A key to the grasses (Poaceae) of Egypt

Paul M. Peterson1,*, Hasnaa A. Hosni2, Eman K. Shamo2

1 Department of Botany MRC-166, National Museum of Natural History, Smithsonian Institution, Washington DC 20013-7012, USA
2 Herbarium, Botany and Microbiology Department, Faculty of Science, Cairo University, Giza 12613, Egypt
*Corresponding author: peterson@si.edu

Abstract. A key for identifying 284 native and naturalized Egyptian grass species belonging to 103 genera in 22 tribes and 7 subfamilies is presented. The key is principally based on floral characters of the inflorescence and spikelet. A list and classification of all known species of Egyptian grasses is provided.

Keywords: classification, Gramineae, grasses, Egypt, identification key.

INTRODUCTION

The Poaceae (Gramineae) is a large cosmopolitan family with 768 genera and 11,506 species (Soreng et al. 2017). The family includes cereal grasses, bamboos, and species occurring in natural grasslands, cultivated lawns, and pastures. The family has been divided into subfamilies ranging from two (Tzvelev 1989) to six (Clayton and Renvoize 1986), and more recently the family has been divided into 12 subfamilies (Takhtajan 2009; Reveal 2012; Soreng et al. 2017, 2019; Stevens 2017).

In Egypt the grasses are the largest family of flowering plants with 284 species belonging to 103 genera and 22 tribes (Ibrahim et al. 2016). The most comprehensive account of the family in Egypt was done by Täckholm et al. (1941). Other treatments of the grasses of Egypt include Täckholm (1974), Cope and Hosni (1991), Cope (2005), Boulos (2009), and Ibrahim et al. (2016).

The identification of grasses is usually based on the structure of the inflorescence and floral characteristics. However, in some cases it is necessary to identify grasses by its vegetative character if the flowers are not available. In such cases the vegetative characters can be used until a flowering specimen is obtained (Hosni and Ibrahim 2004; Ibrahim et al. 2016).

Phylogenetic studies using results from DNA sequences have changed the classification of the grasses and this paper follows the current use of a name as proposed in these papers. With the publication of the grasses of Egypt using a vegetative key (Ibrahim et al. 2016), the need for an updated floral key is apparent. Earlier traditional treatments of the grasses of Egypt,
i.e., Cope and Hosni (1991) and Cope (2005) are outdated and it is often difficult to determine the current use name. Our paper presents a new key for the identification of grasses native and adventive in Egypt and is written for use by both trained botanists and interested amateurs. Therefore, we have included an introduction defining many terms used in the key. The key is designed to facilitate the identification and is simplified as much as possible using characters based on the inflorescence and spikelet. Our key refers only to Egyptian specimens and, in addition, we include a updated classification of all grasses found in Egypt.

The accepted names follow the Catalogue of New World Grasses (Soreng et al. 2015, 2017) using terminology found in Kellogg (2015), Clayton et al. (2016), Ibrahim et al. (2016, 2018), and Herrera Arrieta and Peterson (2018). Because the inflorescence of grasses takes a variety of shapes, it is convenient to group them into categories based on their morphology. Accordingly, the identification key is divided into two parts, a key of major groups based mainly on inflorescence characters followed by keys to the species within each group. Brief descriptions, synonyms, and illustrations of the species was provided in Ibrahim et al. (2016). The classification of each species in Table 1 follows Soreng et al. (2017, 2019).

**GENERAL MORPHOLOGY**

Grasses are annual, biennial or perennial herbs and the root systems are fibrous, rhizomatous or stoloniferous. Flowering stems (culms) are usually unbranched, composed of several internodes and are mostly hollow, rarely solid throughout, and the solid nodes can sometimes be hairy. Leaves are borne solitary at the node and can be crowded at the base of the culm. Each leaf consists of a sheath, ligule and lamina. Leaf blades may be hairy or glabrous. The base of the leaf sheath is attached to the nodes and clasping the stems firmly with overlapping free or connate margins, sometimes with two small falcate or erect outgrowths at the mouth (auricles). At the junction of a sheath and blade is a ligule that can be membranous or hairy (often a line of hairs) but occasionally a ligule can be absent. Leaf sheaths are mostly linear, flat, and sometimes folded or rolled in various ways.

Flowers (Fig. 1) are usually hermaphrodite, sometimes unisexual (male and female), anemophilous (sometimes autogamous, apomictic or entomophilous) small and inconspicuous. The perianth is usually represented by two or three, minute but up to six, inconspicuous hyaline scales (lodicules) which correspond to the inner perianth whorl of other monocots. Stamens are hypogamous, 1–6 in number but usually 3 with delicate filaments and two anthers that dehisce through terminal pores or longitudinal slits. The ovary is unilocular with a single ovule. There are usually two or three (rarely 1) styles, generally with plumose stigmas. In grasses the fruit or caryopsis is single-seeded with an adherent pericarp, although there are numerous species with free pericarps and these would technically be termed akenes.

The floral parts are placed between two bracts, the lower (lemma) and upper (palea). These two structures are collectively referred to as a floret. The floret is usually subtended by two glumes. Lemmas vary in size and texture like the glumes and differ in the number of veins (usually with an odd number of veins), their overall shape, and the nature of their attachment to the rachilla. Lemmas are often awned or mucronate near the apex, or the awn is borne somewhere along the dorsal back. Awns can be straight, keeled or twisted. The paleas are usually membranous, tightly enclosing the pistil and stamens. Paleas (sometimes reduced) usually have two major veins and are therefore 2-keeled. The lemma, palea, and reproductive structures are called florets. The characteristic floral structure in grasses (spikelets) consist of one to many florets distichously inserted on either side of a slender, jointed rachilla (Fig. 1). Spikelets vary in size from minute (1 mm or less) to relatively large (1 or 2 cm). Each spikelet is usually subtended by two lower empty scales or glumes. Glumes are variously veined and sometimes bear one or more awns. The base of a spikelet or floret is sometimes enlarged and hardened into a small knob or stalk (often sharp) called a callus. Glumes may be shorter than the adjoining lemma or longer and sometimes can be long enough to enclose the entire spikelet, or one or both glumes may be reduced or absent. Spikelets may be dorsiventrally compressed, laterally compressed, or terete.

| Table 1. The following list is a synopsis of the classification of the genera into subfamilies and tribes for the grasses of Egypt. |
|---------------------------------------------------------------|
| **I. Subfamily: ARISTIDOIDEAE Caro** |
| **1. TRIBE: ARISTIDEAE C.E.Hubb.** |
| Aristida adscensionis L. |
| Aristida funiculata Trin. & Rupr. |
| Aristida mutabilis Trin. & Rupr. |
| Stipagrostis acutiflora (Trin. & Rupr.) De Winter |
| Stipagrostis ciliata (Desf.) De Winter |
| Stipagrostis drarri (Täckh.) De Winter |
| Stipagrostis hirtigluma (Steud. ex Trin. & Rupr.) De Winter |
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II. Subfamily ARUNDINOIDEAE Kunth ex Beilschm.

2. TRIBE: ARUNDINEAE Dumort.
Arundo donax L.

3. TRIBE: MOLINIEAE Jirásek
Phragmites australis (Cav.) Trin. ex Steud.
Phragmites karka (Retz.) Steud. [syn Phragmites mauritianus Kunth]

III. Subfamily CHLORIDOIDEAE Kunth ex Beilschm.

4. TRIBE: CENTROPODIEAE P.M. Peterson, N.P. Barker & H.P. Linder
Centropodia forskalii (Vahl) Cope
Centropodia fragilis (Guinet & Sauvage) Cope

5. TRIBE: CYNODONTEAE Dumort.
Aeluropus lagopoides (L.) Trin. ex Thwaites
Aeluropus littoralis (Gouan) Parl.
Chloris flagellifera (Nees) P.M. Peterson [syn. Ochthochloa compressa (Forssk.) Hihu]
Chloris gayana Kunth
Chloris prierii Kunth [syn Enteropogon prierii (Kunth) Clayton]
Chloris pycnothrix Trin.
Chloris virgata Sw.
Coelachyrum brevifolium Hochst. & Nees
Cynodon dactylon (L.) Pers.
Cynodon transvaalensis Burtt Davy
Dactylolobium egypitum (L.) Willd.
Dactylolobium aristatum Link
Dactylolobium scindicum Boiss.
Desmostachya bipinnata (L.) Stapf
Dinebra retroflexa (Vahl) Panz.
Dinebra panicea (Retz.) P.M.Peterson & N.Snow [syn. Leptochloa panicea (Retz.) Ohwi]
Diplachne fusca (L.) P.Beauv. [syn. Leptochloa fusca (L.) Kunth]
Eleusine africana Kenn.- O’Byrne
Eleusine coracana (L.) Gaertn.
Eleusine floccifera (Forssk.) Spreng.
Eleusine indica (L.) Gaertn.
Halopyrum mucronatum (L.) Stapf
Leptololobium senegalense (Kunth) Clayton
Melanochloa abyssinica (R.Br. ex Fresen.) Hochst.
Schoenoplectus gracilis Kunth
Tetrapogon cenchriiformis (A.Rich.) Clayton
Tetrapogon villosus Desf.
Tragus berteronianus Schult.
Tragus racemosus (L.) All.
Trichoneura mollis (Kunth) E.Ekman

6. TRIBE ERAGROSTIDEAE Stapf
Enneapogon desvauxii P.Beauv.
Enneapogon lophotrichus Chiov. ex H.Scholz & P.Koinig
Enneapogon persicus Boiss.
Enneapogon scaber Lehman. 
Eragrostis egyptiaca (Willd.) Delile
Eragrostis aspera (Jacq.) Nees
Eragrostis barrelieri Daveau
Eragrostis ciliata (L.) Vign. ex Janch.
Eragrostis ciliaris (L.) R. Br.
Eragrostis japonica (Thunb.) Trin.
Eragrostis lepida (A.Rich.) Hochst. ex Steud.
Eragrostis minor Host
Eragrostis pilosa (L.) P.Beauv.
Eragrostis sarmentosa (Thunb.) Trin.
Eragrostis tef (Zucc.) Trotter
Eragrostis tenuifolia (A.Rich.) Hochst. ex Steud.
Eragrostis tremula Hochst. ex Steud.
Schmidtia pappophoroides Steud.

7. TRIBE TRIRAPHIDEAE P.M. Peterson
Triraphis pamiliao R.Br.

8.TRIBE ZOYSIEAE Benth.
Sporobolus alopecuroides (Piller & Mitterp.) P.M.Peterson [syn. Crypsis alopecuroides (Piller & Mitterp.) Schrad.]
Sporobolus aculeatus (L.) P.M.Peterson [syn. Crypsis aculeata (L.) Aiton]
Sporobolus ioclados (Nees ex Trin.) Nees
Sporobolus natalensis (Steud.) T. Durand & Schinz
Sporobolus niliacus (Bornm.) P.M.Peterson [syn. Crypsis vaginiflora (Forssk.) Opiz]
Sporobolus spicatus (Vahl) Kunth
Sporobolus pungens (Schreb.) Kunth
Sporobolus schoenoides (L.) P.M.Peterson [syn. Crypsis schoenoides (L.) Lam.]
Sporobolus wrightii Munro ex Scribn.
IV. Subfamily DANTHONIOIDEAE H.P. Linder & N.P. Barker

9. TRIBE: DANTHONIEAE Zotov. Cortaderia selloana (Schult. & Schult. f.) Asch. & Graebn.
Schismus arabicus Nees
Schismus barbatus (L.) Thell.

V. Subfamily: ORYZOIDEAE Kunth ex Beilschm.

10. TRIBE: EHRHARTEAE Nevski
Ehrharta calycina Sm.

11. TRIBE: ORYZEAE Dumort.
Leersia hexandra Sw.
Oryza sativa L.

VI. Subfamily PANICOIDEAE Link

12. TRIBE: ANDROPOGONEAE Dumort.
Andropogon distachyos L.
Chrysopogon plumulosus Hochst.
Chrysopogon zizanioides (L.) Roberty
Coix lacryma-jobi L.
Cymbopogon citratus (DC.) Stapf
Cymbopogon flexuosus (Nees ex Steud.) Watson
Cymbopogon jwarancusa (Jones) Schult.
Cymbopogon martini (Roxb.) Watson
Cymbopogon nardus (L.) Rendle
Cymbopogon schoenanthus (L.) Spreng. subsp. schoenanthus
Cymbopogon schoenanthus subsp. proximus
Dichanthium annulatum (Forsk.) Stapf
Dichanthium foioelatum (Delile) Roberty
EIonurus royleanus Nees ex A. Rich
Hemarthria altissima (Poir.) Stapf & C.E.Hubb.
Hyparrhenia hirta (L.) Stapf
Imperata cylindrica (L.) Raesusch.
Lasiurus scindicus Henrard
Miscanthus sinensis Andersson
Pogonatherum panicum (Lam.) Hack.
Saccharum officinarum L.
Saccharum spontaneum L.
Sorghum arundinaceum (Desv.) Stapf
Sorghum bicolor (L.) Moench
Sorghum x drummondii (Nees ex Steud.) Millsp. & Chase
Sorghum halepense (L.) Pers.
Sorghum virgatum (Hack.) Stapf
Themeda triandra Forsk.
Themeda villosa (Poir.) A.Camus

Vossia cuspidata (Roxb.) Griff.
Zea mays L. subsp. mays
Zea mays subsp. mexicana (Schrad.) Iltis

13. TRIBE: PANICEAE R.Br.
Cenchrus americanus (L.) Morrone [syn. Pennisetum glaucum (L.) R.Br.]
Cenchrus biflorus Roxb.
Cenchrus ciliaris L. [syn. Pennisetum ciliare (L.) Link]
Cenchrus clandestinus (Hochst. ex Chiov.) Morrone (syn. Pennisetum cladoestinum Hochst. ex Chiov.)
Cenchrus echinatus L.
Cenchrus longisetus M.C.Johnst. (syn. Pennisetum villosum R. Br. ex Fresen.)
Cenchrus orientalis (Rich.) Morrone (syn. Pennisetum orientale Rich.)
Cenchrus pennisetiformis Hochst. & Steud.
Cenchrus ramosissimus Poir. (syn. Pennisetum ramosissimus Poir.)
Cenchrus setaceus (Forssk.) Morrone [syn. Pennisetum setaceum (Forssk.) Chiov.]
Cenchrus setiger Vahl
Cenchrus sieberianus (Schldtl.) Verloove [syn. Pennisetum sieberianum (Schldtl.) Verloove]
Cenchrus violaceus (Lam.) Morrone
Digitaria ciliaris (Retz.) Koeler
Digitaria nodosa Parl.
Digitaria sanguinalis (L.) Scop.
Digitaria velutina (Forssk.) P.Beauv.
Digitaria violascens Link
Echinochloa colona (L.) Link
Echinochloa crusgalli (L.) P.Beauv.
Echinochloa pyramidalis (Lam.) Hitchc. & Chase
Echinochloa stagnina (Retz.) P.Beauv.
Megathyrsus maximus (Jacq.) B.K.Simon & S.W.L.Jacobs (syn. Panicum maximum Jacq.)
Melinis minutiflora P.Beauv.
Melinis repens (Willd.) Zizka
Moorochloa eruciformis (Sm.) Veldkamp [syn. Brachiaria eruciformis (Sm.) Griseb.]
Panicum antidotale Retz.
Panicum coloratum L.
Panicum hygrochris Steud.
Panicum milacaeum L.
Panicum repens L.
Panicum turgidum Forssk.
Setaria gerninata [syn. Paspalidium gerninatum (Forssk.) Stapf] [syn. Paspalidium gerninatum (Forssk.) Stapf]
Setaria italica (L.) P.Beauv.
Setaria megaphylla (Steud.) T.Durand & Schinz
Setaria obtusifolia (Delile) Morrone [syn. Paspalidium obtusifolium (Delile) D.Simpson]
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Setaria pumila (Poir.) Roem. & Schult.
Setaria verticillata (L.) P.Beauv.
Setaria viridis (L.) P. Beauv.
Stenotaphrum secundatum (Walter) Kuntze
Tricholaena tenerifae (L.f.) Link
Urochloa deflexa (Schumach.) H.Scholz [syn. Brachiaria deflexa (Schumach.) C.E.Hubb. ex Robyns.]
Urochloa leersioides (Hochst.) H.Scholz & Valdés [syn. Brachiaria leersioides (Hochst.) Stapf]
Urochloa panicoides P. Beauv.
Urochloa ramose (L.) T.Q.Nguyen [syn. Brachiaria ramosa (L.) Stapf]
Urochloa reptans (L.) Stapf [syn. Brachiaria reptans (L.) C.A. Gardner]

14. TRIBE: PASPALEAE J.Presl
Paspalum dilatatum Poiret
Paspalum distichum L.
Paspalum racemosum Lam.

15. TRIBE: TRISTACHYIDEAE Sánchez-Ken & L.G. Clark
Danthoniopsis barbata (Nees) C.E.Hubb.

VII. Subfamily: POOIDEAE Benth.

16. TRIBE: BRACHYPODIEAE Harz
Brachypodium distachyon (L.) P.Beauv.

17. TRIBE: BROMEAE Dumort.
Bromus aegyptiacus Tausch
Bromus alopecuros Poir.
Bromus catharticus Vahl
Bromus danthoniae Trin. ex C.A.Mey.
Bromus diandrus Roth var. diandrus
Bromus diandrus var. rigidus (Roth) Sales
Bromus fasciculatus C.Presl
Bromus hordeaceus L.
Bromus inermis Leyss.
Bromus japonicus Thunb.
Bromus lanceolatus Roth
Bromus lepidus Holmb.
Bromus madritensis L.
Bromus pectinatus Thunb.
Bromus pulchellus Fig. & De Not.
Bromus pumilio (Trin.) P.M. Sm. [syn Boissiera squarrosa (Banks & Sol.) Nevski]
Bromus rubens L.
Bromus scoparius L.

Bromus sterilis L.
Bromus tectorum L. subsp. tectorum
Bromus tectorum subsp. lucidus Sales

18. TRIBE: LYGEEAE J.Presl
Lygeum spartum Loefl. ex L.

19. TRIBE: MELICEAE Rchb.
Melica persica Kunth

20. TRIBE: POEAE R.Br.
Agrostis stolonifera L.
Alopecurus myosuroides Huds.
Ammochloa palustrioides Boiss.
Avena barbata Pott ex Link subsp. barbata
Avena barbata subsp. wiestii (Steud.) Mansf.
Avena fatua L.
Avena longiglumis Durieu
Avena sativa L.
Avena sterilis L.subsp. sterilis
Avena sterilis subsp. ludoviciana (Durieu) J.M.Gillet & Magne
Briza maxima L.
Briza minor L.
Calamagrostis arenaria (L.) Roth [syn. Ammophila arenaria (L.) Link
Catapodium rigidum (L.) C.E.Hubb.
Corynephorus divaricatus (Pourr.) Breistr.
Cortandia dichotoma (Forssk.) Batt. & Trab.
Cutandia memphitica (Spreng.) Benth.
Cynosurus echinatus L.
Dactylis glomerata L.
Desmazeria philistaca subsp. rohlfสiana (Coss.) H.Scholz
Festuca brevis (Boiss. & Kotschy) Asch., Schweinf. & Muschl. (syn. Vulpia brevis Boiss. & Kotschy)
Festuca fasciculata Forssk. [syn. Vulpia fasciculata (Forssk.) Samp.]
Festuca bromoides L. [syn. Vulpia bromoides (L.) Gray]
Festuca myuros L. [syn. Vulpia myuros (L.) C.C.Gmel.]
Festuca pectinella Delile [syn. Vulpia pectinella (Delile) Boiss.]
Gastridium phleoides (Nees & Meyen) C.E.Hubb.
Holcus annuus Salzm.
Lagaris ovatus L.
Lagarus ovatus L.
Lamarckia aurea (L.) Moench
Lolium arundinaceum (Schreb.) Darbysh. (syn Festuca arundinacea Schreb.)
Lolium multiflorum Lam.
Lolium perenne L.
Lolium rigidum Gaudin
Lolium temulentum L.
Figure 1. General morphology of a grass, illustrating the culm, blade, panicle, spikelet, floret, flower, and caryopsis.

*Parapholis filiformis* (Roth) C.E.Hubb.  
*Parapholis incurva* (L.) C.E.Hubb.  
*Parapholis marginata* Runem.  

*Phalaris aquatica* L.  
*Phalaris arundinacea* L.  
*Phalaris canariensis* L.
Figure 2. Inflorescence types used to determine groups in the key. A Open panicle (*Avena sativa*) B Headlike panicle (*Bromus rubens*) C Dichotomously branched panicle (*Cutandia dichotoma*) D Digitately arranged spikes (*Dactyloctenium aegyptium*) E Spikes along central axis (*Dinebra retroflexa*) F Simple spike (*Lolium rigidum*) G Panicles subtended by spatheole (*Lygeum spartum*) H Plumose panicle (*Saccharum spontaneum*) I Spiciform panicle (*Trisetaria linearis*).
The inflorescence (synflorescence) is usually compound, composed of simple or complex aggregation of primary inflorescences (spikelets) often produced on a central axis (rachis) which may be terminal, rarely axillary, or compound and rebranched (Fig. 2). Spikelets may be arranged in spikes, racemes or panicles (open or contracted). In spikes, the spikelets are attached directly (sessile) to the unbranched main axis without pedicels. Racemes are unbranched inflorescences with each spikelet borne on a single pedicel directly on a branch axis. Multiple racemes can be arranged digitally or scattered along the rachis. Open or contracted panicles are inflorescences in which the main axis has several lateral, whorled or individual indeterminate branches with each branch terminating in a pedicellate spikelet. Spiciform panicles is where contraction has proceeded to the point where individual branches are closely appressed or adherent to the central axis. Inflorescences can sometimes be subtended by a bladeless sheath known as spatheole.

**IDENTIFICATION KEY**

The identification key is composed of two parts: a key to major groups and a key to each group.

**Key to major groups**

1a. Inflorescence ovoid, cylindrical or a headlike panicle ......

1b. Inflorescence open and not ovoid or a headlike panicle ..

2a. Inflorescence branches or spikes digitate or subdigitally inserted, terminal...

2b. Inflorescence branches branched and rebranched (paniculate) and not digitately or subdigitally inserted .........
3a. Inflorescence with racemes or spikelike panicles terminal; spikelets with an involucre of numerous bristles or hairs at the base .................................................. \textbf{group 3}

3b. Inflorescence with racemes appressed along a central axis or a panicle; spikelets without an involucre of numerous bristles or hairs at base ........................................ 4

4a. Spikes or racemes appressed along central axes .... \textbf{group 4}

4b. Spikes or racemes not appressed along central axes ...... 5

5a. Spikelets 3–9-awned or lemma awns 3-branched; inflorescence a contracted or open panicle ................................ \textbf{group 5}

5b. Spikelets 1-awned or unawned; inflorescence a raceme or panicle .............................................................................. 6

6a. Spikelets prickly; inflorescence a simple raceme or spikelike panicle .................................................. \textbf{group 6}

6b. Spikelets not prickly; inflorescence a raceme or panicle .. 7

7a. Inflorescence tri- or dichotomously branched....... \textbf{group 7}

7b. Inflorescence not tri- or dichotomously branched ........ 8

8a. Inflorescence subtended by spatheoles........................ \textbf{group 8}

8b. Inflorescence not subtended by spatheoles............... 9

9a. Inflorescence plumose, large 20–60 cm long, open; culms 4–8 m tall ................................................................. \textbf{group 9}

9b. Inflorescence not plumose, generally ≤ 20 (−60 cm) long, if longer, never plumose, open or contracted; culms ≤ 2 m tall ................................................................................. 10

10a. Inflorescence a simple spike, raceme or spikelike panicle..... ........................................................................ \textbf{group 10}

10b. Inflorescence an open or contracted panicle............ 11

11a. Panicles spiciform, narrow usually < 1 cm wide : \textbf{group 11}

11b. Panicles open usually 0.5–30 cm wide..................... 12

12a. Panicles contracted, 0.5–3 (−4) cm wide ........ \textbf{group 12}

12b. Panicles open, not contracted, usually (2–) 4–30 cm wide. ............................................................................. 13

13a. Spikelets awned .................................................... \textbf{group 13}

13b. Spikelets unawned .................................................... \textbf{group 14}

\textbf{Group 1: Inflorescence ovoid, cylindrical or a headlike panicle}

1a. Heads woolly with plumose hairs or bristles ............ 2

1b. Heads not wooly ...................................................... 3

2a. Spikelets not subtended by bristles, 1-flowered with a single perfect floret; glumes (5.5–) 7–10 mm long, awned, the awns 1.5–3 mm long. .................................................. \textbf{Lagurus ovatus}

2b. Spikelets subtended by an involucre of bristles, 2-flowered, the lower floret sterile; glumes 0.3–5.2 mm long, unawned ................................................................. \textbf{Cenchrus longisetus}

3a. Spikelets subtended by an involucre of bristles, bristles plumose, 4–7 cm long ....................................... \textbf{Cenchrus longisetus}

3b. Spikelets not subtended by an involucre of bristles ...... 4

4a. Panicle bilateral, pyramidal; cultivated ................................ ............................................................... \textbf{Triticum pyramidale}

4b. Panicle not pyramidal; native ........................................ 5

5a. Stoloniferous perennials; with stringlike culms, richly branched at the nodes ................ \textbf{Aeluropus lagopoides}

5b. Plants not stoloniferous; culms erect ....................... 6

6a. Glumes shiny with attenuate apices; lemmas shiny, surface villous, hairy below, hairs 4–8 mm long, apex setaceous or attenuate ........................................ \textbf{Cortaderia selloana}

6b. Glumes and lemmas green and not shiny, with acute and/or mucronate apices .................................................. 7

7a. Panicles subtended by an inflated leaf sheath, or spatheole; spikelets 1-flowered .................................................. 8

7b. Panicles not subtended by an inflated leaf sheath or spatheole; spikelets 2-many-flowered ............................................... 10

8a. Panicles ellipsoid; lower glume with glabrous margins ...... \textbf{Sporobolus schoenoides}

8b. Panicles ovoid or ellipsoid, lower glumes with hairy margins .............................................................................. 9

9a. Panicles 0.5–1 cm long; uppermost leaf continuous with its sheath; paleas 0–1-veined ........ \textbf{Sporobolus aculeatus}

9b. Panicles 0.3–1.5 cm long; uppermost leaf clearly demarcated from its sheath; paleas 2-veined . \textbf{Sporobolus niliacus}

10a. Lemmas unawned ........................................... \textbf{Ammochloa palaestina}

10b. Lemmas awned ................................................. 11

11a. Spikelets 4–14-flowered; panicles exerted .............. \textbf{Ammochloa palaestina}

11b. Spikelets 3-flowered with only one fertile floret; panicles partially included in the sheath ................. \textbf{Phalaris minor}

12a. Glumes dissimilar; lemmas mucronate or short-awned, the awns ≤ 1.5 mm long ................ \textbf{Dactylis glomerata}

12b. Glumes similar; lemmas all awned, awns ≥ 2 mm long. 13
13a. Most florets perfect; sheaths pubescent to pilose ........ 14
13b. Florets both sterile and perfect; sheaths glabrous .......... 15
14a. Spikelets 15–30 mm long; lemmas 10–15 mm long, awns 7–23 mm long ..................................................... Bromus rubens
14b. Spikelets 4–5 mm long; lemmas 3–4. 5 mm long, awns 3–5 mm long, .......................................................... Rostraria hispida
15a. Awns of sterile spikelets 15–20 mm long; spikelets 6–7 mm long; lemmas 3.4–4 mm long..... Cynosurus coloratus
15b. Awns of sterile spikelets 6–15 mm long; spikelets 8–14 mm long; lemmas 4–6.5 mm long..... Cynosurus echinatus

Group 2: Inflorescence branches or spikes digitate or subdigitately inserted, terminal

1a. Racemes 1–2 (3) digitate ..................................................... 2
1b. Racemes usually 2 or more .............................................. 8
2a. Lemmas awned .................................................................. 3
2b. Lemmas unawned ................................................................ 4
3a. Racemes subtended by reddish spatheole; rachis with white hairs; lemma awns 10–35 mm long, geniculate with twisted column ..................................................... Hyparrhenia hirta
3b. Racemes not subtended by spatheole; rachis glabrous; lemma awns 7–10 mm long, straight ..................................................... Brachypodium distachyon
4a. Culms spongy; racemes 10–30 cm long; rachis angular; glumes with long caudate apex ............................. Vossia cuspidata
4b. Culms not spongy; racemes ≤ 15.5 cm long; rachis winged or flattened; glumes without a caudate apex ...... 5
5a. Spikelets 4–7-flowered, 3.3–7.8 mm long ......................... 6
5b. Spikelets 1 or 2-flowered, when 2-flowered the lower floret sterile, 2–3.2 mm long ..................................................... Dichanthium annulatum
6a. Leaf blades with tufts of short white hairs scattered along the margins; upper glumes 1-veined; grain rugulose ........ Elusine floccifolia
6b. Leaf blades without tufts of hairs scattered along the margins; upper glumes 2–3-veined; grains striate .................. Elusine indica
7a. Racemes 2–8 cm long; rachis narrowly winged; spikelets dorsally compressed............................ Paspalum distichum
7b. Racemes 0.7–1.5 cm long; rachis flattened; spikelets laterally compressed............................. Cynodon transvaalensis
8a. Lemmas awned .................................................................. 9
8b. Lemmas unawned or short aristate .................................. 14
9a. Lemmas with geniculate awnate ...................................... 16
9b. Lemmas with straight or flexuous awns ......................... 10
10a. Upper glume awned, the awn 4–10 mm long; fertile spikelets 8–16 mm long.......................... Andropogon distachyos
10b. Upper glume unawned; fertile spikelets 2–7 mm long... 11
11a. Racemes 3–7 cm long; lemma apex entire, awns 8–25 mm long, adventive ................................. Dichanthium annulatum
11b. Racemes 10–30 cm long; lemmas apex bifid, awns 6–12 mm long, cultivated.......................... Miscanthus sinensis

12a. Lemmatal awns flexuous, 10–30 (–40) mm long; glumes 1-awned, awns 0.5–1 mm long ....... Schoenefeldia gracilis
12b. Lemmatal awns straight, less than 10 mm long.............. 13
13a. Lemmatal awns 0.5–5 mm long, as long as lemma ......................... Choris gayana
13b. Lemmatal awns more than 5 mm long, more than twice as long as lemma .............................. 14
14a. Leaf blade with an obtuse apex; glume apex acute ............ Choris pycnothrix
14b. Leaf blade with an acute apex; glume apex acuminate 15
15a. Lowest lemma without a crown of spreading hairs; spikelets 4–6-flowered ................................. Choris prieurii
15b. Lowest lemma with a crown of spreading hairs, the hairs 1.5–4 mm long; spikelets 3 flowered .. Choris virga
16a. Flowers unisexual, plants monoeious, female inflorescences subtended by leafy spatheoles, rachis enlarged into a woody cob ..................................................... 17
16b. Flowers perfect, plants hermaphroditic, inflorescences not subtended by spatheoles and rachis not enlarged into a cob ..................................................... 18
17a. Female inflorescences 2–5 (~10) cm thick with 8–24 rows of spikelet pairs forming a thick woody cob, all tightly enclosed by several leafy spatheoles ............................. Zea mays subsp. mays
17b. Female inflorescences less than 1 cm thick with 2 rows of spikelet pairs forming a hardened rachis, all enclosed by a single leafy spatheole .......... Zea mays subsp. mexicana
18a. Racemes 1–2 mm broad ..................................................... 19
18b. Racemes 2–5 mm broad ..................................................... 23
19a. Glumes equal; racemes 3–5......................... Choris flagellifera
19b. Glumes unequal or absent; racemes 2–16.............. 20
A key to the grasses (Poaceae) of Egypt

20a. Spikelets 1-flowered; racemes 2 or more closely placed or whorled with a flat rachis, unwinged; ligule a ciliate membrane .......................................................... Cynodon dactylon

20b. Spikelets 2-flowered; racemes mostly in pairs or whorled or alternate, he rachis flat or triquetrous, winged; ligule membranous .......................................................... 21

21a. Glumes two, dissimilar ......................... Digitaria ciliaris

21b. Glume one, the lower absent or obscure ................. 22

22a. Spikelets 2.5–3.3 mm long; fertile spikelets paired along a narrowly winged rachis ........................................... Digitaria sanguinalis

22b. Spikelets 1.2–2 mm long; fertile spikelets tenuate along a broadly winged rachis ................................ Digitaria violascens

23a. Racemes terminated by the naked tips of the rachis, bristle like ................................................................. 24

23b. Racemes terminated by a spikelet ........................................ 26

24a. Racemes 1.2–6.5 cm long, inflorescence open .......................................................... Dactyloctenium aegyptium

24b. Racemes 0.8–2 cm long, inflorescence compact .................. 25

25a. Stoloniferous perennials; anthers 1.1–2 mm long .......................................................... Dactyloctenium scindicum

25b. Tufted annuals often rooting at the lower nodes; anthers 0.3–0.5 mm long .......................................................... Dactyloctenium aristatum

26a. Racemes in terminal pairs (rarely 3) with scattered one or two below; spikelets 8–20-flowered .... Acrachne racemosa

26b. Racemes not in terminal pairs, digitate or subdigitately arranged; spikelets 3–9-flowered .......................................................... 27

27a. Upper glume apex obtuse; lemma apex obtuse .................. .......................................................... Coelachyrum brevifolium

27b. Upper glume apex acute; lemma apex acute ...................... 28

28a. Racemes 9–15 mm wide; spikelets ovate; grains subglobose, brown, exposed between gaping lemmas and paleas at maturity, cultivated ........................................... Eleusine coracana

28b. Racemes 3–8 mm wide; spikelets elliptic; grains ellipsoid, blackish, not exposed or concealed by the florets, native and/or weedy .......................................................... 29

29a. Leaf blades with tufts of short white hairs scattered along the margins; upper glumes 1-veined; grain rugulose .................. .......................................................... Eleusine floccifolia

29b. Leaf blades without tufts of hairs scattered along the margins; upper glumes 2–3-veined; grains striate or granular .................................................. 30

30a. Lemmas 2.1–3.6 mm long; racemes 3–3.5 mm wide; grains 1–1.3 mm long, striate .................................................. Eleusine indica

30b. Lemmas 3.7–5 mm long; racemes 4–8 mm wide; grains 1.2–1.6 mm long, granular ........................................... Eleusine africana

Group 3: Inflorescence with racemes or spikelike panicles terminal; spikelet with an involucre of numerous bristles or hairs at the base

1a. Inflorescence 1 or 2 digitate racemes; spikelets surrounded by hairs; lemmatal awns 2–4 mm long, straight .................. .................................................. Tetrapogon villosus

1b. Inflorescence a panicle; spikelets surrounded by free or coniate bristles; lemmas unawned ........................................... 2

2a. Plants robust 2–3 m tall .......................................................... 3

2b. Plants 90 cm or less tall .................................................. 4

3a. Annuals; culms glabrous below the panicle; bristles shorter than the spikelets, persistent; cultivated ........................................... Cenchrus americanus

3b. Perennials; culms villous below the panicle; bristles much longer than the spikelets, deciduous; indigenous ........................................... Cenchrus orientalis

4a. Bristles connate, deciduous with the spikelets, inner bristles longer than outer with one long bristle, flat .................. 5

4b. Bristles free, not deciduous with the spikelet ...................... 9

5a. Bristles of the involucre retrorsely barbellate, tenaciously clinging to clothing, longest bristles scarcely emergent .... 6

5b. Bristles of the involucre antrorsely scaberulous not clinging; sometimes with one conspicuous longer bristle ....... 7

6a. Inner bristles connate only at the bases to form a shallow disc; 2–4 mm long; inner bristle 2.9–7 mm long; ciliate ........................................... Cenchrus biflorus

6b. Inner bristles fused for about half their length to form a cup, 5–10 mm long; longest bristle 2–5 mm long, pubescent spinose ........................................... Cenchrus echinatus

7a. Inner bristles rigid, flattened, 2–3 mm long, connate for ½/3 their length forming a cup, inner bristles with longest bristle scarcely emergent; 2–4 mm long .................. ........................................... Cenchrus setiger

7b. Inner bristles flexuous, filiform above, 6–12 mm long, inner bristles with one conspicuously longer bristle 8–16 mm long; ciliate ........................................... 8

8a. Inner bristles united only at the bases to form shallow disc 0.5–1.5 mm diam., occasionally connate for up to 0.5 mm above its rim ........................................... Cenchrus citrariis

8b. Inner bristles connate for 1–2.5 mm above the rim of the basal disc forming a cup ........................................... Cenchrus pennisetiformis
9a. Bristles persistent ........................................................................ 10
9b. Bristles deciduous with the spikelets ........................................ 14
10a. Inflorescences open panicles, bristles 2–2.5 cm long ..............
     ............................................................................. Setaria megaphylla
10b. Inflorescences a spiciform panicles ........................................... 11
11a. Bristles retroserely barbed clinging to clothes, 4–7 mm long
     ............................................................................. Setaria verticillata
11b. Bristles anterisorely barbed ...................................................... 12
12a. Upper glumes as long as the spikelets; each spikelet sub-
     tended by 1–3 bristles, 5–10 times as long as the spikelets.
     Setaria viridis
12b. Upper glumes shorter than the spikelets ................................... 13
13a. Lemmas strongly rugose; each spikelets subtended by
     4–12 bristles, 3–8 mm long ............................................ Setaria pumila
13b. Lemmas rugulose or unwrinkled; each spikelet subtended
     by 1–3 bristles, 4–16 mm long ..................................... Setaria italica
14a. Inflorescences comprising only a few spikelets; compris-
     ing 2–4(–6) fertile spikelets; shorter than basal leaves;
     subtended by an inflated leaf-sheaths; enclosed; bristles
     shorter than the spikelets (cult.) ..................................... Cenchrus clandestinum
14b. Inflorescences spike-like panicles, exserted ......................... 15
15a. Panicles ovoid to subpherical very dense; bristles plu-
     mose, 40–70 mm long; lemmas acute, 7–9-veined ............... Cenchrus longisetus
15b. Panicles elongate; lemmas ..................................................... 16
16a. Involucre sessile .............................................................. Cenchrus violaceum
16b. Involucre stipitate (stalked) .................................................... 17
17a. Plants glaucous, pinkish; spikes purple or pink; involucr
     base stipitate, the stipe 1–3 mm long.... Cenchrus setaceus
17b. Plants not glaucous, not pinkish; involucr base stipitate,
     the stipe 0.5–1 mm long.............................................. 18
18a. Panicles axes glabrous; involucr bristles 7–20 mm long
     ............................................................................. Cenchrus ramosissimus
18b. Panicles axes pubescent; involucr bristles 6–9 mm long
     with a conspicuous longer bristle, 10–25 mm long .......... Cenchrus sieberianus

Group 4: Spikes or racemes appressed along central axes

1a. Spikelets headlike, several, small, nodding along an
     unbranched axes; glumes long villous and soft ..................... Melanocenchrus abyssinica
1b. Spikelets not headlike, erect or reflected along the central
     axis but not nodding; glumes not long villous ............... 2
2a. Glumes as long as or longer than the spikelets, persistent,
     similar, exceeding apex of florets; lower glume apex cu-
     date ........................................................................... Dinebra retroflexa
2b. Glumes much shorter than the spikelets; lower glume
     apex not caudate ...................................................... 3
3a. Racemes 0.5–1 cm long; spikelets embedded in a corky
     rachis; leaf blade apex obtuse...... Stenotaphrum secundatum
3b. Racemes more than 1 cm long, not embedded in rachis;
     leaf blades apex acute ............................................. 4
4a. Lemmas and/or glumes acuminate or awned .................. 5
4b. Lemmas or glumes unawned ........................................... 9
5a. Racemes 15–35 cm long; spikelets 8–15 mm long; lemma
     apex mucronate or with a short awn ≤ 1.5 mm long; fer-
     tile spikelets pedicelled, pedicels filiform, 0.5–1.5 mm
     long; glumes unequal........................... Diplachne fusca
5b. Racemes 2–10 cm long; spikelets 3–6 mm long; lemma
     apex awned; fertile spikelets sessile or with pedicels <0.5
     mm long; glumes equal or subequal.............................. 6
6a. Lemmas apex mucronate or short awned, the awns 0.3–3
     mm long...................................................................... 7
6b. Lemmas awned, the awn 20–50 mm long...................... 8
7a. Racemes 2–7(–10); spikelets comprising 1 fertile floret;
     spikelets 3–4.5 mm long; lemmas rugulose, mucronate,
     the macro 0.3–1 mm long....................... Urochloa panicoides
7b. Racemes 10–40; spikelets comprising 5–9 fertile florets;
     spikelets 6–8 mm long; lemmas sparingly hairy, mucro-
     nate or short awned up to 2 mm long ... Trichoneura mollis
8a. Caespitose annuals; racemes straight; spikelets pedicelled,
     1–2 mm long; lemmas hispid, awns up to 50 mm long;
     upper glumes apex cuspidate........... Echinochloa crusgalli
8b. Rhizomatous perennials; racemes flexuous; spikelets ses-
     sile to subsessile; lemmas pubescent, awns 20 mm long,
     upper glumes entire or awned, the awns 0–4 mm long.....
     ............................................................................. Echinochloa stagnina
9a. Rachis winged ........................................................................ 10
9b. Rachis unwinged .................................................................. 15
10a. Racemes compact, appressed to the long slightly hollowed
     common axis; leaf blade apex obtuse .... Setaria obtusifolia
10b. Racemes not compact, and not as above; leaf apex acute
     11a. Spikelets 6–9 mm long; lemma margin and midvein
     pubescent; glume apex caudate ............... Dinebra panicea
11b. Spikelets 1.5–4 mm long; lemmas glabrous; glume apex acute to obtuse ................................................................. 12

12a. Spikelets 2.5–3.5 mm long; rachis broadly winged, the wing 0.5–2 mm wide; lemmas apex obtuse ......................... 13

12b. Spikelets 1.5–2.5 mm long; rachis narrowly winged, the wing 0.5 mm wide; lemma apex acute .......................... 15

13a. Lower glumes absent or obscure..... *Paspalum racemosum*

13b. Both glumes present, dissimilar ........................................ 14

14a. Racemes 5–20 cm long; spikelets 2.5–3.5 mm long; lemma surfaces rugulose, stramineous .................. *Urochloa mutica*

14b. Racemes 0.5–4 cm long; spikelets 1.5–2.5 mm long; lemma surface smooth, shiny, dark brown.......................... *Setaria geminata*

15a. Glume one, the lower absent or obscure ................. 16

15b. Glumes 2, the lower present .......................................... 17

16a. Glumes apex obtuse; lemmas 3-veined .......................................................... *Paspalum dilatatum*

16b. Glumes apex acute; lemmas 7-veined ..... *Digitaria velutina*

17a. Inflorescences up to 60 cm long, racemes numerous 20-50 or more ............................................................... *Desmostachya bipinnata*

17b. Inflorescences <60 cm long, racemes few, up to 10....... 18

18a. Lemma and glume apices obtuse ....... *Moorochloa eruciformis*

18b. Lemma and glume apices acute or cuspidate............... 19

19a. Spikelets with 8-25 florets .............................................. 20

19b. Spikelets with 1 fertile and 1 sterile floret ...................... 21

20a. Rachilla villous; callus bearded ....... *Halopyrum mucronatum*

20b. Rachilla glabrous; callus not bearded .............................................................. *Catapodium rigidum*

21a. Lower glume apex obtuse; lemmas pilose or villous, bearing white hairs ............................................ *Digitaria nodosa*

21b. Lower glume apex acute; lemmas not pilose or villous .. 22

22a. Spikelets packing adaxial, distant, irregular.................. *Urochloa deflexa*

22b. Spikelets packing regular, 2- or 4-6-rowed ............... 23

23a. Spikelets packing regular, 2-rowed .............................. 24

23b. Spikelets packing regular, 4-6-rowed .......................... 27

24a. Spikelets packing broadside to rachis; glume apex obtuse and erose, lemma apex apiculate .......... *Aeluropus littoralis*

24b. Spikelets not packing broadside to rachis; glume apex acute, not erose; lemma apex acute, often mucronate .... 25

25a. Spikelets 1.5–2 mm long with hirsute pedicels; lower glumes 0.15–0.25 as long as the spikelets without veins, apex truncate ................. *Urochloa reptans*

25b. Spikelets 2–3.5 mm long with glabrous or scabrous pedicels; lower glumes 1/3–½ as long as the spikelets with 3–7 veins, apex acute or obtuse .................................................. 26

26a. Lemmas dark brown; upper glumes not separated from lower glumes by an internode............. *Urochloa ramosa*

26b. Lemmas green; the upper glumes separated from the lower glumes by a distinct internode 0.2–0.5 mm long......... *Urochloa leersioides*

27a. Plants annual, caespitose; upper glumes pubescent, apex cuspidate ......................................... *Echinochloa colona*

27b. Plants perennial with rhizomes; upper glumes glabrous or hispidulous, apex acute .................. *Echinochloa pyramidalis*

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**Group 5: Spikelets 3–9-awned or lemma awns 3-branched; inflorescence a contracted or open panicle**

1a. Lemmas 5–9-awned ................................................................ 2

1b. Lemmas awns 3, or awns 3-branched .................................. 7

2a. Panicles open or contracted; lemmas hairy below the middle, 5-awned, the awns 4–8 mm long ......................... *Schmidtia pappophoroides*

2b. Panicles compact or spiciform; lemmas not hairy; lemmas 5–9-awned ................................................................. 3

3a. Small villous grasses; panicles densely ovoid; lemmas with 5–9 scabrid awns .................................. *Bromus pumilio*

3b. Tall, glabrous grasses, panicles spiciform, oblong-linear; lemma awns 9, feathery......................................................... 4

4a. Lemmas awns scaberulous throughout .................................. *Enneapogon scaber*

4b. Lemmas awns ciliate below, scaberulous only towards tip.. .......................................................... 5

5a. Fertile lemmas with 3 dense patches of hairs on the backs, one along midrib and one along each margin; nodes glabrous .................................*Enneapogon lophotrichus*

5b. Lemmas with hairs on the back evenly distributed; nodes bearded.......................................................... 6

6a. Basal leaf sheaths persistent, forming a bulbous swelling near base; spikelets 2.8–5.5 mm long ..................... *Enneapogon desvauxii*
7a. Basal leaf sheaths persistent, not forming a bulbous swelling near base; spikelets 5.5–12 mm long.................................\textit{Emmeapogon persicus}

7a. Lemma awns glabrous to scabrous, column not twisted..8

7b. Lemma awns feathery, at least the principal or central awn with an twisted column..................................................14

8a. Lemma 3-awned, central awn arising from sinus and the lateral awns arising dorsally or marginally, persistent, central awn not more than 10 mm long, lateral awns not more than 5 mm long...........................................9

8b. Lemma with a single 3-branched awn, deciduous, central awn more than 10 mm long, lateral awns usually more than 5 mm long...........................................15

9a. Central lemma awns geniculate with twisted column, apex of awn smooth..................................................10

9b. Central lemma awn straight, apex of awn scabrous......13

10a. Central lemma awns inserted below the middle, scarcely exserted from the spikelet, the awns 2.5–3 mm long, lateral lemma awns 1–1.5 mm long........\textit{Trisetaria glumacea}

10b. Central lemma awns inserted near the middle or upper \(\frac{1}{4}\), exserted from the spikelet, the awns 3–10 mm long, lateral lemma awns 1–5 mm long...........................................11

11a. Lemmas glabrous, central awns 5–7 mm long; lateral awns 1.5–5 mm long..................................................12

11b. Lemmas villous, central awns 3–4 mm long, lateral awns 1–1.5 mm long..................................................\textit{Triplachne nitens}

12a. Panicles loosely contracted, 0.5–3.5 cm wide, oblong-ovate; central lemma 5–8 mm long, lateral awns 1.5 mm long..................................................\textit{Trisetaria macrochaeta}

12b. Panicles densely contracted, 0.5–1 cm wide, linear; central lemma 8–15 mm long, lateral awns 3.5–5 mm long ..........\textit{Trisetaria linearis}

13a. Spikelets elliptic, 10–40 mm long; lemma with minutely bifid apex, awns curved, spreading, 5–15 mm long, lateral lemma awns arising dorsally, shorter than the central ...... \textit{Bromus danthoniae}

13b. Spikelets lanceolate, 4–6 mm long; lemma central awns 1.5–3 mm long, lateral lemma awns arising from the margins 0.5–1 mm long ..........\textit{Trisetaria glumacea}

14a. Spikelets 5–11-flowered; glumes 1.5–3 mm long, shorter than the spikelet; lemma pilose, margins ciliate, central awn inserted in the sinus, the awn 1.5–2.5 mm long, not geniculate or twisted ...\textit{Tiriraphis pumilio}

14b. Spikelets 2-flowered; glumes 4–5 mm long, longer than the spikelet; lemma entirely glabrous, shiny, central awn inserted dorsally on upper \(\frac{1}{2}\), the awn 2.5–3 mm long, geniculate and twisted \textit{Trisetaria glumacea}

15a. All three awns glabrous, lateral awns as long as the central awn; glumes unequal..................................................16

15b. Central and sometimes lateral awns plumose, lateral awns shorter than the central; glumes subequal..................\textit{Aristida adscensionis}

16a. Awns without a column, not articulating at the summit; ligule a ciliolate membrane........\textit{Aristida adscensionis}

16b. Awns with a column, articulating at the summit; ligule a fringe of hairs .................................................................17

17a. Spikelets 6–7 mm long; lemma awns 10–30 mm mm long ...........................................................................\textit{Aristida mutabilis}

17b. Spikelets 20–30 mm long; lemma awns 35–45 mm long .... \textit{Aristida funiculata}

18a. All three lemma awns plumose, lateral awns about as long as the central awn with or without a twisted column ....19

18b. Only the central lemma awn plumose, lateral awns much shorter than the central awn with a twisted column ......21

19a. Internodes densely woolly; panicles 5–10 cm long; central lemma awns 20–35 mm long, the column 3–5 mm long, twisted .................................................................\textit{Stipagrostis lanata}

19b. Internodes glabrous; panicles 10–40 cm long; central lemma awns 7–10 mm long, the column 0–1 mm long, straight or slightly twisted .................................................20

20a. Lower glumes longer than the upper; panicles 20–40 cm long; awns not or scarcely exserted from spikelets......... \textit{Stipagrostis scoparia}

20b. Lower glumes shorter than the upper; panicles 10–20 cm long; awns exserted from the spikelets.......................... \textit{Stipagrostis vulgarens}

21a. Nodes bearded; lemmas articulating near the middle (across the body) ..................................................\textit{Stipagrostis ciliata}

21b. Nodes not bearded; lemmas articulating near apex ......22

22a. Central lemma awns plumose throughout ..................23

22b. Central lemma awns glabrous in the lower and/or upper portions ..................................................25

23a. Callus glabrous; column straight or slightly twisted ........ \textit{Stipagrostis raddiana}

23b. Callus bearded; column twisted........................24

24a. Callus with 2 collars of hairs; column 7–13 mm long, hairy on the upper portion; central lemma awns 35–70 mm long, lateral lemma awns 10–25 mm long..............................\textit{Stipagrostis hirtigluma}

24b. Callus with a single collar of hairs; column 5–10 mm long, glabrous; central lemma awns 20–35 mm long, lateral lemma awns 10–12 mm long \textit{Stipagrostis uniplumis}
25a. Central lemma awns glabrous in the lower or upper portion ......................................................... 26
25b. Central lemma awns glabrous in the lower and upper portion .......................................................... 29
26a. Central lemma glabrescent toward tip .................................................. 27
26b. Central lemma awns glabrescent toward base ........................................... 28
27a. Callus glabrous; column 1.5–2 mm long; central lemma awns 13–25 mm long, lateral lemma awns 7–17 mm long ................................................................. Stipagrostis cvartii
27b. Callus bearded; column 11–14 mm long; central lemma awns 60–70 mm long, lateral lemma awns 17–25 mm long ........................................................................... Stipagrostis paradisea
28a. Lower glume apex obtuse; lemmas 2–2.5 mm long, central lemma awns 20–30 mm long, ................... Stipagrostis obtusa
28b. Lower glume apex acute; lemmas 3–4 mm long, central lemma awns 45–47 mm long .................. Stipagrostis shawii
29a. Column straight or slightly twisted, 1 mm long, central lemma awns 13–18 mm long............... Stipagrostis acutiflora
29b. Column twisted, 3–9 mm long, central lemma awns 25–60 mm long .................................................. 30
30a. Glumes 3-veined, lower glumes glabrous .................................................................................. 30
30b. Glumes 5–7-veined, lower glumes pilose ................................................................................... Stipagrostis multiwerta

Group 6: Spikelets prickly; inflorescence a simple raceme or panicle
1a. Lower glumes well developed, modified into a long flat recurved tail, upper glumes usually smaller, enfolding the lemmas, tuberculate Leptothriftium senegalense
1b. Lower glumes very small or suppressed, upper glumes and lemmas about equal with raised veins bearing hooked bristles ................................................................. 2
2a. Apical spikelets sterile; upper glumes 7-veined ................................................................. Tragus racemosus
2b. All spikelets fertile; upper glumes 5-veined ................................................................................. Tragus berteronianus

Group 7: Inflorescence tri- or dichotomously branched
1a. Panicles trichotomously branched and rebranched; spikelets 2 mm long; pedicels terete, club-shaped, slender .......... Sphenopus divaricatus
1b. Panicles dichotomously branched; spikelets 6–8 mm long; pedicels 3-angled .................................................. 2
2a. Spikelets 5–9 (–12)-flowered; glumes 3–5-veined ................................................................. Cutandia maritima
2b. Spikelets 2–4-flowered; glumes 1-veined ......... 3
3a. Panicles partially enclosed in the sheath below; panicle internodes longer in length than the spikelets; lemmas 7.5–8.5 mm long, apex awned, the awns 10–11 mm long ................................................................. Cutandia membranosa
3b. Panicles exerted not enclosed in the sheath; panicle internodes shorter in length than the spikelets; lemmas 4.5–5.5 mm long, apex acute or bidentate ........................................................................... Cutandia dichotoma

Group 8: Inflorescence subtended by spatheoles
1a. Inflorescence a single terminal spikelet, one-sided enclosed by spatheole; lemmas villous Lygeum spartum
1b. Inflorescence composed of many spikelets; lemmas not villous ................................................................. 2
2a. Inflorescence composed of male and female racemes ................................................................. 3
2b. Inflorescence composed of bisexual florets ................................................................. 5
3a. Female racemes sessile subtended by bony utricles; male racemes pedunculate projecting from the utricles Coix lacryma-jobi
3b. Female racemes subtended by 1 or more herbaceous spatheoles ................................................................. 4
4a. Female inflorescences 2–5 cm broad; rachises thick woody, enclosed by several leafy spatheoles Zea mays subsp. mays
4b. Female inflorescences less than 1 cm broad; rachises tough not woody, enclosed by single spatheole ................................................................. Zea mays subsp. mexicana
5a. Rachis with white hairs Hyparrhenia hirta
5b. Rachis pubescent or glabrous but not with white hairs .................................................. 6
6a. Spatheoles colored red or brown ................................................................. 7
6b. Spatheoles green ................................................................. 9
7a. Plants not aromatic; spikelets 6–14 mm long surrounded by hairs; callus bearded, the hairs red; lemma awns 20–70 mm long, straight, hispidulous Themeda triandra
7b. Plants aromatic; spikelets 4–5.5 mm long; callus not bearded; lemma awns 7–18 mm long, geniculate with a twisted column ................................................................. 8
8a. Lower glume of sessile spikelet veins distinct, winged; lemma awns 12-18 mm long. .......... Cymbopogon martini
8b. Lower glume of sessile spikelet veins absent or obscure and not winged; lemma awns 7-10 mm long. ................................................................. Cymbopogon jwarancusa
9a. Rachis villous; spikelet pedicels villous; lemmas unawned. ................................................................. Cymbopogon citratus
9b. Rachis ciliate; spikelet pedicels ciliate; lemmas awned ...
10a. Awns geniculate with a twisted column. .......... 11
10b. Awns straight ........................................................................................................ 14
11a. Plants aromatic; racemes 2 ................................................. 12
11b. Plants not aromatic; racemes 1 ................................. 13
12a. Lower glume of sessile spikelet elliptic lanceolate, usually 2- or 3-veined between the keels. .......... Cymbopogon nardus
12b. Lower glume of sessile spikelet narrowly lanceolate, usually veinless between the keels. .......... Cymbopogon flexuosus
13a. Lower glume of sessile spikelet pubescent with reddish hairs and not pitted, apex obtuse; lemma awns absent or to 10 mm long. .......... Themeda villosa
13b. Lower glumes of sessile spikelet glabrous, shining, pitted, apex acute; lemma awns 12-18 mm long. ................................................................. Dichanthium foveolatum
14a. Racemes 2-3 cm long; spatheoles 2-3 cm long; lower glume of sessile spikelet glabrous. ......................... Cymbopogon schoenanthus subsp. schoenanthus
14b. Racemes 1-2 cm long; spatheoles 1-2 cm long; lower glume of sessile spikelet pubescent. .......................... Cymbopogon schoenanthus subsp. proximus

Group 9: Inflorescence plumose, large 20-60 cm long, open; culms 4-8 m tall

1a. Culms solid; callus bearded with white silky hairs ................................................... 2
1b. Culms not solid; callus not bearded ........................................................................ 3
2a. Callus hairs white; panicles 25-40 cm long .................................................................... Saccharum spontaneum
2b. Callus hairs off-white; panicles up to 1 m long ................................................................. Saccharum officinarum
3a. Lemmas pilose, the hairs 4-9 mm long; rachilla glabrous; glumes longer than the florets. .......... Arundo donax
3b. Lemmas glabrous, rachilla hairy; glumes shorter than the florets ......................................... 4
4a. Rachilla hairs 4-7 mm long; upper glumes 3-5(6) mm long; leaf blades scabrid below .......... Phragmites karka
4b. Rachilla hairs 8-15 mm long; upper glumes 6-9 mm long; leaf blades smooth ................. Phragmites australis

Group 10: Inflorescence a simple spike, raceme or spikelike panicle

1a. Inflorescence a fragile cylindrical bilateral raceme with spikelets sunken in hollow of axes, glumes placed side by side covering the hollow ......................... 2
1b. Inflorescence not as above and without any sunken spikelets along the axis. .................... 4
2a. Keel of glume wingless; culms and racemes strongly curved ........................................... Parapholis incurva
2b. Keel of glume winged; culms and racemes usually straight ............................................................. 3
3a. Racemes bearing 5-10 spikelets; upper glume apices acute; lemma apices acute .......... Parapholis marginata
3b. Racemes bearing 10-20 spikelets; upper glume apices acuminate; lemma apices obtuse ...... Parapholis filiformis
4a. Spikes 1-sided ........................................................................ 5
4b. Spikes 2- or more sided ......................................................................................... 6
5a. Raceme not subtended by inflated leaf sheath; spikelets pectinate, solitary .......... Festuca pectinella
5b. Raceme subtended by an inflated leaf sheath; spikelets surrounding the rachis, not pectinately arranged ................................................................. Tetrapogon cenchriiformis
6a. Spikelets white-silky villous ...................................................................... Lasius scindicus
6b. Spikelets green ......................................................................................... 7
7a. Raceme subtended by an inflated leaf sheath ................................................................. Eliionurus royleanus
7b. Racemes not subtended by an inflated leaf sheath ...................................................... 8
8a. Racemes partially enclosed in the sheath ................................................................. Dichanthium foveolatum
8b. Racemes exerted, not enclosed in the sheath ...................................................... 9
9a. Inflorescence open, lax with remote spikelets .................................................. 10
9b. Inflorescence dense, narrow with approximate spikelets. ............................ 16
10a. Lower glumes absent; spikelets rotated 90° edgewise from the culm axis and packed adaxially ........................................................................ 11
10b. Lower glumes present; spikelets not rotated 90° edgewise from culm axis and packed laterally ........................................................................ 14
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20a. Spikelets in pairs, comprising 1 sessile and 1 pedicelled spikelet without rachilla extension; glumes dissimilar; central lemma awned from apex, not within a sinus

20b. Spikelets in group of 3 at each node, lateral spikelets staminate or sterile, central spikelets 1-flowered with bristlelike rachilla extension; glumes similar; central lemma awned from apex, not within a sinus

21a. Inflorescence rachis tough, not disarticulating at maturity.

21b. Inflorescence rachis fragile, disarticulating at maturity

22a. Awns of fertile lemma stout, 4–15 cm long; 2 lateral florets sessile; glumes silky hairy

22b. Awns of fertile lemma slender, not more than 3 cm long; 2 lateral florets pedicelled; glumes not silky hairy

23a. Margin of glumes eciliate; lemma awns 10–24 mm long

23b. Margin of glumes ciliate; lemma awns 18–50 mm long

24a. One glume of the lateral spikelets expanded below into a broad or narrow wing

24b. Both glumes of the lateral spikelets not expanded below into a broad or narrow wing

25a. Leaf blades green; anthers of central spikelets 0.7–1.4 mm long; prolongation of rachilla of lateral spikelets 3–4 mm long, slender

25b. Leaf blades glaucous; anthers of central spikelets 0.2–0.5 mm long; prolongation of rachilla of lateral spikelets 1–2 mm, stout

26a. Glumes rounded over the midveins, lateral veins distinct

26b. Glumes keeled over the midveins, lateral veins not always distinct

27a. Spikes moniliform (resembling a string of beads), swollen at base; disarticulating at the base of the spikelet

27b. Spikes not moniliform or swollen at base; disarticulating at the base of the internode

28a. Spikes 10–20 cm long; glumes unawned; only the terminal spikelets with 2 long stout awns

28b. Spikes 1–8 cm long; glumes awned or unawned; terminal spikelet with awns no different than those below

29a. Spikes 4–8 cm long; glume apex bidentate; principal lemma awns 30–60 mm long

29b. Spikes 0.5–5 cm long; glumes apex not bidentate; principal lemma awns ≤30 mm long
30a. Glumes with veins unequal in width, unequally spaced and sunk into the surface of the glume .............................................................. Aegilops geniculata

30b. Glumes with veins equal in width, equally spaced, riblike and protruding from the surface of the glume .........................................................

31a. Palea shorter than the body of the lemma; lemma awns 2 or 3 awns ................................................................. Aegilops kotschyi

31b. Awns of lower glumes of unequal width below and unequal in length; glumes of lowest fertile spikelet always with 3 awns .........................................................

32a. Lemma awns up to 15 cm long (cultivated wheat) ................... 33

32b. Lemma awns 0-7 mm long (wild plants) ............................... 36

33a. Inflorescence rachis fragile, disarticulating at maturity; upper glumes apex emarginate; lemma awns 10-15 cm long ......................................................... Triticum aestivum

33b. Inflorescence rachis tough, not diararticulating at maturity; upper glumes apex with a unilateral teeth, truncate or 1-awned ..........................................................

34a. Glumes keeled above; winged on keeled, rounded below; upper glumes apex with a unilateral teeth; truncate or 1-awned, awns 0-40 mm long; lemma awns 0-15 cm long Triticum aestivum

34b. Glumes keeled from the bases to the apex; upper glumes apex with unilateral teeth, truncate; lemma awns 8-15 cm long ..............................................................

35a. Spikelets with 2-3 fertile florets ...................... Triticum durum

35b. Spikelets with 3-5 fertile florets ...................... Triticum turgidum

36a. Perennials; racemes tough; anthers 3-5 mm long ................. Agropyron cristatum

36b. Annuals; racemes fragile; anthers < 1.5 mm long ................

37a. Palea at least as long as the body of the lemma; lemma awned, the awns 5-7 mm long; upper glumes awned, the awns 5-7 mm long .......................... Eremopyrum distans

37b. Palea shorter than the body of the lemma; lemma unawned or with a short awn, the awns up to 3 mm long; upper glumes unawned ............ Eremopyrum bonaepartis

Group 11: Panicles spiciform, narrow usually < 1 cm wide

1a. Panicles silky with the spikelets enveloped in long silky white hairs originating from the callus .......................................................... Imperata cylindrica

1b. Panicles not silky and callus not long hairy ............................ 2

2a. Base of glumes dilated forming a bulblike swelling ................ Gastridium phleoides

2b. Base of glumes not dilated ................................................................. 3

3a. Panicle branches consisting of clusters each with 3 sterile spikelets ± covering 2 smaller spikelets, one of which is fertile ........................................... Lamarckia aurea

3b. Panicle branches not as above ................................................. 4

4a. Spikelets awned (lemma and/or glumes) ............................... 5

4b. Spikelets unawned ................................................................. 13

5a. Glumes awned ........................................................................ 6

5b. Glumes unawned; lemmas awned or mucronate ............ 9

6a. Lemmas awned ........................................................................ 7

6b. Lemmas unawned ................................................................. 8

7a. Lower glume mucronate, the mucro 0.5–1 mm long; upper glume awns 1.5–6 mm long; fertile lemma apex entire; sterile lemma awn hooked ......... Holcus annuus

7b. Lower glume awns 3–7 mm long; upper glume awns 4–7 mm long; lemma apex dentate, 4-fid; lemma awns not hooked .......................... Polypogon monspeliensis

8a. Lower and upper glumes awns 1–2 mm long ......................... Phleum pratense

8b. Lower and upper glumes awns 3-7 mm long ....................... Polypogon maritimus

9a. Lemma apex entire, mucronate or awned, the awns up to 2 mm long .......................................................... Trisetaria koeleroides

9b. Lemmas usually awned, the awns 1-16 mm long ............. 10

10a. Lemma awns 8-16 mm long, the geniculate awn arising dorsally near the base of the lemma ................................................................. Alopecurus myosuroides

10b. Lemma awns 1–5 mm long; the straight awn arising near or just below the apex of the lemma ................................................. 11

11a. Glumes subequal, the lower minutely longer than the upper and often densely wooly ...................... Rostraria pumila

11b. Glumes unequal, the lower shorter and narrower than the upper, the lower never densely wooly, usually glabrous or with a few scattered hairs ........................................ 12

12a. Panicles oval in outline, bristly; lemma surface setose, the hairs 0.5 mm long; lemma awns 3-5 mm long ................................................. Rostraria hispida

12b. Panicles linear or oblong in outline, not bristly; lemma surface not setose; lemma awns 1-3 mm long ........................................... 13
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13a. Panicles branches pubescent; lower glumes pubescent; lemma awns subterminal, scabrous. Rostraria rohlsii

13b. Panicles branches glabrous; lower glumes glabrous or pubescent; lemma awns terminal, glabrous. Rostraria cristata

14a. Glume keel winged .......................... 15
14b. Glume keel not winged ...................... 20

15a. Glume with 2 teethlike projections just above the middle. Phalaris paradoxa

15b. Glume without 2 teethlike projections just above the middle ........................................ 16

16a. Wings broad, margins erose or denticulate .................. 17
16b. Wings narrow, margins entire .............................. 18

17a. Perennials; culms with a swollen base or pseudocorm; sterile spikelets surrounding the fertile spikelet; lemmas glabrous or with a few hairs near apex. Phalaris coerulescens

17b. Annuals; culms without a swollen base; sterile spikelets not surrounding the fertile spikelet; lemmas pubescent. Phalaris minor

18a. Inflorescence capitate, wider near base; caespitose annuals ........................................ Phalaris canariensis
18b. Inflorescence oblong, not wider near base; rhizomatous perennials ........................................ 19

19a. Panicles interrupted below; rhizomes long and creeping; ligules 6–10 mm long. Phalaris arundinacea

19b. Panicles not interrupted below; rhizomes short and knotty; ligules 2–4 mm long. Phalaris aquatica

20a. Lemmas pilose with tubercle-based hairs, the hairs 4–5 mm long. Melica persica
20b. Lemmas not long pilose or with tubercle-based .................................................. 21

21a. Glumes deciduous ............................................. 22
21b. Glumes persistent ............................................. 23

22a. Spikelets with 6–12 florets; palea keels pectinate-ciliate, the hairs nearly 1 mm long; ligule a ciliate membrane; lemma apex obtuse Eragrostis ciliaris

22b. Spikelets with 1 floret; palea keels not pectinate-ciliate; ligule a line of hairs; lemma apex acute. Sporobolus spicatus

23a. Lemma surface pubescent with clavate hairs; lemma apex truncate Phleum subulatum

23b. Lemma surface glabrous or pubescent but without clavate hairs; lemma apex acute or obtuse ........................................ 24

24a. Culms 60–150 cm tall, erect and reedlike; spikelets 10–16 mm long; panicles 7–22 cm long. Calamagrostis arenaria
24b. Culms 5–50 cm tall, decumbent, geniculate or mat-forming; spikelets 2–7 mm long; panicles 1–7.5 cm long. 25

25a. Spikelets 1-flowered, 2–2.5 mm long; lemmas 1-veined, 2–2.5 mm long; glumes shorter than the florets. Sporobolus alopecuroides

25b. Spikelets 3–5-flowered, 3–77 mm long; lemmas 5-veined, about 4 mm long; glumes slightly longer than the florets. Rostraria obtusiflora

Group 12: Panicles contracted, 0.5–3 (–4) cm wide

1a. Upper and/or lower glumes awned ........................................ 2
1b. All glumes unawned ............................................. 3

2a. Lower glume awned, the awns 3–5 mm long; upper glume awns 7–8 mm long; lemmas 6–7 mm long; spikelets 7–10 mm long. Festuca brevis

2b. Lower glume unawned; upper glume awns 4–6 mm long; lemmas 8–18 mm long; spikelets 12–16 mm long. Festuca fasciculata

3a. Principal lemmas awned .............................................. 4
3b. Principal lemmas unawned ............................................ 9

4a. Lemmas hairy between the veins with 2–8 transverse rows of hair tufts; lemma awns 3–5 mm long. Festuca bromoides

4b. Lemmas not hairy between veins or with transverse rows of hair tufts; awns 5–15 mm long .................................. 6

5a. Culms 50–120 cm tall, robust; panicles 17–35 cm long; anthers 1.4–2.7 mm long. Centropodia fragilis

5b. Culms 10–50 cm tall, smaller; panicles 2–15 (~20) cm long; anthers 0.7–1.3 mm long. Centropodia forskalii

6a. Lemma apex bidentate Bromus fasciculatus

6b. Lemmas apex entire .................................................. 7

7a. Panicles curved or nodding.......................... Festuca myuros

7b. Panicles straight, not curved or nodding .................. 8

8a. Lemmas awns 5–12 mm long; callus rounded, about 0.2 mm long; glumes similar.................. Festuca bromoides

8b. Lemma awns 15–25 mm long; callus pointed, 0.5–0.8 mm long; glumes dissimilar. Festuca fasciculata

9a. Spikelets 1-flowered .............................................. 10
9b. Spikelets 3–10-flowered .............................. 13
10a. Lemmas 1-veined; ligule a line of hairs; glumes as long or shorter than the floret ........................................ 11
10b. Lemmas 3 or 5-veined; ligule membranous; glumes longer than the floret .......................................................... 12
11a. Leaf blades stiff and pungent, conspicuously distichous; glumes ½ to as long as the floret; lower glume apex acute. .......................................................... Sporobolus pungens
11b. Leaf blades not stiff, pungent or distichous; glumes <1/2 as long as the floret; lower glume apex obtuse ..................

12a. Glumes shiny and glabrous, scaberulous only along the keel; lemmas 1.5–2.3 mm long, apex obtuse; anthers 1–1.5 mm long ........................................... Agrostis stolonifera
12b. Glumes scabrous throughout, roughened and not shiny; lemmas 1–1.5 mm long, apex truncate; anthers 0.5–0.8 mm long ............................................. Polypogon viridis

13a. Lemmas 3-veined, 1.4–1.5 mm long, membranous, apex acute; glumes deciduous ........................................... Eragrostis sermreta
13b. Lemmas 5–7-veined, 2–7.5 mm long, coriaceous, apex obtuse or truncate; glumes persistent ........................................ 14

14a. Spikelets with 3–10 fertile florets, if sterile florets present these located above the fertile ones; lemmas 2–2.5 mm long, apex obtuse; stamens 3; anthers about 0.3 mm long. .......................................................... Catapodium rigidum
14b. Spikelets with a single upper fertile floret and two basal sterile florets; lemmas 3.5–7.5 mm long, apex truncate; stamens 6; anthers 3–4 mm long ............... Ehrharta calycina

**Group 13: Spikelets awned; panicles open**

1a. Lemma awns (8–)10–30 cm long, feathery ........................................ 2
1b. Lemma awns much shorter, usually < 5 cm long, glabrous or scabrous ............................................................................. 5
2a. Awns conspicuously twisted together with adjacent spikelet awns forming a tail; annuals .......... Stipella capensis
2b. Awns not conspicuously twisted together with others and not forming a tail; perennials ......................................................... 3
3a. Awns plumose for their whole length, the hairs 0.5–1.3 mm long ................................................................................. Stipa arabica
3b. Awns scabrid or pubescent, the hairs < 0.3 mm long ......... 4
4a. Awns 20–25 cm long, pubescent ...................... Stipa lagascae
4b. Awns 6–13 cm long, scabrous .................. Stipella parviflora
5a. Spikelets usually flushed with purple; awns of lemmas inserted from the base, the column with a clavate upper limb, brownish, with a ring of hairs at the junction .......... Corynophorus divaricatus
5b. Spikelets green; awns of lemmas subapical or inserted near the middle, the column never clavate or with a ring of hairs at the junction ........................................ 6
6a. Spikelets all solitary .................................................. 7
6b. Spikelets in pairs usually with a sessile and pedicellate or in triplets with two pedicellate and one sessile ......... 30
7a. Spikelets (10–) 15–60 mm long ........................................ 8
7b. Spikelets 1.5–12 mm long ............................................. 36
8a. Glumes longer than the spikelet; lemma awns geniculate with a strongly twisted column; ovaries pubescent all over ................................................................. 9
8b. Glumes much shorter than the spikelet; lemma awns usually straight and not geniculate; ovaries pubescent only near the apex ....................................................... 15
9a. Tips of lemmas bidentate with awned teeth, the teeth awns usually 1–1.5 cm long .............................................. 10
9b. Tips of lemmas bidentate with unawned teeth or with the awns of the teeth much shorter than 0.8 mm long ......... 12
10a. Spikelets erect; callus elongated, 4.2–6 mm long; lower glumes 25–40 mm long .................. Avena longiglumis
10b. Spikelets pendulous; callus obtuse, < 2 mm long; lower glumes 16–26 mm long ......................................................... 11
11a. Spikelets (1.8–) 2–3 cm long; lower lemma 1.6–2 cm long ................. Avena barbata subsp. barbata
11b. Spikelets 1.4–1.8 cm long; lower lemma 1.2–1.4 cm long ...... Avena barbata subsp. wiestii

12a. Floret callus glabrous; lemmas glabrous .......... Avena sativa
12b. Floret callus hairy; lemmas hairy on the lower 1/3 .......... 13
13a. Lemmas dark brown; rachilla not disarticulating at maturity .......................................................... Avena fatua
13b. Lemmas green; rachilla disarticulating between the florets at maturity ......................................................... 14
14a. Glumes 30–50 mm long; lowest lemmas 25–40 mm long .......................................................... Avena sterilis subsp. sterilis
14b. Glumes 25–30 mm long; lowest lemmas 20–25 mm long ......................................................... Avena sterilis subsp. ludoviciana
15a. Spikelets 45–60 mm long; lemmas awns 45–60 mm long .......................................................... 16
15b. Spikelets less than 45 mm long; lemmas awns 4–40 mm long .......................................................... 17
16a. Panicles lax, spreading, broadly ovate, the branches longer than spikelets; base of lemmas in profile, contracted just above the callus; callus blunt with an oval scar .......................... Bromus diandrus var. diandrus

16b. Panicles contracted, stiffly erect, narrowly ovate, the branches usually shorter than the spikelets; base of lemma in profile, continuous with callus; callus pointed with an elliptic scar .......................... Bromus diandrus var. rigidus

17a. Lower glumes 1-veined; upper glumes 3-veined; lemma awns not more than 20 mm long.......................................... 18

17b. Lower glumes 3-9-veined; upper glumes 5-13-veined; awns usually 15-40 mm long ............................................. 21

18a. Panicles branches compound bearing (3-) 5-8 fertile spikelets.......................... Bromus tectorum var. tectorum

18b. Panicles branches simple bearing 1-3 fertile spikelets.... 19

19a. Panicles branches bearing 1-3 fertile spikelets; spikelet pedicels ≤ 1 cm long; lemmas 10-20 mm long...................... 20

19b. Panicles branches bearing a single fertile spikelet; spikelet pedicels usually > 3 cm long; lemmas 15-40 mm long..................... .......................... Bromus sterilis

20a. Plants perennial and rhizomatous; lemmas awnless, mucronate or short-awned, the awns up to 1.5 mm long.......................................................... Bromus inermis

20b. Plants annuals, caespitose; lemmas awned, the awns 12-20 mm long.................................................. 29

21a. Lemma awns curved and reflexed-spreading......................... 22

21b. Lemma awns straight ................................................................. 23

22a. Lemmas coriaceous with inconspicuous veins; margins of lemma not involute but overlapping the back of the adjacent lemma; ligules 1-3 mm long........ Bromus japonicus

22b. Lemmas membranous with conspicuous veins; margins of lemma somewhat involute at maturity, not overlapping the back of the adjacent lemma but wrapped around the caryopsis; ligules 3-6 mm long .......... Bromus pulchellus

23a. Lemma awns briefly coiled at the base .............................................................................................................. 24

23b. Lemma awns not coiled at the base ............................................. 26

24a. Spikelets 10–15 mm long, 2–3 mm wide; lemmas 6-11 mm long.......................................................... Bromus scoparius

24b. Spikelets (12-) 25–50 mm long, 3–16 mm wide, lemmas 11–18 mm long.................................................. 25

25a. Leaf blades 3–5 mm wide; lemma awns 11-20 mm long; spikelets 3-7 mm wide........ Bromus alopecurus

25b. Leaf blades 1-2.5 mm wide; lemma awns 6-12 mm long; spikelets 6-16 mm long .................. Bromus lanceolatus

26a. Lemmas strongly keeled; spikelets strongly laterally compressed.......................................................... Bromus catharticus

26b. Lemmas rounded on the back; spikelets terete to moderately laterally compressed........................................... 27

27a. Glumes with ciliolate margins; culms nodes swollen........ Bromus egyptiacus

27b. Glumes without ciliolate margins; culm nodes not swollen ........................................................................... 28

28a. Lemmas 5.5–6.5 mm long; lemma awns 3–7 mm long, terete near base, straight; caryopsis longer than the palea, often visible beyond the tip of the lemma... Bromus lepidus

28b. Lemmas 8–17 mm long; lemma awns 5–17 mm long, flattened near base, straight or slightly divergent; caryopsis shorter than the palea, concealed within the floret.... 29

29a. Lemmas 5–7–veined, 2–4 mm wide, glabrous or pubescent, narrowly lanceolate in profile; lemma awn arising 2–3 mm below the tip; anthers 1 mm long; lower glumes usually 3-veined .................................................. Bromus pectinatus

29b. Lemmas 7–9 (–11)-veined, 4.5–5.5 mm wide, hisrate, narrowly oblanceolate in profile; lemma awn arising 0.7–1.9 mm below the tip; anthers 2–2.5 mm long; lower glumes 3–7–veined.......................... Bromus hordeaceus

30a. Spikelets in triplets with two pedicellate and one sessile..... 31

30b. Spikelets in pairs, fertile spikelets sessile and sterile spikelets pedicelled.............................................. 32

31a. Panicles branches villous with white or dark brown hairs; fertile lemmas glabrous without transverse tufts of hairs; leaf blade apices not stiff and pungent, margins not white cartilaginous; upper glume of fertile lemma plumose........ Bromus aegyptiacus

31b. Panicle branches scaberulous without white or dark brown hairs; fertile lemmas with transverse tufts of hairs, the hairs 4–5 mm long; leaf blade apices stiff and pungent with conspicuous white cartilaginous margins; upper glume of fertile lemma unawned...... Danthoniopsis barbata

32a. Column of the lemma awns pubescent, hairy on the spiral; paleas present .......................................................... 33

32b. Column of the lemma awns glabrous, not hairy on the spiral; paleas absent or minute................................................. 34

33a. Apex of lower glume dentate, 3-fid; awns of upper lemma 10–16 mm long; plants perennial, rhizomatous .................. Sorghum halepense

33b. Apex of lower glume entire; awns of upper lemma up to 10 mm long; plants annual or short-lived perennials, not rhizomatous ................................. Sorghum bicolor

34a. Lower glumes pubescent with white or yellow hairs.......... Sorghum arundinaceum
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Group 14: Spikelets unawned; panicles open

1a. Both glumes absent or obscure ........................................2

1b. Both glumes or at least the upper present ........................3

2a. Spikelets 8–11 mm long, 2.5–3.5 mm wide, persistent; lemma apex mucronate or awned, the awns up to 160 (cult.) ...................... Oryza sativa

2b. Spikelets 3.4–4.8 (–5.2) mm long, 1.2–1.4 (–1.7) mm wide, disarticulating entire; lemma apex entire, not mucronate or awned ..................... Leersia hexandra

3a. Primary panicles branches whorled, at least on the lower nodes ........................................................................... 4

3b. Primary panicles branches not whorled at most nodes .............................................................. 10

4a. Lemmas pubescent, hairy below and along the veins ......5

4b. Lemmas glabrous throughout ......................................................................................................................... 6

5a. Lemma apex apiculate; anthers 1.4–2.6 mm long ......................... Poa diaphora

5b. Lemma apex not apiculate; anthers 0.3–0.7 (–1) mm long .............. Poa persica

6a. Glumes longer than the florets, persistent .........................7

6b. Glumes ≤ the florets, deciduous or persistent ......................8

7a. Roots aromatic; lower glumes surface spinose, glumes dissimilar; spikelets 3.5–5 mm long ............................................. Chrysopogon zizanioides

7b. Roots not aromatic; lower glumes surface not spinose, glumes similar; spikelets 1.8–3 mm long ........................................ Agrostis stolonifera

8a. Spikelets dorsally compressed with a 5-veined sterile lemma just below the fertile lemma; leaf blades usually 12–35 mm wide ............... Megathyrsus maximus

8b. Spikelets laterally compressed without a sterile lemma below the fertile lemma, the fertile lemma 1-veined; leaf blades 1–10 mm wide .................... Sporobolus ioclados

9a. Panicles 3–20 cm long; apex of lower glumes obtuse; anthers 0.7–1 mm long .................................................... Sporobolus wrightii

9b. Panicles 20–60 cm long; apex of lower glumes acute; anther 1.1–1.3 mm long ........................................... Sporobolus australis

10a. Spikelets pendulous; lemmas orbicular, gibbous, and auriculate near base ................................................................. 11

10b. Spikelets not pendulous; lemmas not orbicular, gibbous or auriculate near base ....................................................... 12

11a. Spikelets 3–5 mm long, 3–5 mm wide; apex of lemma not cuspidate .......................................................... Briza minor

11b. Spikelets 14–25 mm long, 8–15 mm wide; apex of lemma cuspidate .......................................................... Briza maxima

12a. Spikelets in pairs with a fertile sessile and sterile pedicelled .......................................................... Sorghum bicolor

12b. Spikelets not in pairs ......................................................................................................................... 13

13a. Lemmas with white capitate hairs near base, the hairs 0.2 mm long ................................................................ Desmazeria philistaea

13b. Lemmas without white capitate hairs ........................................................................................................ 14

14a. Glumes and lemmas pilose with white tubercle-based hairs ................................................................ Tricholaena tenerifae

14b. Glumes and lemmas not pilose or, if hairy, the hairs not white and tubercle-based ................................................................................. 15

15a. Lemma apex bifid and dentate ........................................................................................................ 16

15b. Lemma apex not bifid or dentate ......................................................................................... 19

16a. Spikelets 15–25 mm long; lemmas 10–13 mm long; ovary pubescent on the apex; rhizomatous perennials ........................................ Bromus inermis

16b. Spikelets ≤ 7 mm long; lemmas 1.2–3.3 mm long; ovary glabrous throughout; caespitose annuals or perennials ..................................... 17

17a. Spikelets 1.5–2.4 mm long, persistent; lower glumes without veins ................................................................ Melinis minutiflora

17b. Spikelets 4–7 mm long, deciduous with the pedicels; lower glumes 5–7-veined ............................................................................. 18

18a. Lemmas 2–3.5 mm long, apical lobes narrowly triangular,
A key to the grasses (Poaceae) of Egypt

0.6‒1.3 mm long; palea shorter than the lemma. ................................. Schismus arabicus

18b. Lemmas 1.5‒2 mm long, apical lobes broadly triangular, 0.3‒0.4 mm long; palea ≥ the lemma in length ................................. Schismus barbatus

19a. Spikelets all 1-flowered with no additional florets ................. Sporobolus wrightii

19b. Spikelets with more than a single floret........................................ 20

20a. Spikelets with one fertile floret and 1 or 2 sterile florets.............. 21

20b. Spikelets with 3‒10 fertile florets ................................................. 28

21a. Spikelets laterally compressed, each spikelet with 2 basal sterile florets; fertile florets with 6 stamens ........................................... Ehrharta calycina

21b. Spikelets dorsally compressed, each spikelet with 1 basal sterile floret; fertile florets with 3 stamens ................................. 22

22a. Upper fertile lemma faintly to strongly rugose .......................... Megathyrsus maximus

22b. Upper fertile lemma smooth ......................................................... 23

23a. Spikelets 3.5‒5.5 mm long .............................................................. 24

23b. Spikelets 2‒3.2 (‒3.5) mm long ....................................................... 25

24a. Plants annual without woody culms or resembling bushes; leaf blade apices not pungent .......................... Panicum miliaceum

24b. Plants perennial with woody culms resembling bushes; leaf blade apices pungent ........................................... Panicum turgidum

25a. Lower glumes ½‒2/3 the length of the spikelet; lemmas apex acute ........................................... Panicum antidotale

25b. Lower glumes up to ½ the length of the spikelet ......................... 26

26a. Plants with a knotty rootstock; lower glume membranous, 1‒3 (‒7)-veined.............................................. Eragrostis tenuifolia

26b. Plants without a knotty rootstock but with slender rhizomes or stolons; lower glumes hyaline, usually unveined, rarely 3-veined.............................................. Eragrostis pilosa

27a. Plants erect with spreading rhizomes; leaf sheaths tough, woolly on the margins when young; leaf blade apices pungent; ligules 0.3‒0.5 mm long. ................................. Panicum repens

27b. Plants with stolons; leaf sheaths loose, papery, glabrous on the margins; leaf blade apices not pungent; ligules 0.8‒2 mm long. .............................................. Panicum hygrocharis

28a. Lemmas 5-veined............................................................................ 29

28b. Lemmas 3-veined ....................................................................... 32

29a. Spikelets 10‒18 mm long; lemmas 6‒9 mm long; culms 50‒150 cm tall; leaf blades 4‒10 mm wide .................................. Lolium arundinaceum

29b. Spikelets 2‒10 mm long; lemmas 2‒5 mm long; culms ≤ 65 cm tall; leaf blades 1‒5 mm wide .................................................. 30

30a. Plants perennial forming a bulbous base composed of old leaf sheaths; anthers 1.5‒2.5 mm long; apex of ligule obtuse ........................................... Poa sinaica

30b. Plants annual or short-lived perennials, not forming a bulbous base of old leaf sheaths; anthers ≤ 1.1 mm long; apex of ligule obtuse .......... 31

31a. Anthers 0.6‒1 (‒1.1) mm long; spikelets crowded or sparsely arranged on the branches. Poa annua

31b. Anthers 0.1‒0.5 mm long; spikelets always crowded on the branches. Poa annua

32a. Plants perennial, forming innovations at the basal nodes; caryopses narrowly triangular in cross section, strongly laterally flattened with a deep ventral groove. Eragrostis tenuifolia

32b. Plants annual, usually tufted, without innovations at the basal nodes; caryopses not narrowly triangular in cross section or strongly laterally flattened, without a deep ventral groove ........................................... 33

33a. Palea keels prominently ciliate, the cilia 0.2‒1 mm long 34

33b. Palea keels smooth or scabrous the scabridities < 0.2 mm long ........................................... 35

34a. Spikelets 2.2‒3 mm long; lemmas and culms without glands; lemmas (0.8‒) 1‒1.2 mm long, oblong; anthers 2... Eragrostis lepida

34b. Spikelets 6‒20 mm long; lemmas with crateriform glands on the keels, similar glands also often present below the nodes; lemmas 2‒2.8 mm long, broadly ovate; anthers 3... Eragrostis ciliaris

35a. Ligules membranous, neither ciliolate or ciliate ........................... Eragrostis japonica

35b. Ligules membranous and ciliolate to ciliate, the cilia often longer than the basal membrane ............................................. 36

36a. Plants with glandular pits or bands somewhere, the locations various, including any or all of the following: below the caulinle nodes, on the sheaths, blades, rachises, panicle branches or pedicles, or on the keels of the lemmas and paleas ............................................. 37

36b. Plants without glandular pits or bands ......................................... 40

37a. Spikelets 1‒1.4 mm wide; pedicels 1–10 mm long, lax appressed or divergent Eragrostis pilosa

37b. Spikelets 1.1‒4 mm wide; pedicels 0.2‒4 mm long, stiff, straight, usually divergent ............................................. 38
38a. Lemmas 2–2.8 mm long with 1–3 crateriform glands along the keels; spikelets 6–20 mm long, 2–4 mm wide, with 10–40 florets; disarticulation below the florets, the rachillas persistent; anthers yellow. Eragrostis ciliaris

38b. Lemmas 1.4–1.8 mm long, rarely with 1 or 2 crateriform glands along the keels; spikelets 4–7 (–11) mm long, 1.1–2.2 mm wide, with 7–12 (–20) florets; disarticulation below the lemmas, both the paleas and rachillas usually persistent; anthers reddish-brown. Eragrostis cilianensis

39a. Panicles with glandular regions below the nodes, the glandular tissue forming a ring or band, often shiny or yellowish; blade margins without crateriform glands; pedicels without glandular bands. Eragrostis barrelieri

39b. Panicles sometimes with glandular areas, but rarely rings of glandular spots or crateriform pits below the nodes, the glands usually dull greenish-gray to straminious; blade margins sometimes with crateriform glands; pedicels usually with glandular bands. Eragrostis minor

40a. Lemmas 1.6–3 mm long; florets persistent and the grain retained within; caryopses 0.3–1.3 mm long obovoid, smooth, light brown to white; plants cultivated, occasionally escaping. Eragrostis tef

40b. Lemmas 1.2–1.7 mm long; florets deciduous, the grains not retained within; caryopses 0.4–0.9 mm long, ovoid, orbicular to prism-shaped or isodiametric, smooth or striate, brownish; plants native or established introductions. Eragrostis minor

41a. Spikelets 5–25 mm long, 10–60-flowered; anthers 2. Eragrostis tremula

41b. Spikelets 3–15 mm long, 4–20 flowering; anthers 3. Eragrostis porteriana

42a. Lower glumes 1.5 mm long, about as long as the upper glume, 1-veined; panicle branches not whorled at the lower nodes; lemma apex truncate or obtuse; caryopses orbicular, isodiametric. Eragrostis aspera

42b. Lower glumes 0.5–0.7 mm long, ½ to 2/3 as long as the upper glume, unveined; panicle branches whorled at the lower nodes; lemma apex acute or obtuse caryopses ellipsoid. Eragrostis pilosa

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