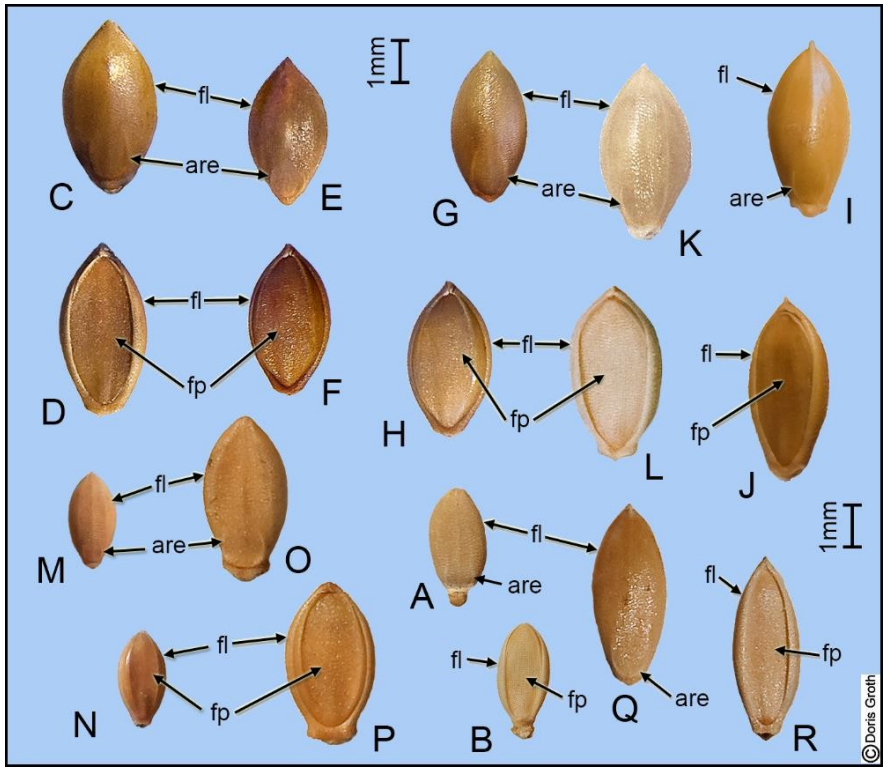

Fig. 4. *Urochloa* spp. fertile florets: *U. arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga (A,B); *U. brizantha* (Hochst. ex A.Rich.) R.D.Webster (C,D); *U. decumbens* (Stapf) R.D.Webster (E–H); *U. dictyoneura* (Fig. & De Not.) Veldkamp (I,J); *U. humidicola* (Rendle) Morrone & Zuloaga (K,L); *U. mutica* (Forssk.) T.Q.Nguyen (M,N); *U. plantaginea* (Link) R.D.Webster (O,P); *U. ruziziensis* (R.Germ. & C.M.Evrard) Crins (Q,R). A,C,E,G,I,K,M,O,Q

– dorsal side; B,D,F,H,J,L,N,P,R – ventral side.

Abbreviations: are – areole; fl – fertile lemma; fp – fertile palea

DIFFERENTIATING CHARACTERISTICS OF SOME SPECIES OF UROCHLOA

UROCHLOA ARRECTA
(Hack. ex T.Durand & Schinz) Morrone & Zuloaga

(= *Brachiaria arrecta* (Hack. ex T.Durand & Schinz) Stent; *Brachiaria latifolia* Stapf; *Brachiaria radicans* Napper; *Panicum arrectum* Hack. ex T.Durand & Schinz)
(Figures 5–7)

COMMON NAMES – [English] African signal grass, tanner grass.

SPIKELETS – two-flowered, ovoid-ellipsoid, apiculate, plano-convex, 3.5–4.0(–4.4) mm long, (1.5–)2.0–2.2(–2.6) mm wide and 0.6–0.8(–1.0) mm thick, glabrous, coloured from dark purple to green; 2-seriate and arranged in two rows on each side of the midrib of the rachis; first or lower glume (**fgl**) broadly lanceolate, more than ⅓ the length of the spikelet, not clasping the base of the spikelet, 3–5-nerved (not so evident) and with some anastomosing nerve ends (**nv** – joined) at the apex; second glume (**sgl**) ovate, apex acuminate, glabrous, 5–7-nerved and with some cross-veins near the apex; basal floret sterile or male with sterile lemma (**sl**) very similar to the second glume in shape, size, texture and colour; sterile palea (**sp**) long-acuminate, hyaline and as long as the sterile lemma; upper floret fertile, crustaceous, ovate-elliptic, straw coloured or dark yellowish and (2.2–)2.6–3.1(–3.5) mm long, 1.7 mm wide and 0.4–0.6 mm thick; fertile lemma (**fl**) ovate-elliptic, finely transversely rugose (45×), with conspicuous rupture line and areole (are) rounded, less rugose than the rest of the lemma and depressed near the base; fertile palea (**fp**) flat, slightly shorter, similar to the fertile lemma in texture and colour, with two distinctly thickened keels (more conspicuous at the apex to about ½ of the length and becoming more inconspicuous at the base), with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – not examined.

SPECIES – herbaceous, perennial, stoloniferous, toxic to mammals, fodder grass, with reproduction by ‘seeds’ and vegetatively through stolons. Grown as forage in Trinidad, Tobago, Venezuela, Brazil and Colombia; native in tropical Africa; naturalized in Brazil where it was introduced as fodder grass and occurs as an aggressive weed in humid, swampy areas and in irrigated rice culture. Found in the Brazilian states of São Paulo, Paraná, Mato Grosso and along the east coast (Kissmann and Groth, 1997).

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

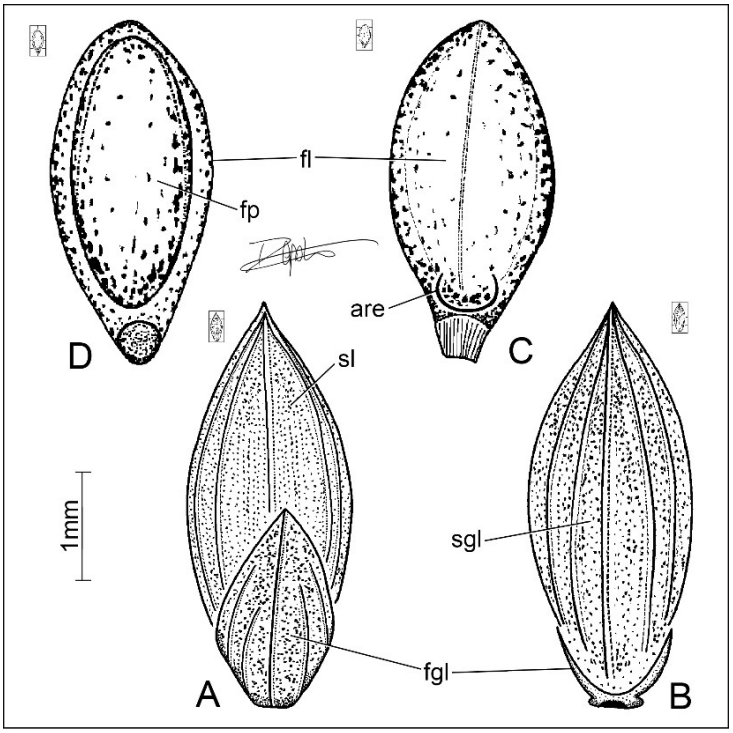

Fig. 5. *Urochloa arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga – spikelets (accompanied by actual size images): A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets (accompanied by actual size images): C – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D – ventral side with central *fertile palea* (fp), enveloped at the margin by the *fertile lemma* (fl).

Fig. 6. *Urochloa arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga – spikelets in dorsal and ventral views.

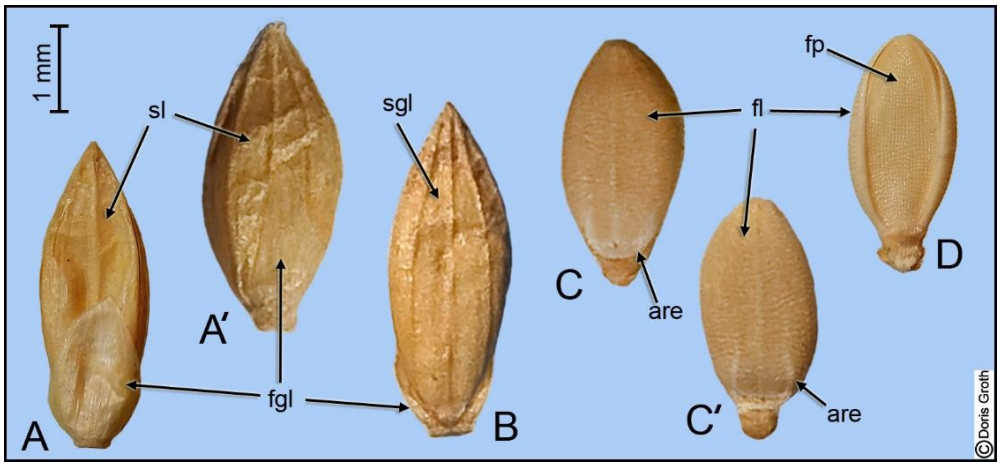

Fig. 7. *Urochloa arrecta* (Hack. ex T.Durand & Schinz) Morrone & Zuloaga – spikelets: A,A'

– ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets: C,C' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin.

UROCHLOA BRIZANTHA
(Hochst. ex A.Rich.) R.D.Webster

(= *Brachiaria brizantha* (Hochst. ex A.Rich.) Stapf; *Panicum brizanthum* Hochst. ex A.Rich)
(Figures 8–10)

COMMON NAMES – [English] bread grass, palisade grass, palisade signal grass, signal grass; [Brazil] braquiária, braquiarão, brizantão, capim-braquiária, capim-marandú; [German] Palisadengras.

SPIKELETS – two-flowered, oblong or ellipsoid-oblong, (4.0–)4.7–5.8(–6.0) mm long, 2.0–2.5(–2.8) mm wide and 1.1–1.9 mm thick (measures vary with cultivar), apex slightly obtuse or subacute, surface glabrous or sparsely pilose at the apex, straw coloured and often with purple tips or pigmented with purple, base attenuate and with a thick and conspicuous pedicel; first or lower glume (**fgl**) broadly ovate, more than ⅓ to ½ the length of the spikelet, clasping the base of the spikelet, 7–11-nerved, glabrous, sometimes with anastomosing nerve ends (**nv** – joined); second glume (**sgl**) ovate, a little shorter than the sterile lemma, apex sparsely pilose or glabrous, 7-nerved and with some cross-nerves, more or less inconspicuous near the apex; basal floret sterile or staminate; sterile lemma (**sl**) similar to the second glume, flattened on the back, apex short curved, glabrous or hairy, 5-nerved and some cross-veins near the apex; upper floret fertile, oblong or elliptic-oblong, crustaceous, plano-convex, straw coloured, 4.2–5.8 mm long, 1.5–2.3 mm wide and 0.8–1.3(–1.6) mm thick (measures vary with cultivar); fertile lemma (**fl**) elliptic-ovate, finely striate lengthwise, with short and incurved obtuse apex, rupture line conspicuous and areole (**are**) rounded, depressed near the base and up to ⅓ of the lemma length; fertile palea (**fp**) slightly shorter than the lemma, almost flat to slightly convex near the base, sometimes with a mild elongated swelling, 2-keeled (in some cultivars most conspicuous from the apex to about ½ of the length and becoming inconspicuous at the base), with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – ovoid or obovoid; in outline ovate or obovate; 2.8–4.9(–5.0) mm long, 1.0–1.9(–2.0) mm wide and 0.6–1.0 mm thick (measures vary with cultivar); hilar macula (**mh**) sub-basal/ventral, point-like, dark brown and about 1/6 the length of the caryopsis; embryo area dorsal/basal and ¾ the length of the caryopsis; pericarp (**per**) thin and straw coloured; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, perennial, fodder grass, with reproduction by ‘seeds’; native in tropical Africa; introduced in Brazil as a fodder grass for the formation of artificial pastures, with many selected and improved cultivars, such as ‘marandu’, which is resistant to trampling, more tolerant to cold and dryness and is a weed in cacao and rubber tree plantations in the Brazilian states of Bahia and Espirito Santo (Kissmann and Groth, 1997).

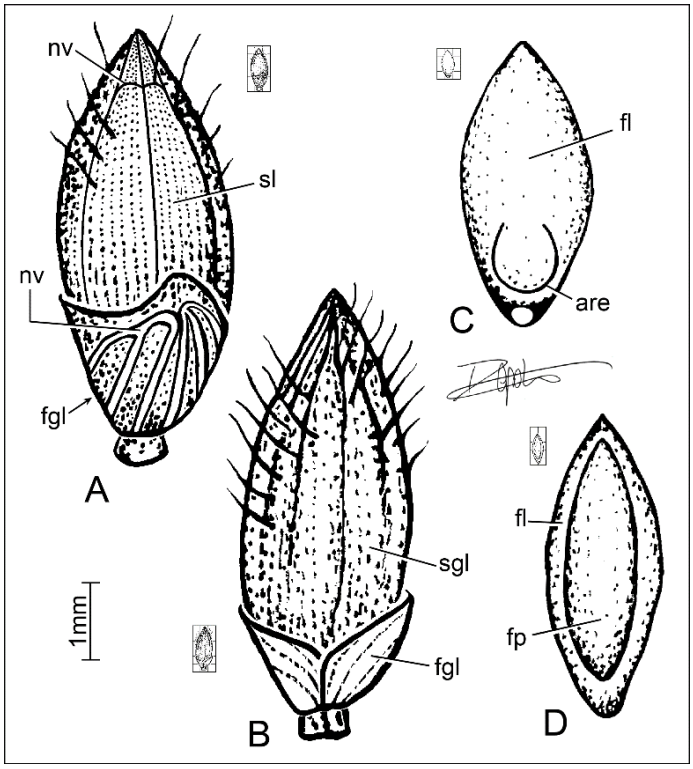

Fig. 8. *Urochloa brizantha* (Hochst. ex A.Rich.) R.D.Webster – spikelets (accompanied by actual size images): A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets (accompanied by actual size images): C – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D – ventral side with *fertile palea* (fp) in the middle and enveloped at the margin by the *fertile lemma* (fl).

Abbreviations: nv – anastomosing nerve ends

Fig. 9. *Urochloa brizantha* (Hochst. ex A.Rich.) R.D.Webster – spikelets, fertile florets and caryopses in dorsal and ventral views.

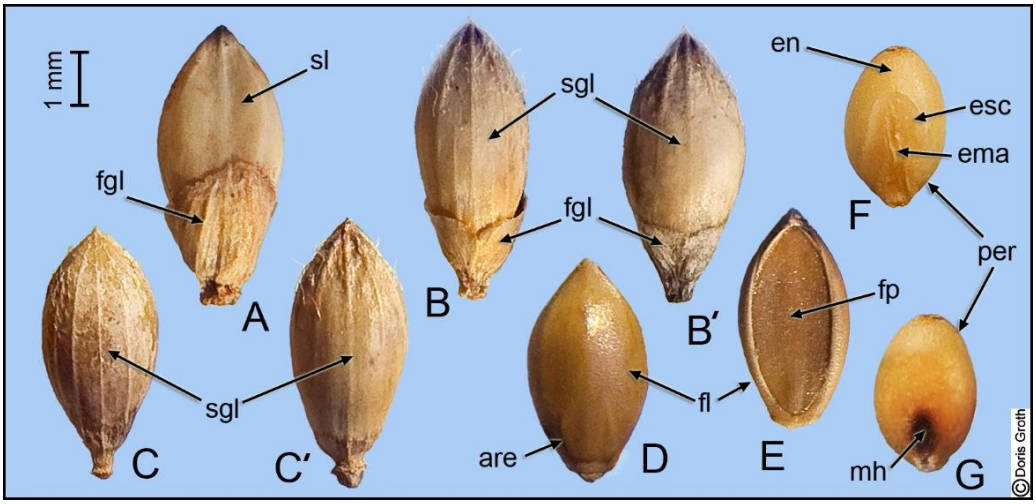

Fig. 10. *Urochloa brizantha* (Hochst. ex A.Rich.) R.D.Webster – spikelets: A – dorsal side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B,B' – ventral side with basal *first glume* (fgl) and *second glume* (sgl) above; C,C' – ventral side with *second glume* (sgl). Fertile florets: D – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; E – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin. Caryopses: F – dorsal side with *embryo area* (esc – scutellum; ema – hypocotyl–radicle axis); G – ventral side with sub-basal *hilar macula* (mh).

Abbreviations: en – endosperm; per – pericarp

UROCHLOA DECUMBENS
(Stapf) R.D.Webster
(= *Brachiaria decumbens* Stapf)
(Figures 11–13)

COMMON NAMES – [English] Basilisk signal grass, signal grass, Surinam grass; [Brazil] braquiária-caída, braquiária-decumbens, capim-decumbens, digitária- decumbens; [German] Surinamgras; [Spanish] zacate-Suriname, pasto- chontalpo, pasto-de-la-palizada, pasto-de-las-orillas, pasto-peludo, pasto- prodigio, zacate-prodigio.

SPIKELETS – two-flowered, obovate-ellipsoid, acuminate, sparsely pilose at the apex, 4.0–5.0(–5.1) mm long, 1.6–2.0 mm wide and 0.9–1.1mm thick; first or lower glume (**fgl**) broadly ovate, apex acute, glabrous, clasping the base of the spikelet, more than ⅓ to ½ the length of the spikelet, 9–11-nerved, sometimes with anastomosing nerve ends (**nv** – joined) and some cross-veins near the apex; second glume (**sgl**) ovate, slightly shorter than the sterile lemma, glabrous or sparsely pilose at the apex, 7-nerved and some cross- veins near the apex; basal floret sterile or staminate; sterile lemma (**sl**) similar to the second glume, as long as the spikelet, with a few hairs or glabrous, 5- nerved and with some anastomosing cross-veins; sterile palea (**sp**) hyaline, as long as the sterile lemma; upper floret fertile, ovate, crustaceous, plano- convex, light yellow, (3.0–)3.9–4.0 mm long, 1.6–2.0(–2.1) mm wide and 0.5–1.1 mm thick; fertile lemma (**fl**) ovate, acuminate, finely striate lengthwise, rupture line conspicuous and areole (are) rounded, depressed near the base and up to ¼ the length of the lemma; fertile palea (**fp**) flat, 2-keeled (more conspicuous from the apex to about ½ of the length and becoming inconspicuous at the base), with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – ovoid or obovoid; in outline ovate or obovate; 2.9–3.0(–3.3) mm long, 1.7–1.9 mm wide and 0.9 mm thick; hilar macula (**mh**) sub-basal/ventral, oblong, brown in colour and about ⅓ the length of the caryopsis; embryo area dorsal/basal and ¾ the length of the caryopsis; pericarp (**per**) thin and straw coloured; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, perennial, erect or decumbent, fodder grass, with reproduction by ‘seeds’ and vegetatively; native in tropical Africa; introduced in Brazil as fodder grass for the formation of artificial pastures; resistant to intensive grazing and trampling.

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

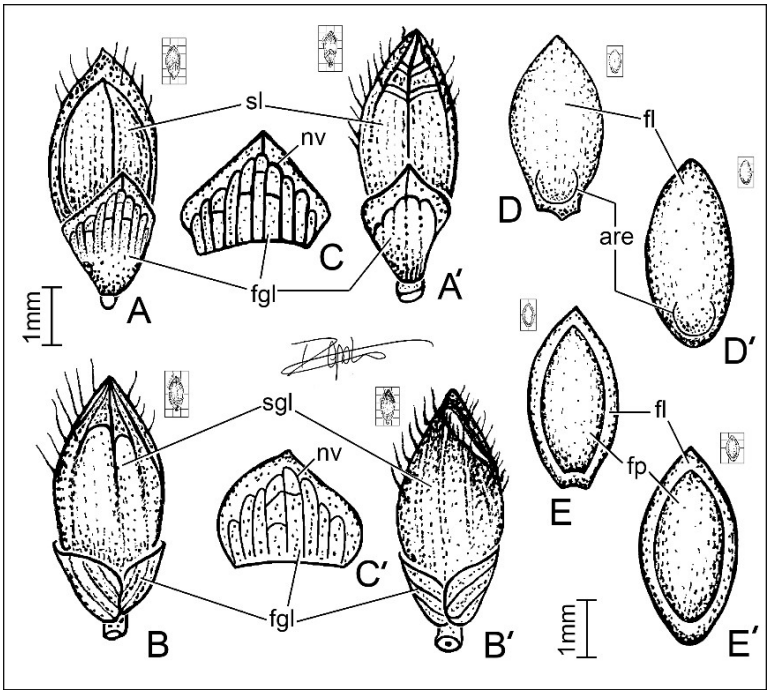

Fig. 11. *Urochloa decumbens* (Stapf) R.D.Webster – spikelets (accompanied by actual size images): A,A' – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B,B'

– dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above; C,C' – *first glume* (fgl). Fertile florets (accompanied by actual size images): D,D' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; E,E' – ventral side with *fertile palea* (fp) in the middle and enveloped at the margin by the *fertile lemma* (fl).

Abbreviations: nv – anastomosing nerve ends

Fig. 12. *Urochloa decumbens* (Stapf) R.D.Webster – spikelets, fertile florets and caryopses in dorsal and ventral views.

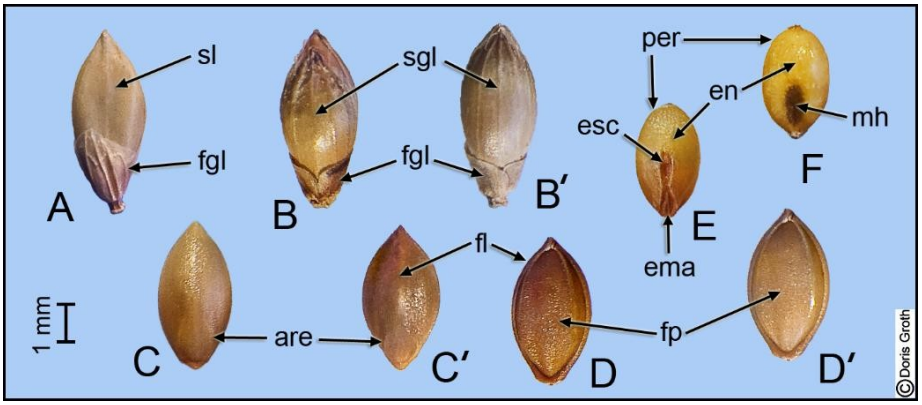

Fig. 13. *Urochloa decumbens* (Stapf) R.D.Webster – spikelets: A – dorsal side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B,B' – ventral side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets: C,C' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D,D' – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin. Caryopses: E – dorsal side with *embryo area* (esc – scutellum; ema – hypocotyl–radicle axis); F – ventral side with sub- basal *hilar macula* (mh).

Abbreviations: en – endosperm; per – pericarp

UROCHLOA DICTYONEURA
(Fig. & De Not.) Veldkamp
(= *Brachiaria dictyoneura* (Fig. & De Not.) Stapf)
(Figures14–15)

COMMON NAMES – [English] Koronivia grass; [Brazil] braquiária-dictioneura.

SPIKELETS – two-flowered, obovoid or broadly oblong, apex obtuse, (5–)6–7 mm long and about (2.1–)2.4–2.5 mm wide; first or lower glume (**fgl**) broadly oblong, membranaceous, glabrous, dull, plicate, as long as the spikelet, with the margins joined at the base of the spikelet, 9–11-nerved, usually purplish- black or green or straw-yellow in colour and finely reticulated toward the apex; second glume (**sgl**) oblong, less broad than the lower glume, membranaceous, light green to straw-yellow in colour, pilose (with long white hairs, adpressed and longer in the upper portion), 7–9-nerved longitudinally and with dense anastomosing cross-veins (**nv** – joined); basal floret sterile or staminate; sterile lemma (**sl**) basal, broadly ovate, 5-nerved, similar to the second glume in texture, colour and hairiness, nearly glabrous in the centre, with dense and long anastomosing cross-veins; sterile palea (**sp**) hyaline, broadly elliptic, as long as the sterile lemma; upper floret fertile, crustaceous, plano-convex, dark straw coloured or yellow, (3–)4–5 mm long and (1.6–)1.9–2.1 mm wide, much shorter than the glumes and the sterile lemma; fertile lemma (**fl**) obovatemucronate, finely transversely rugose, with rupture line conspicuous and areole (**are**) rounded and depressed near the base; fertile palea (**fp**) slightly convex on the back, slightly shorter than the fertile lemma, with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – ovoid; in outline ovate; hilar macula (**mh**) sub-basal/ventral and point- like; embryo area dorsal/basal and about ¾ the length of the caryopsis; pericarp (per) thin and straw coloured; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, perennial, fodder grass, with reproduction by ‘seeds’; native in tropical Africa; introduced in Brazil as fodder grass for the formation of artificial pastures.

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

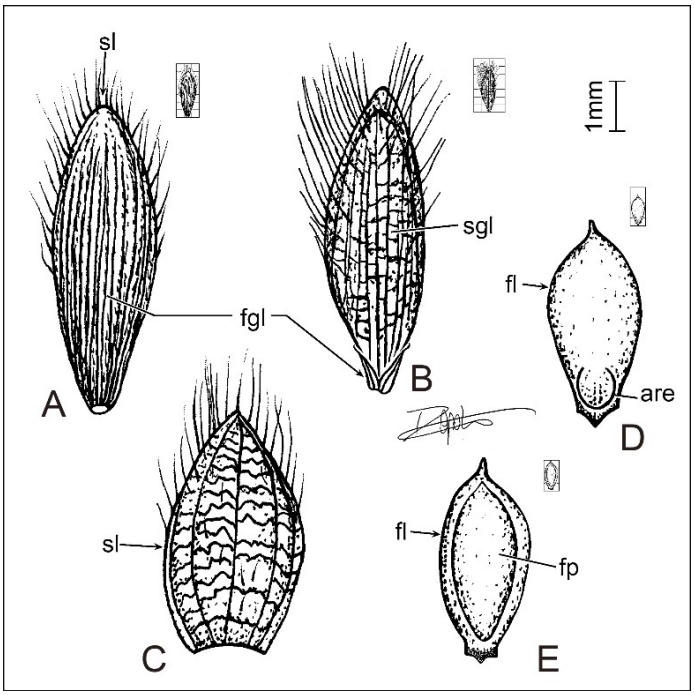

Fig. 14. *Urochloa dictyoneura* (Fig. & De Not.) Veldkamp – spikelets (accompanied by actual size images): A – ventral side with *first glume* (fgl) and *sterile lemma* (sl) behind; B– dorsal side with basal *first glume* (fgl), *second glume* (sgl) above and *fertile lemma* (fl) behind; C – *sterile lemma* (sl). Fertile florets (accompanied by actual size images): D – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; E – ventral side with *fertile palea* (fp) in the middle and enveloped at the margin by the *fertile lemma* (fl).

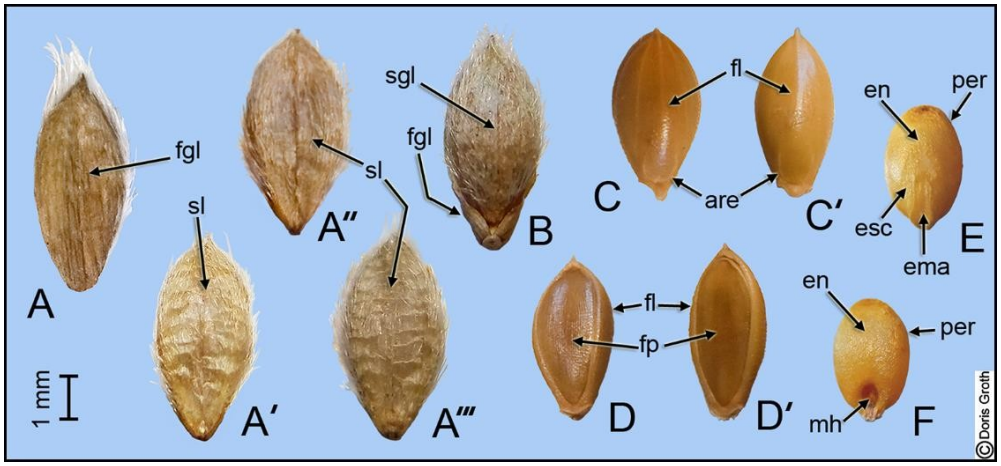

Fig. 15. *Urochloa dictyoneura* (Fig. & De Not.) Veldkamp – spikelets: A – dorsal side with *first glume* (fgl); A',A",A"' – dorsal side with *sterile lemma* (sl); B – ventral side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets: C,C' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D,D' – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin. Caryopses: E – dorsal side with *embryo area* (esc – scutellum; ema – hypocotyl–radicle axis); F – ventral side with sub-basal *hilar macula* (mh).

Abbreviations: en – endosperm; per – pericarp

UROCHLOA HUMIDICOLA
(Rendle) Morrone & Zuloaga
(= *Brachiaria humidicola* (Rendle) Schweick.)
(Figures 16–18)

COMMON NAMES – [English] creeping signal grass, Koronivia grass; [Brazil] braquiária-passo-a-passo, capim-agulha, capim-quicuio-da-Amazônia, kikuiu-da-Amazônia, quicuio-da-Amazônia; [German] Kikuyogras; [Spanish] braquiaria-dulce, Kikuyo-de-la-Amazonia, pasto-humidicola, pasto- humidicola-dulce.

SPIKELETS – two-flowered, ovoid-ellipsoid, 4.0–5.5 mm long, 1.8–2.1(–2.4) mm wide and 0.9–1.2 mm thick, light yellowish, almost white or partially purple, with rounded appearance and more open than the other species of the genus due to the size of the lower glume and fertile lemma; first or lower glume (**fgl**) broadly ovate, as long as the spikelet, margins touch at the base of the spikelet, glabrous, slightly plicated, yellowish or dark purple or purplish in appearance, 9–11-nerved and with 1–2 cross-veins at the apex; second glume (**sgl**) membranaceous, ovate, less broad than the lower glume, light green in colour, with sparse, long, hard and thick hairs, 7–9-nerved and with anastomosing cross-veins (**nv** – joined); basal floret sterile or staminate; sterile lemma (**sl**) basal, ovate, similar to the upper glume in texture and colour, 5-nerved and with long anastomosing cross-veins and almost glabrous in the centre; sterile palea (**sp**) hyaline, broadly ovate, as long as the sterile lemma and hardened keels; upper floret fertile, crustaceous, plano-convex, straw coloured or white (at maturity), 3.5–4.4(–4.8) mm long, 1.6–2.0(–2.1) mm wide and 0.7–1.0 mm thick; fertile lemma (**fl**) obovate, apiculate, finely transversely rugose, conspicuously 5-nerved, with rupture line conspicuous and areole (**are**) rounded, depressed near the base and ⅓ to ¼ the length of the lemma; fertile palea (fp) slightly convex in the middle, slightly shorter, 2-keeled (more conspicuous from the apex to about ½ the length and becoming more inconspicuous at the base), with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – obovoid; in outline obovate; 2.4–3.0 mm long, 1.3–1.8 mm wide and 0.5–0.8 mm thick; hilar macula (**mh**) sub-basal/ventral, point-like and dark brown; embryo area dorsal/basal and about ⅔ the length of the caryopsis; pericarp (**per**) thin and straw coloured; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, perennial, rustic fodder grass, with reproduction by ‘seeds’ and mainly vegetatively, through stolons and rhizomes; native in tropical Africa; introduced in Brazil as fodder grass for the formation of artificial pastures.

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

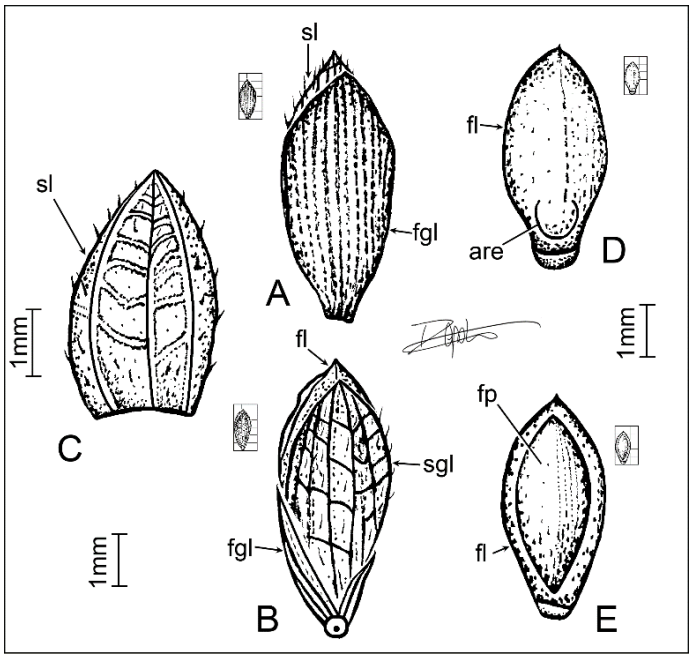

Fig. 16. *Urochloa humidicola* (Rendle) Morrone & Zuloaga – spikelets (accompanied by actual size images): A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) behind; B – dorsal side with basal *first glume* (fgl), *second glume* (sgl) above and *fertile lemma* (fl) behind; C – *sterile lemma* (sl). Fertile florets (accompanied by actual size images): D – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; E – ventral side with *fertile palea* (fp) in the middle and enveloped at the margin by the *fertile lemma* (fl).

Fig. 17. *Urochloa humidicola* (Rendle) Morrone & Zuloaga – spikelets and fertile florets in dorsal and ventral views; caryopses in ventral view.

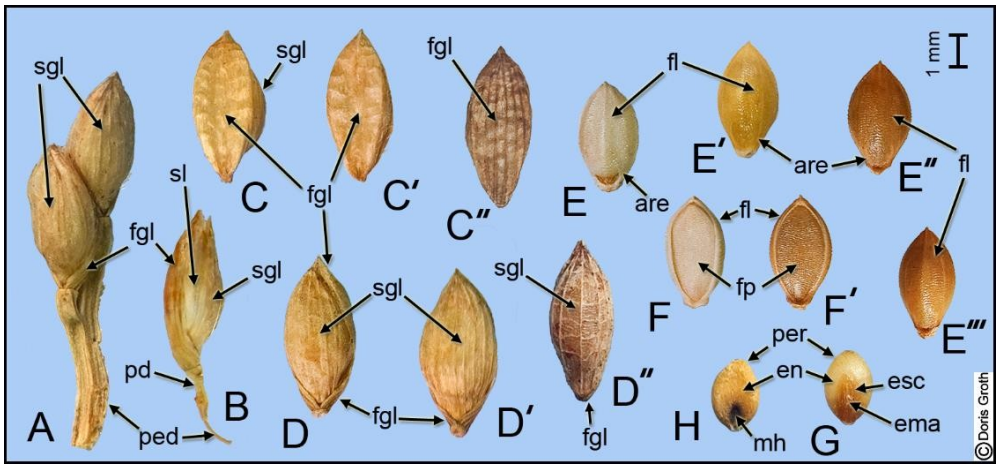

Fig. 18. *Urochloa humidicola* (Rendle) Morrone & Zuloaga – spikelets: A – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above; B – lateral view with *first glume* (fgl) on the left side, *second glume* (sgl) on the right side; C,C',C" – ventral side with *first glume* (fgl); D,D',D" – dorsal side with *first glume* (fgl) at the base and *second glume* (sgl) above. Fertile floret: E,E',E",E"' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; F,F' – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin. Caryopses: G – dorsal side with *embryo area* (esc – scutellum; ema – hypocotyl–radicle axis); H – ventral side with sub-basal *hilar macula* (mh).

Abbreviations: en – endosperm; per – pericarp; ped – peduncle; pd – pedicel

UROCHLOA MUTICA
(Forssk.) T.Q.Nguyen

(= *Brachiaria mutica* (Forssk.) Stapf; *Panicum barbinode* Trin.; *Panicum muticum* Forssk.; *Panicum numidianum* Lam.; *Panicum purpurascens* Raddi)
(Figures 19–21)

COMMON NAMES – [English] Angola grass, Pará grass, buffalo grass, California grass, Dutch grass, giant couch, Scotch grass, Scottish grass, Mauritius grass; [Brazil] angolinha, capim-branco, capim-canudo, capim-d'angola, capim-do-Pará, capim-fino, capim-planta, erva-do-Pará; [German] Paragras; [Spanish] hierba-de-Pará, pasto-Pará, Paraná.

SPIKELETS – two-flowered, oblong or ovoid-ellipsoid, acute, (2.5–)3.1–3.3(–4.0) mm long, 2.2–2.5(–2.6) mm wide and 0.6–0.8 mm thick, glabrous, green or purple or dark straw coloured; glumes glabrous, greenish in colour and with intense pigmentation of anthocyanin; first or lower glume (**fgl**) membranaceous, broadly ovate, acute or subacute, finely 1-nerved, not clasping, usually about ¼ the length of the spikelet and often purple coloured; second glume (**sgl**) membranaceous, oblong or lanceolate-oblong, 5–7-nerved, almost as long as the spikelet and with some cross-veins above; basal floret sterile or staminate; sterile lemma (**sl**) basal and similar to upper glume; sterile palea (**sp**) hyaline, oblong and as long as the sterile lemma; upper floret fertile, crustaceous, plano-convex, straw coloured and 2.2–2.5(–3.0) mm long, 0.6–0.7(–1.0) mm wide and 0.4–0.6 mm thick; fertile lemma (**fl**) elliptic, inconspicuously 5-nerved, apex inconspicuous, apiculate or mucronate (tip acute and short), from very finely transversely rugose to smooth, with rupture line conspicuous and areole (**are**) hippocrepiform-rounded, almost glossy, depressed near the base and 1/5 the length of the lemma; fertile palea (**fp**) slightly shorter than fertile lemma, slightly convex in the middle, 2-keeled (more conspicuous from the apex to about ½ the length and becoming more conspicuous at the base), with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – broadly ovoid; in outline broadly ovate; about 1.16 mm long and 1.0 mm wide; hilar macula (**mh**) sub-basal/ventral, point-like and dark brown; embryo area dorsal/basal, with the same colour of the pericarp and with ½ to ¾ the length of the caryopsis; pericarp (**per**) thin, smooth, slightly glossy and yellowish; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, perennial, stoloniferous, fodder grass, usually with vegetative reproduction (rhizomes), sometimes by 'seeds', which often do not form under the conditions of the state of São Paulo in Brazil; native in tropical Africa; introduced in Brazil as fodder grass, where it has acclimatised, spread and become a problematic weed; occurs in Brazil in tropical regions.

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

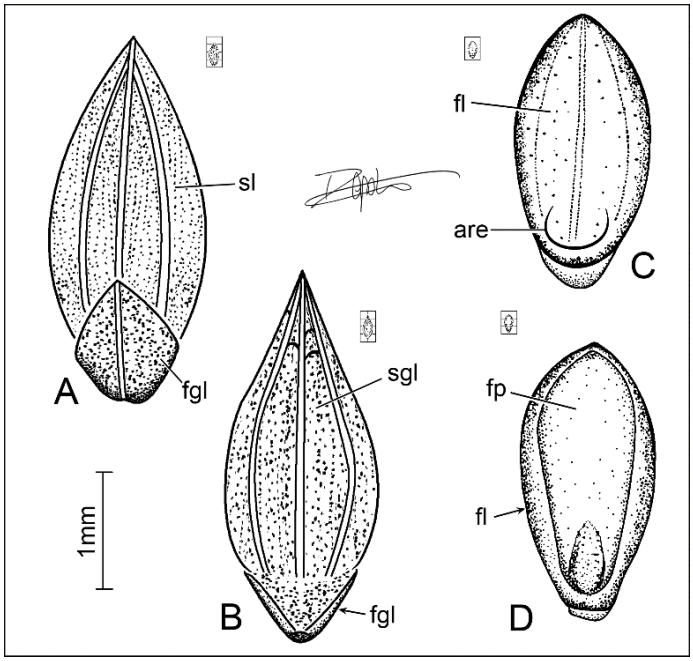

Fig. 19. *Urochloa mutica* (Forssk.) T.Q.Nguyen – spikelets (accompanied by actual size images): A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets (accompanied by actual size images): C – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D – ventral side with *fertile palea* (fp) in the middle and enveloped at the margin by the *fertile lemma* (fl).

Fig. 20. *Urochloa mutica* (Forssk.) T.Q.Nguyen – spikelets in dorsal and ventral views.

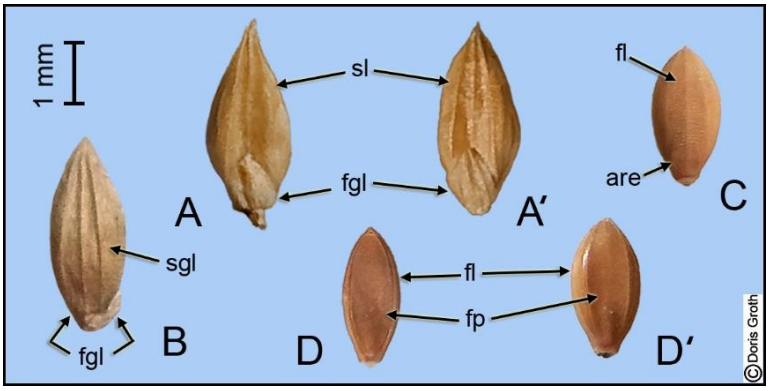

Fig. 21. *Urochloa mutica* (Forssk.) T.Q.Nguyen – spikelets: A,A' – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets: C – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D,D' – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin.

UROCHLOA PLANTAGINEA
(Link) R.D.Webster

(= *Brachiaria plantaginea* (Link) Hitchc.; *Panicum plantagineum* Link)
(Figures 22–24)

COMMON NAMES – [English] Alexander grass, plantain signal grass; [Brazil] capim-de-São Paulo, capim-marmelada, capim-papuã, papuã, marmelada, grama-paulista, capim-Guatemala, capim-mimoso, capim-Itapoá, capim- doce, milhã-branca; [German] Alexandergras.

SPIKELETS – two-flowered, ovoid-ellipsoid to ovoid, from plano-convex to flattened at the middle of the sterile lemma, 4.0–5.0(–5.6) mm long, (1.8–)2.0–2.5 mm wide and (0.8–)0.9–1.0(–1.1) mm thick, glabrous, stramineous, 2-seriate and inserted isolated and alternately in a slightly winged rachis; first or lower glume (**fgl**) broadly ovate, apex subacute, glabrous, thinly membranaceous, about ⅓ as long as the spikelet, clasping the base of the spikelet, 10(–11)-nerved and with conspicuous anastomosing nerve ends (**nv** – joined) at the apex; second glume (**sgl**) from ovate to ovate-elliptic, acuminate, glabrous, at the same length of the fertile floret, 9-nerved and near the apex with anastomosing cross-veins wanting or obscure; basal floret sterile with sterile lemma (**sl**) 5-nerved and very similar to the second glume in shape, size and texture; sterile palea (**sp**) broadly elliptic, hyaline, 2-keeled and as long as the sterile lemma; upper floret fertile, crustaceous, ovoid, plano-convex (but flattened on the back), glabrous, yellowish, (3.0–)3.2–3.6(–4.0) mm long, 2.0–2.2 mm wide and (0.6–)0.7–0.8(–0.9) mm thick; fertile lemma (**fl**) from obovate to elliptic, apex obtuse-rounded, finely transversely rugose (45×), nerves slightly evident, with rupture line conspicuous and areole (**are**) more or less glossy, hippocrepiform-rounded and depressed near the base; fertile palea (**fp**) slightly convex on the back, slightly shorter than the fertile lemma, with two conspicuous thickened keels, with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – from ovoid to ovoid-globous and from plano-convex to flattened; in outline ovate to ovate-rounded; 2.2–2.5(–2.6) mm long, (1.3–)1.5–1.8 mm wide and 0.5–0.6(–0.7) mm thick; hilar macula (**mh**) sub-basal/ventral, from obovate to oblong and slightly darker than the thin pericarp; embryo area dorsal/basal, ovate, about 4/5 to ½ the length of the caryopsis, light yellowish, radicle basal and inconspicuously higher; pericarp (**per**) glabrous, slightly glossy and from white to yellowish in colour; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, annual, cespitose, erect or decumbent or sometimes semi-prostrate, weed, reproduction by ‘seed’ and with 130-day cycle; native in Africa, North America (Mexico), Caribbean, Mesoamerica and South America (French Guiana, Venezuela, Brazil, Bolivia, Colombia, Ecuador, Argentina and Paraguay); occurs in Brazil in almost the whole country; as ruderal plant occurs in wastelands, gardens, roadsides, near to rural habitations and in cultivated soil with cassava, maize and others; prefers clay soils, while in acid soils the occurrence is much lower.

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

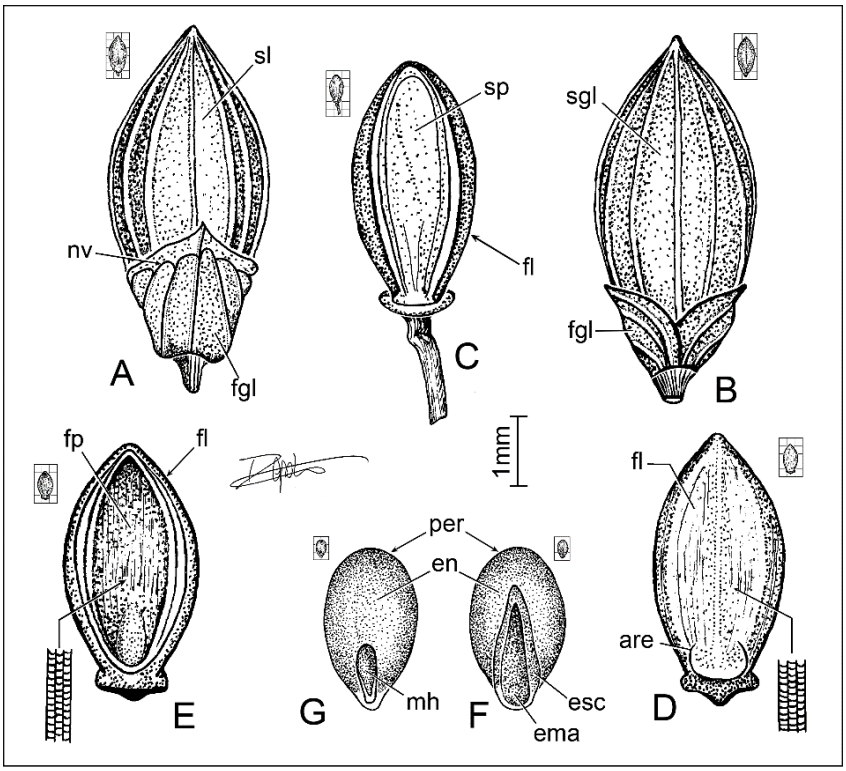

Fig. 22. *Urochloa plantaginea* (Link) R.D.Webster – spikelets (accompanied by actual size images): A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above; C – ventral side with *sterile palea* (sp) and *fertile lemma* (fl) behind. Fertile florets (accompanied by actual size images): D – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base, with surface detail; E – ventral side with *fertile palea* (fp), enveloped at the margin by the *fertile lemma* (fl), with surface detail; Caryopses (accompanied by actual size images): F– dorsal side shows the basal/lateral *embryo area* (esc – scutellum; ema – hypocotyl– radicle axis) and G – ventral side shows the punctiform and basal *hilar macula* (mh).

Abbreviations: en – endosperm; nv – anastomosing nerve ends or cross-veins; per – pericarp

Fig. 23. *Urochloa plantaginea* (Link) R.D.Webster – spikelets and fertile florets in dorsal and ventral views; caryopses in ventral view.

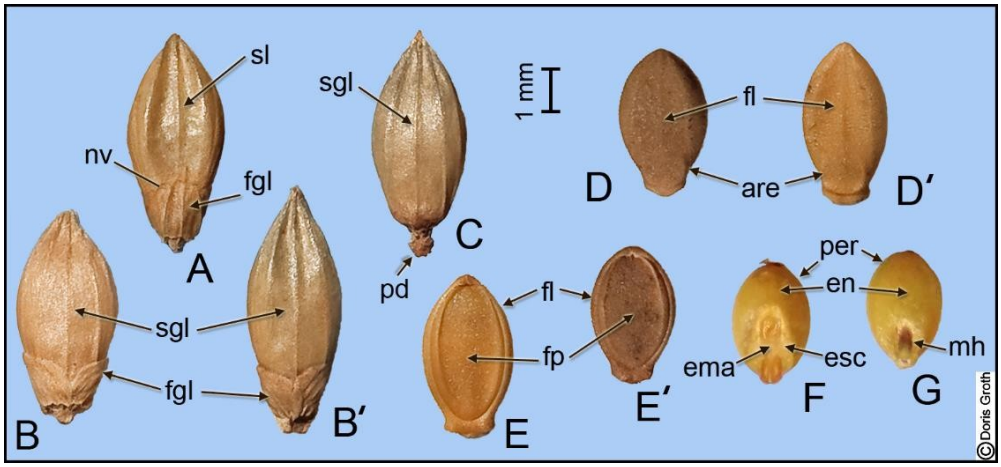

Fig. 24. *Urochloa plantaginea* (Link) R.D.Webster – spikelets: A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B,B' – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above; C – dorsal side with *second glume* (sgl) and *pedicel* (pd) at the base. Fertile florets: D,D' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; E,E' – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin. Caryopses: F – dorsal side with *embryo area* (esc – scutellum; ema – hypocotyl–radicle axis); G – ventral side with sub-basal *hilar macula* (mh).

Abbreviations: en – endosperm; nv – anastomosing nerve veins; per – pericarp

UROCHLOA RUZIZIENSIS
(**R.Germ. & C.M.Evrard) Crins**
(= *Brachiaria ruziziensis* R.Germ. & C.M.Evrard)
(Figures 25–27)

COMMON NAMES – [English] Congo grass, Congo signal grass, ruzi grass; [Brazil] braquiária-ruzizi, braquiária-ruziziensis, braquiária-do-Congo; [German] Congogras, Keniagras; [Spanish] Congo-señal, gambutera, Kenia, pasto- Congo, pasto-ruzi.

SPIKELETS – two-flowered and 2-seriate along the rachis; ovoid, apiculate, (5.0–)5.5–6.0 mm long, 1.8–2.0 mm wide and 0.9–1.0 mm thick, with long white hairs at the apex and margins, sometimes with purple pigmentation at apex; first or lower glume (**fgl**) broadly ovate, apex acute, glabrous, clasping the base of the spikelet, about ½ the length of the spikelet, 11-nerved, with conspicuous anastomosing nerve ends (**nv** – joined) and some anastomosing cross-veins at the apex; second glume (**sgl**) ovate, apiculate, 7- nerved, with long white hairs on the margins and on the upper portion, near the apex with some anastomosing cross-veins; basal floret sterile or male; sterile lemma (**sl**) similar to second glume in shape, size and texture, apiculate, 5-nerved, flat or slightly depressed on the back; sterile palea (**sp**) hyaline, broadly elliptic and as long as the sterile lemma; upper floret fertile, crustaceous, ovate-elliptic, plano-convex and 4.0–4.9(–5.5) mm long, 1.5– 1.7(–1.8) mm wide and 0.7–0.9 mm thick; fertile lemma (**fl**) obovate, apex short, mucronated, from finely striated lengthwise to almost smooth, conspicuously 5-nerved, with rupture line conspicuous and areole (**are**) rounded and depressed near the base, with elongated ‘U’ legs and about 1/4 the length of the lemma; fertile palea (**fp**) slightly shorter, at the base with a slightly raised area (rounded sometimes, slightly convex) and flat to the apex, 2-keeled (conspicuously thickened), with margins (below the keel) smooth, glossy, finer in texture and conspicuously convexly curved over the caryopsis.

CARYOPSES – broadly ovoid; in outline broadly ovate; 2.8–3.4 mm long, 1.3–1.5(– 1.7) mm wide and 0.5–0.8(–0.9) mm thick; hilar macula (**mh**) sub- basal/ventral, oblong, brown and about ½ the length of the caryopsis; embryo area dorsal/basal and about ⅔ the length of the caryopsis; pericarp (per) thin, glabrous and whitish-yellow; integument closely adhered to the pericarp; endosperm (**en**) abundant, farinaceous and white coloured.

SPECIES – herbaceous, perennial, fodder grass, with reproduction by ‘seeds’ and vegetatively through hard rhizomes; native in tropical Africa; introduced in Brazil as fodder grass for the formation of artificial pastures.

POACEAE
SUBFAMILY: PANICOIDEAE TRIBE: PANICEAE

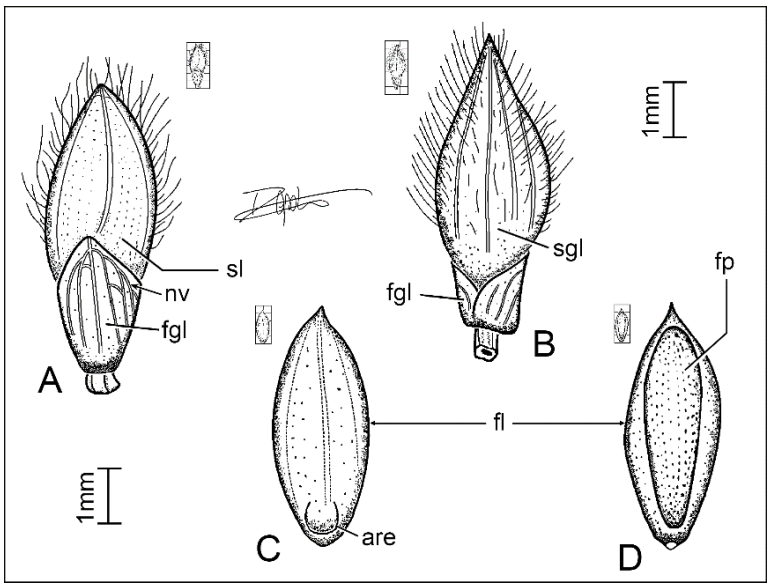

Fig. 25. *Urochloa ruziziensis* (R.Germ. & C.M.Evrard) Crins – spikelets (accompanied by actual size images): A – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets (accompanied by actual size images): C – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D – ventral side with central *fertile palea* (fp) and enveloped at the margin by the *fertile lemma* (fl).

Abbreviations: nv – anastomosing nerve veins

Fig. 26. *Urochloa ruziziensis* (R.Germ. & C.M.Evrard) Crins – spikelets, fertile florets and caryopses in dorsal and ventral views.

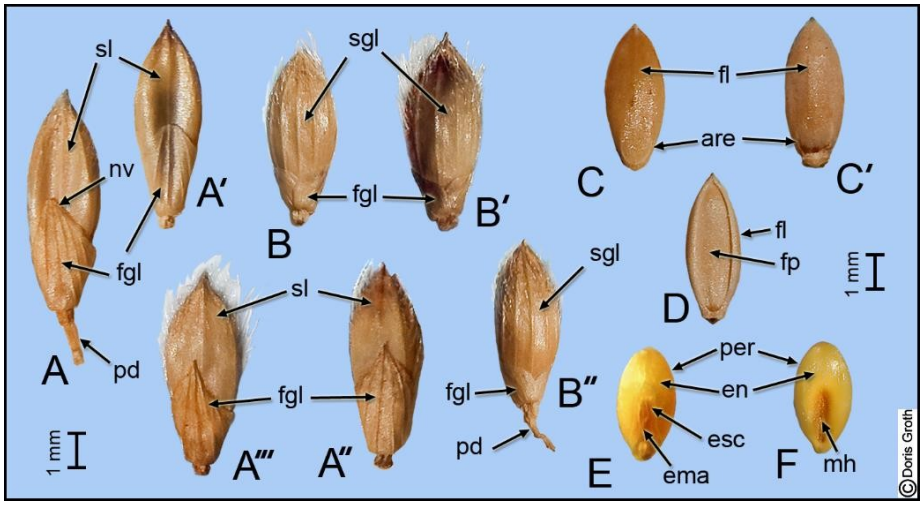

Fig. 27. *Urochloa ruziziensis* (R.Germ. & C.M.Evrard) Crins – spikelets: A,A',A",A"' – ventral side with basal *first glume* (fgl) and *sterile lemma* (sl) above; B,B',B" – dorsal side with basal *first glume* (fgl) and *second glume* (sgl) above. Fertile florets: C,C' – dorsal side with *fertile lemma* (fl), showing *areole* (are) and *rupture line* near the base; D – ventral side with *fertile palea* (fp) in the middle and *fertile lemma* (fl) at the margin. Caryopses: E – dorsal side with *embryo area* (esc – scutellum; ema – hypocotyl–radicle axis); F – ventral side with sub-basal *hilar macula* (mh).

Abbreviations: en – endosperm; nv – anastomosing nerve ends; pd – peduncle; per – pericarp

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