



A revision of *Cenchrus* incl. *Pennisetum* (*Gramineae*) in Malesia with some general nomenclatural notes

J.F. Veldkamp¹

Key words

Cenchrus frutescens
Gramineae
history

Abstract Recent molecular research has confirmed that *Cenchrus* and *Pennisetum* (*Gramineae*) should be united. For nomenclatural, not practical, reasons, *Cenchrus* is accepted as the correct name. In Malesia there are 16 species. A key, descriptions, and notes are provided. Observations on the nomenclature are given. Some typifications are discussed, e.g. of *Cenchrus frutescens*. Three new combinations, one neotype and three lectotypes are designated.

Published on 22 August 2014

INTRODUCTION

Cenchrus L. s.s. (*Gramineae*) long has been regarded as closely related to *Pennisetum* Rich., differing mainly by the usually retrorsely barbed bristles at least basally connate and the chromosomal allopolyploid base number $x = 17 (8 + 9)$. Donadio et al. (2009) found that *Cenchrus* is nested in *Pennisetum*. Morrone in Chemisquy et al. (2010) made the 'necessary' new combinations in *Cenchrus*, apparently more induced by the molecular 'evidence' than the nomenclatural stability of the majority of the species.

Cenchrus

Linnaeus (1753) described five species in *Cenchrus* (*Gramineae*). He (1742) arbitrarily used *Cenchrus* for what had been described as *Panicastrella* P.Micheli (1729) and included species that now belong to three different subfamilies: the *Chloridoideae-Cynodonteae*, *Panicoideae-Paniceae*, and *Pooideae-Poeae*.

The name is derived from the ancient Greek κενχρ(ι)ος, *Cenchrus*. This is the classical Greek name for millet, *Panicum miliaceum* L. Lunell (1915) referred to a *Cenchrus* by the Greek physician Hippocrates (fl. 400 BC) in a work that he abbreviated to 'Morb.', but which I have not found. The word does not refer to something piercing as Gledhill (2008: 97) has it. Possibly he confused it with κεντρον, kentron, sharp point, spur, etc.: *Kentranthus* Raf.: flowers spurred.

Of the Linnaean species *C. capitatus* L. is now *Echinaria capitata* (L.) Desf. (*Poeae*), and *C. racemosus* L. has become *Tragus racemosus* (L.) All. (*Cynodonteae*). For the enigmatic *C. frutescens* L., see below.

Only *C. echinatus* L. and *C. tribuloides* L. (*Paniceae*) have remained while on the other hand the genus up till recently increased to about 42 species.

Cenchrus and *Pennisetum* have always been regarded as closely related. *Cenchrus* would differ mainly by the usually retrorsely barbed bristles at least basally connate and the chromosomal allopolyploid base number $x = 17 (8 + 9)$.

Chrték & Osbornova (1996) have proposed a complicated subdivision of *Cenchrus*, where e.g. *C. ciliaris* L. and *C. setigerus* Vahl are in two different subgenera. Martel et al. (2004: 139) found the only *Cenchrus* they included, *C. ciliaris*, to nest within *Pennisetum*. As the generic position of this species has been contentious, this only supports the notion that it belongs in *Pennisetum* s.s.

Donadio et al. (2009) with more species also observed that *Cenchrus* is nested in *Pennisetum*. After the recent unification by Chemisquy et al. (2010) with the much larger *Pennisetum* there are about 110. The lectotype is *C. echinatus*, designated by Nash (1913: 166).

In general the species are considered to be noxious weeds because of their spiny burs.

The grains of some species are highly nutritious (*C. brownii* Roem. & Schult., *C. biflorus* Roxb., *C. prieurii* (Kunth) Maire). See Brink (2006).

Panicastrella

The name *Panicastrella* P.Micheli (1729) refers to the supposed similarity of the plant to *Panicum*. The 'genus' included two American 'species', actually a splitting up of what Sloane (1696, 1707) had described as *Gramen echinatum, maximum, spica rubra seu alba*, a red and a white form of *C. echinatus*.

In post-Linnaean times Moench (1794: 205) validated the name. It is a nomen rejiciendum against *Echinaria* Desf. (1799: 385). He included two species, now belonging to two different genera: *Panicastrella capitata* (L.) Moench, based on *C. capitatus* L., now *Echinaria capitata* (L.) Desf., and *Panicastrella muricata* Moench, a superfluous name for *C. echinatus*.

Echinaria

Echinaria Desf. (1799: 385) is restricted now to *E. capitata*. It is conserved against *Echinaria* Heist. ex Fabr. (1759: 206), a superfluous name for *Cenchrus* (Briquet et al. 1905: 73).

Tragus

Tragus was published by Haller (1768) without a specific combination, but clearly referring to *C. racemosus* L. The combination was made by Allioni (1785: 241): *T. racemosus* (L.) All. The

¹ Naturalis Biodiversity Center, section Botany, P.O. Box 9517, 2300 RA Leiden, The Netherlands; e-mail: jef.veldkamp@naturalis.nl

name is derived from *τραγος*, goat, or the plants that goats eat. Goats will eat anything, even this grass. It is conserved against the older *Nazia* Adans. (1763: 31, 581). *Lappago* Schreb. (1789: 55) for a diaspore similar to a *λαππρα*, bur, is a superfluous renaming. There are 8 species, 7 were revised by Anton (1981: 55). Sulekic & Zapater (2001) added *T. andicola*.

EARLY RECORDS OF CENCHRUS S.S.

Laurentius Scholzius de Rosenau (1552–1599)

According to Chase (1920: 47) the first *Cenchrus* mentioned in history would have been *Gramen americanum spica echinata majoribus locustis*, a phrase name she attributed to Scholzius Hortus Vratislaviae (1587: '258'), a publication she had not seen.

About this book by the Silesian physician, horticulturist, and poet Laurentius Scholzius de Rosenau (1552–1599) Cohn (2013) wrote "Diese Ausgabe ist bisher nicht aufzufinden gewesen, wohl aber eine zweite unter dem Titel: "Catalogus arborum, fruticum ac plantarum tam indigenarum quam exoticarum horti medici D. Laur. Scholzii med. Vratisl." Vratisl. A.C. MD.XCVIII [MD.XCIII, corr. JFV]. 4° (Georg. Baumann.). A.W. Henschel hat in der Allgem. Gartenzeitung von Otte [Otto, corr. JFV] u. Dietrich vol. V. 1837, p. 61 [187, JFV] u.f. diesen für die Geschichte der botanischen Gartenpflege wichtigen Katalog, welcher ca. 240 Arten und Varietäten in alphabetischer Ordnung aufzählt, abdrucken lassen". This Catalogus was mentioned, but not seen by Pritzel (1848: 266). Copies are in the Bibliothek für Schlesische Landeskunde der Stiftung Kulturwerk Schlesien, Würzburg, in the Bayerische Staatsbibliothek, München and in the Bibliothèque nationale de France.

Henschel (1837: 177) said that the 'Original-Katalog' was included because already then the 'Hortus Vratislaviae' was extremely rare. The last instalment contains an account of the plants in the garden of Scholzius in 1587, and lists the species of the "Hortus Vratislaviae", and not those of the 'Catalogus arborum', as Cohn claimed. The only grass in both is *Gramen turcicum* (*Zea mays* L.).

THE 'SCHOLA BOTANICA'

Clearly Ms Chase was misled by the various citations of early authors such as 'S.B.P.', 'Schol. Bot.', 'Schol. Bot. Par.' and 'Hort. Reg. Paris', etc. All these refer to the 'Schola botanica' published by Sherard (1689), which consists of two treatises.

The first, with the page heading 'Horti regii parisiensis', apparently was made during Sherard's stay in Paris with Tournefort and the second, the 'Paradisi batavi prodromus', when in Amsterdam with Hermann. Note that on p. 258 (!) in the 'Horti' Chase's '*Gramen americanum etc.*' is present. It is *C. echinatus*, see below.

A possible first record of *Cenchrus echinatus*

The first report of a *Cenchrus* may have been by Piso (1648) for a plant known as *Amongeaba* in the Dutch colonies in north-eastern Brazil (Pernambuco, Recife) (Fig. 1: notwithstanding the quality, it gives a general idea). The rather crude illustration according to Chase (1920: 47) is either *C. echinatus* or *C. viridis* Spreng. (= *C. brownii*). The name *Panicum silvestre* used by Piso has been applied to a number of species. Trinius (1822) mentioned it as referring to *Panicum crus-galli* L. = *Echinochloa crus-galli* (L.) P.Beauv., *P. glabrum* (Schrad.) Gaudin = *Digitaria ischaemum* (Schreb.) Muhl., *P. verticillatum* L. = *Setaria verticillata* (L.) P.Beauv., and *P. viride* L. = *S. viridis* (L.) P.Beauv. The *Digitaria* and *Echinochloa* hardly resemble Piso's illustration, but it might well be of a *Setaria* P.Beauv. If it really



Fig. 1 *Amongeaba* Piso, De medicina brasiliensi: 120. 1648.

represents a *Cenchrus*, it seems most likely *C. echinatus*, see also the distribution maps by Filgueiras (1984). Maybe there is a specimen in the herbarium of Marcgrave (C). (MacBryde 1970). This was the base for *Raram* Adans. (1763: 35, 597), a superfluous name by lectotypification for *Cenchrus* with *C. echinatus* ('*Cenchrus* 3. Linn. '), while his other references pertain to *C. echinatus*.

A more certain early record of *Cenchrus echinatus*

Herman in Sherard's 'Paradisi batavi' (1689: 338) recorded *Gramen aculeatum Curassavicum*. '*Curassavicum*' refers to the island of Curaçao, where at least a century ago there were only two species (Boldingh 1914: *C. carolinianus* Walter and *C. echinatus*). From the very brief phrase name it is not even clear that this refers to a *Cenchrus*. Any spiny grass would do.

Plukenet (1691, 1696) with some doubt mentioned it ('*Schol. Botan.*') under the new phrase name *Gramen americanum spica echinata majoribus locustis*. The illustration of 1691 (Fig. 2) was based on plants grown from fruits given by Sherard to Samuel Doody (1656–1706), a pharmacist in London and from 1691 Superintendent of the Chelsea Physick Garden. He was a friend of Petiver, Plukenet and Ray. "In his time very famous" (Backer 1936). Very likely Sherard had brought diaspores from Amsterdam, and so the two names are linked more closely together than Plukenet thought. Anyway, Chase (1920: 47) commented "A fairly good illustration of *Cenchrus echinatus*". The plate was mentioned by Linnaeus (1753) under *C. echinatus*. It is reproduced here and although of poor quality, does resemble a *Cenchrus*.

Contrary to the citation by Linnaeus (1753) Morison (1699) changed *Gramen americanum, spica echinata, majoribus glumis*, *Schol. Bot. Par.* to *Gramen aculeatum curaßavicum*, *Hort. Reg. Paris*.

I think the 'T.' cited by Linnaeus is a cryptic reference to Tournefort in the 'Schola'.

In the end, the lectotype of *C. echinatus* is a specimen in the *Herb. Van Royen s.n.* (holo L, sh. 912.356-116; microfiche IDC BT-341), designated by Veldkamp (1993).

First record for *Cenchrus tribuloides* with a note on its presumed properties

This species was first described by Plukenet (1696), who was cited in the same year by Sloane: *Gramen tribuloides spicatum maximum virginianum* Doody ex Pluk. (1696). "If the specimen



Fig. 2 *Gramen americanum spica echinata majoribus locustis* Plukenet, Phytographia 1: 174, t. 92, f. 3. 1691.

or seed was sent from Virginia, as indicated by the name, it is doubtless *C. tribuloides*" (Chase 1920: 47).

Gramen maritimum echinatum procumbens, culmo longiori, spicis strigosioribus Sloane (1696). Depicted by Sloane (1707: t. 65, f. 1). The voucher from Jamaica is in BM.

The species has quite nasty spines with retrorse barbs and grows in sandy places like dunes and beaches. They may impede "particularly the feet of non-vigilant bathers" (Youngken & La Wall 1922). Gayle (1892) remarked "It is a well known fact, at least to those who have carelessly handled the vile weed, that the wounds caused by the spines of the involucre ... are unusually painful and long continued ... Barbs of various sizes ... are disposed irregularly over its surface, being more numerous and larger near the point, the tip of which is well supplied with them". He did some anatomy and observed that in the barbs there is a central cavity "with a substance which in colour is light purple. This, in all probability, is of a highly irritating nature and, it may be assumed, is the direct cause of the inflammation of the wound. The barb itself, or at least its point, is of very delicate texture, almost hyaline and is easily broken off".

Youngken & La Wall prompted by this report (no other instances cited) did an extensive study of its history, anatomy of the burs, and chemical analyses of the inclusions in the spines. As they worked with dry burs it is doubtful that they could have detected any poisonous fluid, e.g. *Urtica* species lose their stinging properties when dried or cooked (nettle-soup, nettle-cheese). Yet, their chemical tests suggested the presence of formates (salts or esters of formic acid) which, however, were absent in 'mature' spines. They suggested that Gayle's light purple substances were anthocyanins (p. 575), but that the pain and inflammation more likely would be caused by the stimulation of nerve endings by the sclerenchyma fibres and "subject the wound to invasion by pyrogenic and other bacteria".

If formates would be the cause, it would be the only record of a nettle-like activity in grasses as they also noted (p. 580) and that

I know. It is suggestive to the contrary that no other records of any poisonous properties were found in North American sites. US citizens are notorious for legislative actions.

Buysman (1912: 770) has cultivated this species in Lawang, Java, where it was doing very well (but fortunately did not persist).

Cenchrus frutescens

Linnaeus (1753: 1050) based this combination on two references.

The first is *Arundo graminea aculeata* Alpino (1627) based on an illustration of sterile material from Crete (Fig. 3). As usual this is a crude wood cut, but is illustrative of what one had to work with.

Smith (1806: 76) considered it as a very obscure species. He cited as synonyms *Nasos* Diosc. (apparently not *Nazia* Adans., 1763) and Πετροκαλαμο [Petrokalamo] Messen., a vernacular name from Messenia, SW Greece, and based on Sibthorp's notes thought it would occur there as well as in the Achaean Archipelago.

Sieber (1822) went to the original locality and observed: "Ich bin daher nach Bereisung der ganzen Nordküste dieser Insel [Crete] vollkommen überzeugt, dafs dieser *Cenchrus frutescens* L., insofern es Alpins Pflanze betrifft, durchaus nichts anders als die oft 3 Klafter [fathom, c. 1.9 m] langen Ausläufer von *Arundo Donax* seye, und das Gewächs, da es nicht jährlich abgehauen werde, der gelinden Witterung wegen frutescire, die wahre Pflanz dieses Namens aber im Tournefortischen

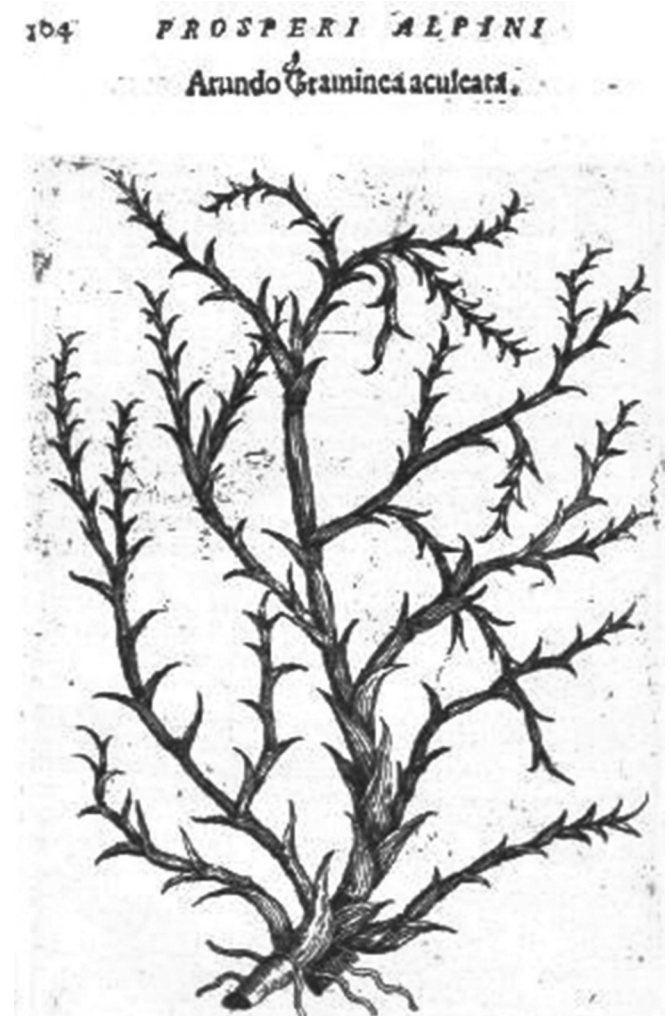


Fig. 3 *Arundo graminea aculeata* Alpino, De plantis exoticis ...: 104. 1627.

Herbar aufgesucht werden müße". Remarkably, Greuter & Scholz (1996) cited Sieber's paper, but did not comment on this statement, a kind of lectotypification.

Sieber thus clearly made a distinction between Alpino's plant and that of Tournefort and said that the "true plant of this name" should be looked for in the latter's herbarium. In short, this constitutes a lectotypification *avant le mot*, incomplete, perhaps, as he did not cite the sheet number as we would require today (how could he have?), but clear enough. The remark by Brummitt (1998) that you cannot designate a (lecto)type when you have not seen it, is not supported by the Code, which does not require so. Article 9.3(b) defines as "original material" "specimens ... even if not seen by the author". Moreover, in my interpretation of Art. 9.12 on lectotypification a specimen takes precedence over an illustration. I here designate *P-TRF 4941*, *P000680157* (IDC microfiche 6208) as the lectotype.

A particular problem was caused by the total misinterpretations by Lunell (1915). He adhered to absolute priority and thus accepted *Nastus* Diosc. ("Ναστος"; 50–70 AD) with as type *Cenchrus frutescens* L. (1753).

The reference to Dioscorides (AD 50–70) cited by him ('I: 114') I have not found, as there are so many editions over the c. 1500 years of use of this seminal medicinal work, and here have used the one by Ruellius (1552), which was also used by Linnaeus (1753: 480). Dioscorides mentioned species of *Harundo* called *Calamos*, *Canna*, *Cypria*, *Donax*, *Ita*, *Nastos*, etc., from which arrows, flutes, or pens were made. Apparently these are species of what we now regard as *Arundo* L. and *Phragmites* Adans.

It is most unlikely that any could pertain to *C. ciliaris*, the only *Cenchrus* native to Europe, but then at present only known from Sicilia and nearby Isola Lipari (Clayton 1980). Certainly the burs would have been noted.

Lunell cited Bubani (1901), who also would have used *Nastus*, but it was not found there.

It is not *Cenchrus* Hippokrates, 'l.c.', which he seems to think is *Panicastrella* Micheli (1729), taken up by Moench (1794), nor *Echinaria* Heist. ex Fabr. (1759), non Desf. (1799), a superfluous name for *Cenchrus* (Briquet et al. 1905).

Lunell included as the other species *Nastus carolinianus* (Walter) Lunell, based on *C. carolinianus* Walter, nom. utique rej. This is now *C. longispinus* (Hack.) Fernald. Clearly he had not seen Alpino's illustration which in no way resembles any *Cenchrus*. Obviously he tried to place this species, whereby later authors have equated his *Nastus* with *Cenchrus* (e.g. Clayton & Renvoize 1986, Sorong & Pennington 2003).

Greuter & Scholz (1996) saw this microfiche. They said that on the label '*orientalis*' is crossed out and replaced by '*armeniaca*'. Through the kind offices of Mme Elodie Lerat (P) a scan was obtained. As can be seen from Fig. 4 their remark is incorrect.

Chase (1920: 49) remarked "It appears more like a species of *Salicornia* [L.; *Chenopodiaceae*]"

Turland (1995), also with field experience in Crete, disagreed with Sieber and regarded Alpino's plant as a curious form of *Phragmites australis* (Cav.) Trin. ex Steud. He therefore proposed *C. frutescens* as a *nomen utique rejiciendum* to avoid a new combination for the Common reed.

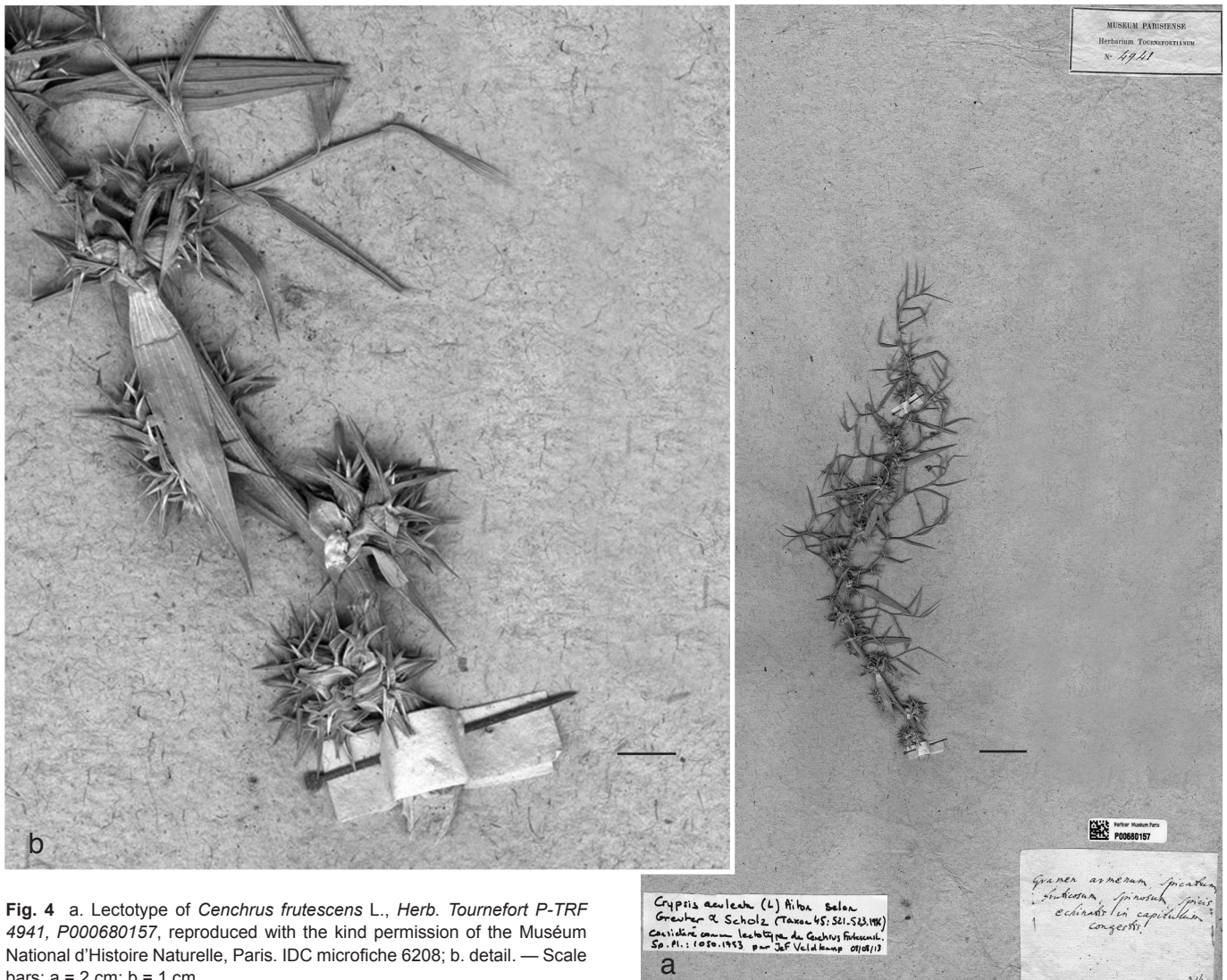


Fig. 4 a. Lectotype of *Cenchrus frutescens* L., *Herb. Tournefort P-TRF 4941*, *P000680157*, reproduced with the kind permission of the Muséum National d'Histoire Naturelle, Paris. IDC microfiche 6208; b. detail. — Scale bars: a = 2 cm; b = 1 cm.

Greuter & Scholz (1996) refrained from lectotypifying *C. frutescens* L., instead they played what is unofficially known as “Mabberley’s Trick” (Geesink ex Mabberley 2004) and described a new species, *Phragmites frutescens* H.Scholz, thereby effectively blocking any later combination in *Phragmites* for *C. frutescens*. As a result Turland’s proposal was not recommended by the Nomenclatural Committee (Brummitt 1998). Scholz’s species would occur also outside Crete in the Aegean, Cyprus, Israel and Syria (Fielding & Turland 2005: 48, 488).

Linnaeus’s second reference is to *Gramen orientale spicatum fruticosum spinosum, spicis echinatis in capitulum congestis* Tournefort (1703). In this work the plants are enumerated which Tournefort had collected during his travels to the Levant as far as Armenia (1700–1702), hence the ‘orientale’. His material in P (*P-TRF 4941, P000680157*; Fig. 4a, b) represents *Crypsis aculeatus* (L.) Aiton. He regarded Alpino’s species as distinct and he renamed it to *Arundo angustifolia, repens, aculeata*.

Although this came from the East, Linnaeus (1753) attributed it to America. In 1763 he corrected this to Armenia, but he never mentioned Crete. He apparently based most of the protologue (epithet, inflorescences, and provenance) on Tournefort. However, the application of this combination has long been enigmatic.

I agree with Greuter & Scholz’s (1996) suggestion that this is *Crypsis aculeatus* (L.) Aiton, based on *Schoenus aculeatus* L. (1753: 42. *Cyperaceae!*).

The epithets ‘*aculeatus*’ and ‘*frutescens*’ are equally old, and the first because of long-time use has obvious preference and is selected here, thus maintaining the combination of *Crypsis aculeata* (L.) Aiton. In this way there is no reason for any re-naming and Turland’s proposal was unnecessary as well as Greuter & Scholz’s (1996) juggling act.

Pennisetum Rich.

The genus was described by Richard (1805). The name refers to the often feathery bristles surrounding the spikelet(s). He included five species of which *P. typhoideum* Rich. was designated as the lectotype by Hitchcock (1920: 245). However, as Richard cited *Holcus spicatus* L. (1759: 1305) and an illustration by Plukenet (1691) these make it a superfluous name, and here it is placed under *Cenchrus americanus* (L.) Morrone. See below.

Pennisetum cenchroides Rich., based on *C. ciliaris* L. (1771: 302), is also a superfluous name as ‘*ciliare*’ should have been used. This was done by Link (1827). It shows an early observation that *Cenchrus* and *Pennisetum* are similar.

Pennisetum glaucum (L.) R.Br., Pearl millet, probably derived from *P. violaceum* (Lam.) Rich., was cultivated in W Africa (e.g. northern Mali) 4 500 years ago and ‘soon’ after, at least 4 000 years ago, was present in India. Other species world wide are of importance as soil binders (*P. clandestinum* Hochst. ex Chiov., *P. orientale* Rich.), forage (e.g. *P. orientale*, Oriental fountain grass, *P. pedicellatum* Trin., Barra grass, *P. purpureum* Schumacher., Elephant grass, but inedible to cattle when mature, currently used as biofuel), weeds (e.g. *P. polystachion* (L.) Schult., see below), and ornamentals (e.g. *P. advena* Wipff & Veldk., *P. alopecuroides* (L.) Spreng., *P. macrostachys* (Brongn.) Trin., *P. orientale*, *P. setaceum* (Forssk.) Chiov. (as *P. ruppellii* Steud.), *P. villosum* R.Br. ex Fresen., *P. violaceum* (Lam.) Rich., etc.).

Under *Pennisetum orientale* Richard cited in synonymy *Cenchrus orientalis* Willd., which is an unpublished name that has also been mentioned as Willd. ex Kunth (1833: 162). There it was also in the synonymy of *P. orientale*, and so it is an invalid name, and only recently was validated by Morrone (2010: 128). Morrone noted that the type was not located, but it is a collec-

tion by Abbé [Dominique] Sestini (1750–1832) in the Willdenow Herbarium (BW-1477) from Galathia (C Asian Turkey).

Pennisetum setosum (Sw.) Rich. is based on *C. setosus* Sw. (1797: 211), but there reference is made to Swartz (1788: 26). *Panicum polystachion* Murray (1784: 105) is cited in such a way that it resembles a synonym, but in a commentary Swartz said “a *Panico polystachyo* L. minime diversum”. Brunken (1979) and Schmelzer (1997: 63) have suggested that the annual diploid (‘*polystachion*’) and perennial polyploid plants (‘*setosum*’) represent two subspecies or species. As the bases of the plants are rarely collected, and the chromosome number is of course not known, it is usually impossible to say what is what.

As said, *Pennisetum typhoideum* Rich. was based on *Holcus spicatus* L. (1759) and *Gramen alopecuroides spica maxima Indiae orientalis* Pluk. (1691: t. 32, f. 4) (Fig. 2), which Plukenet later (1696: 174) renamed to *Gramen paniceum s. Panicum sylvestre maximum indiae orientalis*, names that have not been accounted for by Trinius (1822). Richard’s citations make *P. typhoideum* a superfluous name.

This illustration was also cited by Linnaeus who provided a different phrase name again.

However, in LINN there is 1212.1 which Linnaeus tried to identify with existing literature. I would think that this would be the lectotype of *H. spicatus*, but the combination has been lectotypified with Plukenet (1691: t. 32, f. 4) by Davidse (1994: 363). I feel that according to Art. 9.12 (ICN; McNeill et al. 2012) this uncited specimen should have preference and I here designate it as the lectotype.

Under *Alopecurus typhoides* Burm.f. (1768: 27) also cited Plukenet, uniting the plate (1691) with the text (1696: 174). Because both the Richard and the earlier Burman combinations are based on the same pre-Linnaean reference, even when Richard did not cite Burman, the latter is to be regarded as the author of the basionym to be cited within parentheses (Art. 41.4, Ex. 7), and the epithet is then to be spelled accordingly as ‘*typhoides*’.

Pennisetum violaceum (Lam.) Rich. was based on *Panicum violaceum* Lam. (1791: 169) from Senegal. The type is *Rousillon s.n.* (? holo P-LAM). The species is used as an ornamental and in hybridization experiments as it is regarded as the progenitor of *P. glaucum* (= *Cenchrus americanus*).

Pennisetum polystachion, a foul-up

The species was first described by Linnaeus (1759) as *Panicum polystachion* with the phrase name *P[anicum] spic[is] teretibus, involucellis unifloris fasciculato setosis, culmis erectis superne ramosis*, apparently strictly based on the illustration by Rumphius (1750). The inflorescence shown there is terminal and solitary, so the epithet is not fitting. Rumphius’s editor Burman translated his *Vossesteertegras* (Foxtail grass) to *Gramen vulpinum*. For some reason this was misnamed again by Linnaeus (1762: f. 15) as *Gramen caricosum alterum* but Rumphius’s description and illustration clearly represent *Setaria parviflora* (Poir.) Kerguelen (Merrill 1917: 91 as *S. flava* (Nees) Kunth) which indeed has a solitary terminal inflorescence. Linnaeus’s citations of the phrase names are not to be found in the cited place. This is again an example of someone trying to match a specimen in hand with existing literature as we even do today. Therefore, the specimen in his herbarium (Herb. Linné 80.6) is here designated as the lectotype and belongs to *Setaria glauca* (L.) P.Beauv.

The situation was thrown in a lasting confusion by Linnaeus (1771) when he described another *Panicum polystach[ium]*. According to the diagnosis (“*setis ciliatis a basi ad medium pilis longiusculis*”) and the specimen he used (Linn. 80.4) is

a species of *Pennisetum*. Herb. Linné 80.4 (f. 17) has been designated as the lectotype of *P. polystachion* L. (1771) (Van der Zon 1992: 335).

In fact, it is a later homonym, yet combinations using the Linnaean epithet of 1759 generally, but erroneously, have been applied to it. Because of this widespread confusion I will submit a proposal of conserving the 1771 name with Linn. 80.4 as the conserved type, whereby general usage will be maintained.

The combinations used for the *Cenchrus* / *Pennisetum* in fact pertain to *Setaria glauca* and the correct name in *Cenchrus* for the moment is *C. setosus* Sw.

A curious, remarkable and unexplained thing is that neither *Panicum polystachion* nor *Pennisetum polystachion* are mentioned by several early to mid-19th century standard compilers of names and grasses, or misused the first for something else. Possibly they thought that when a name could not be placed, or was regarded as a synonym, it was allowed to be used again for something else.

Steudel (1821: 589) only had a *Panicum polystachyum* based on *Oplismenus polystachyus* Kunth (1816b), which is now *Echinochloa polystachya* (Kunth) Hitchc.

Trinius (1822: 327) equated *Gramen vulpinum* Rumph. with *Pennisetum setosum*, which is clearly erroneous, as that species was only recently introduced in Malesia and certainly could not have been seen by Rumphius before he lost his sight in 1670. His illustration not even remotely resembles it. It is *Setaria parviflora* (Poir.) Kerguelén.

Sprengel (1824: 302–304, 307–309) did not mention them at all.

Trinius (1826: 65–66) mentioned *Panicum polystachyum* L. under *Pennisetum parviflorum* Trin. (not based on *Cenchrus parviflorus* Poir.!) noting that it did not belong there as the involucre was not ciliate. On p. 68 under *Pennisetum violaceum* Trin. he said “an *Panicum polystachyon* L. sp. pl. ed. 2, et Mant. (tum excl. syn. Rumphii)”.

Trinius (1834) cited *Panicum polystachyum* L. with doubt under *Pennisetum uniflorum* Kunth (1816a, b), now regarded as a synonym of *Pennisetum polystachion* (or *P. setosum*?).

Steudel (1854: 81, 461) had only *Panicum polystachyum* J. Presl, but this is also a later homonym and now a synonym of *Hymenachne donacifolia* (Raddi) Chase.

CENCHRUS L.

Cenchrus L. (1753) 1049; DeLisle (1963) 259; Chrtek & Osb.-Kos. (1996) 85; Chemisquy et al. (2010) 107. — *Echinaria* Heist. ex Fabr. (1759) 206, nom. rej. [contra Desf. (1799), nom. cons.]. — *Raram* Adans. (1763) 35, 597, nom. superfl. — *Nastus* Lunell (1915) 214, nom. superfl., non Juss. (1789). — Lectotype: *Cenchrus echinatus* L., designated by Nash (1913: 166).

Pennisetum Rich. (1805) 72; Leeke (1907) 1; Chase (1921) 209. — *Penicillaria* Willd. (1809) 1036; Kunth (1816 ‘1815’) 71 (*‘Penicellaria* Sw.’), nom. superfl. — Lectotype: *Pennisetum typhoideum* (L.) Rich., nom. superfl. [= *Cenchrus americanus* (L.) Morrone], designated by Hitchcock (1920: 245) and Chase (1921: 210).

Gymnotrix P.Beauv. (1812) 59, 164, t. 13, f. 6; Spreng. (1817) 154 (*‘Gymnothrix*’). — *Pennisetum* Rich. sect. *Gymnotrix* Leeke (1907) 9, 28. — Type: *Gymnotrix thouarii* P.Beauv. [= *Cenchrus cafer* (Bory) Veldk.].

Sericura Hassk. (1842) 2. — Type: *Sericura elegans* Hassk. [= *Cenchrus elegans* (Hassk.) Veldk.].

Beckeropsis Fig. & De Not. (1854) 365; Clayton (1967) t. 3643. — *Pennisetum* Rich. sect. *Beckeropsis* Hack. (1887) 38. — *Pennisetum* Rich. subser. *Beckeropsis* Leeke (1907) 10, 28. — *Pennisetum* Rich. subsect. *Beckeropsis* Leeke ex Pilg. (1940) 80. — Lectotype: *Beckeropsis nubica* (Hochst.) Fig. & De Not. [= *Cenchrus unisetus* (Nees) Morrone], designated by Phillips (1951: 107).

Kikuyuochloa H.Scholz (2006) 513. — Type: *Kikuyuochloa clandestina* (Hochst. ex Chiov.) H.Scholz [= *Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone].

Annuals or perennials, branching intra-vaginally at base. Culms hollow to solid. Ligule a ciliolate rim or row of hairs. Inflorescence a spike or contracted raceme, or spike-like, branches 1–6-spikeled, surrounded by a sessile to shortly stipitate involucre of setae or bur-like with spiny bracts, usually deciduous as a whole, sometimes apparently 1-flowered by absence of glumes and epaleate first lemma. Spikelets quaquaversal, abaxial, sessile or shortly pedicelled, dorso-ventrally compressed. Glumes 0–2, very unequal, shorter than the adjacent lemmas, acute, 0–5-nerved; lower glume absent to well-developed, 0–1-nerved; upper glume and 0–5-nerved. First lemma epaleate or paleate, neuter or male, 3–11-nerved; second lemma membranous to leathery, 5–7-nerved, smooth, germination flap present, margins laying flat on the palea. Hilum punctiform to ovate. Embryo 0.33–0.75 times as long as the caryopsis. Rachilla process absent (occasionally present in *C. setaceus*). x = 5, 7, 8, 9, 10, 17.

Distribution — *C.* 110 pantropical species, 16 Malesian, 3 native.

KEY TO THE TAXA

1. Involucre composed of scales or bristles, usually distinctly connate in the lower parts and bur-like (*Cenchrus*) 2
1. Involucre composed of bristles, free at base (*Pennisetum*) 5
2. Perennials. Common axis puberulous. Inner spines connate only at the very base, forming a small disc or cup 3
2. Annuals. Common axis scaberulous. Inner spines connate for more than halfway above the base, forming a closed bur 4
3. Burs loosely spaced; stipe pubescent, base obconical; outer bristles retrorsely barbed; inner spines subterete, subequal. Upper glume 3–4.9 mm long. First lemma 5–6.5 mm long 4. *C. caliculatus*
3. Burs crowded; stipe puberulous, base obtriangular; outer bristles antrorsely barbed; inner spines flat, one spine distinctly longer than the others. Upper glume 1.9–2.2 mm long. First lemma 3–3.9 mm long. 5. *C. ciliaris*
4. Rachis internodes 0.8–2.25 mm long, burs crowded, outer main bristles subequal to longer than the inner spines of the bur 3. *C. brownii*
4. Rachis internodes 2–3 mm long, burs loosely spaced, outer main bristles mostly less than half the length of the inner spines of the bur 7. *C. echinatus*
5. Culms erect to geniculate at base. Panicle exserted, many-spikeled. Involucral bristles rather stiff. Spikelets 2.5–11 mm long. First lemma 3–7-nerved; second lemma 1.5–11 mm long 6
5. Culms mat-forming. Panicle enclosed in the uppermost sheath, 2–4-spikeled. Involucral bristles soft. Spikelets 16–17 mm long. First lemma 9–11-nerved; second lemma 16–17 mm long 6. *C. clandestinus*
6. Common axis of inflorescence scaberulous to pubescent. Involucral bristles many, scaberulous to pilose 7
6. Common axis of inflorescence glabrous. Involucral bristles 1, smooth 16. *C. unisetus*
7. Involucre not stipitate 8
7. Involucre stipitate 10
8. Involucral bristles a few distinctly longer than the others, densely crinkly pilose around the spikelet (some outer ones excepted). First lemma erosely truncate. Second lemma indurated 9
8. Involucral bristles one distinctly longer than the others, at least the inner ones pilose. First lemma acuminate. Second

- lemma not indurated. — Ligule a setose collar, c. 0.15 mm long, setae 1.8 mm long. Spikelets solitary within the involucre, pedicelled, c. 5.2 mm long. Upper glume c. 3.7 mm long. Second lemma c. 4 mm long, obtuse. 10. *C. orientalis*, note
9. Ligule 0.4–1.3 mm long, setae 0.6–1.5 mm long. Spikelets 1–5 within the involucre, pedicelled (at least the basal one). Anthers 1.8–3.45 mm long. — Spikelets 3.5–6 mm long. Upper glume 3.5–6 mm long. Second lemma 2.1–3.2 mm long, obtuse. 11. *C. pedicellatus*
9. Ligule 1.3–3.5 mm long, setae 1.3–3.5 mm long. Spikelets solitary within the involucre, sessile. Anthers 1.1–1.8 mm long. — Spikelets 3.15–4.5 mm long. Upper glume 3.2–4 mm long. Second lemma 1.8–2.25 mm long, acute 12. *C. polystachios*
10. Involucral bristles scaberulous. — First lemma nerves smooth. 11
10. The inner involucral bristles pilose 12
11. Ligule a ciliolate rim. Blades flat, 8–35 mm wide. Panicle 15–40 cm long. Spikelets 4.5–6.5 mm long. Anthers 1.65–2.1 mm long. 8. *C. elegans*
11. Ligule a setose collar. Blades involute, 0.7–3 mm wide. Panicle 3–12 cm long. Spikelets 6.4–9.25 mm long. Anthers 3–5.5 mm long 13. *C. purpurascens*
12. Ligule a ciliolate rim, 0.4–1.5 mm long, setae absent. First lemma nerves smooth. — Anthers apex glabrous, apiculate 13
12. Ligule a setose collar, 0.1–0.2 mm long. First lemma nerves scaberulous 14
13. Peduncle puberulous below the panicle. Panicle 22–32 cm long. Common axis pubescent. Involucre 11–25 mm long with one bristle exerted, 21–33.5 mm long. Lemmas acuminate 1. *C. advena*
13. Peduncle scaberulous below the panicle. Panicle 2–12 cm long. Common axis scaberulous or puberulous. Involucre 7.5–10 mm long, with one bristle exerted, 10–12 mm long. Lemmas acute 5. *C. ciliaris*
14. Ligule setae 2–3 mm long. The inner involucral bristles pilose. Anthers apex penicillate. — One involucral bristle often distinctly longer than the others. Spikelets 3–6.5 mm long. First lemma 3–5-nerved; second lemma 1.5–6.5 mm long 15
14. Ligule setae 0.6–1.1 mm long. Nearly all involucral bristles pilose (some outer ones excepted). Anthers apex glabrous, apiculate. — Perennials. Blade margins scaberulous. Involucre disarticulating at base with persistent spikelets. First lemma glabrous; second lemma 4.7–11 mm long, acuminate to aristate, membranous 16
15. Annuals. Blade margins scaberulous. Involucre not disarticulating at base, spikelets deciduous. First lemma pubescent on the margins; second lemma 1.5–4 mm long, obtuse, indurated. 2. *C. americanus*
15. Perennial. Blade margins spinulose. Involucre disarticulating at base, spikelets persistent. First lemma glabrous; second lemma 5.5–6.5 mm long, acuminate, membranous 14. *C. purpureus*
16. One or a few involucral bristles distinctly longer than the others. Spikelets 4.7–7 mm long. First lemma 3–5-nerved; second lemma 4.7–6.8 mm long. — Ligule setae 0.6–0.7 mm long 17
16. Involucral bristles unequal, but not one or a few distinctly longer than the others. Spikelets 8.2–11 mm long. First lemma 7–11-nerved; second lemma 8.2–11 mm long. — Ligule setae 0.7–1.1 mm long. Blades involute. Stigmas long-connate, apparently 1 9. *C. longisetus*

17. Blades flat. One involucral bristle distinctly longer than the others. Lower glume well-developed. First lemma paleate, male 10. *C. orientalis*
17. Blades involute. A few involucral bristles distinctly longer than the others. Lower glumes absent or obsolete. First lemma epaleate 15. *C. setaceus*

1. *Cenchrus advena* (Wipff & Veldk.) Morrone

Cenchrus advena (Wipff & Veldk.) Morrone in Chemisquy et al. (2010) 127. — *Pennisetum advena* Wipff & Veldk. (1999) 1033, t. 1. — Type: Wipff 1723 (holo L; K, MO, US, UTC).

Pennisetum macrostachys auct. non Trin.

Pennisetum setaceum (Forssk.) Chiov. cv. 'Burgundy Giant'.

Pennisetum setaceum (Forssk.) Chiov. cv. 'rubrum'.

Perennials. Culms erect, not stoloniferous, not rhizomatous, 1–1.15 m long, nodes glabrous. Ligule a ciliolate rim, 0.4–0.8 mm long. Blades flat, 23–52 cm by 6–11 mm, margins scaberulous. Peduncle puberulous below the panicle. Panicle exerted, many-spikelet, 22–32 cm long, common axis pubescent, angular. Involucre stipitate, disarticulating at base. Callus pilose. Bristles many, rather stiff, the inner ones pilose, one distinctly longer than the others, 11–25 mm long, longest bristle 21–33.5 mm long. Spikelets 1–3 within the involucre, sessile (the laterals shortly pedicelled), 5.2–6.5 mm long. Lower glume absent to obsolete, 0–1 mm long, 0–0.37 times as long as the upper glume; upper glume 1.9–3.6 mm long, 0–1-nerved. First lemma paleate, sterile to male, acuminate, membranous, 5(–6)-nerved, glabrous, nerves smooth; second lemma 5.2–6 mm long, acuminate, not indurated. Anthers 1.95–2.6 mm long, apex glabrous, apiculate. $2n = 54$.

Distribution — Origin unknown. Records at USDA suggest a provenance from Papua New Guinea, but this is very unlikely. It is running wild in frost-free areas such as Florida, Texas, California and Hawai'i. Ng (2006: 80, f.) recorded it as cultivated in Malaysia and not to produce viable caryopses.

Vernacular name — Purple fountaingrass.

Notes — Dr. E.A. Widjaja (BO, pers. comm.) reported the presence of a purple-leaved *Pennisetum* cultivated in Bandung. It might be the present species.

Chromosome number, reproductive behaviour, and fertility have been discussed by Dujardin & Hanna (1984: 197) as *P. 'macrostachyum'*.

2. *Cenchrus americanus* (L.) Morrone

Cenchrus americanus (L.) Morrone in Chemisquy et al. (2010) 127. — *Cenchrus americanus Panicum americanum* [Clusius (1601) 215, f., nom. inval.] L. (1753) 56. — *Pennisetum americanum* K.Schum. [in Engl. (July 1895b) 51, nom. inval.] ex Leeke (1907) 52. — Lectotype: Clusius' plate, designated by Clayton & Renvoize (1982: 672). — Epitype: *Herb. Van Royen s.n.* (L, sh. 908.93-181, IDC microfiche BT-341), designated by Soreng & Pennington (2003: 312).

Panicum glaucum L. (1753) 56, non *Cenchrus glaucus* C.R.Mudaliar & Sudararaj (1957). — [*Pennisetum glaucum* R.Br. (1810) 195. — *Setaria glauca* P.Beauv. (1812) 51, 169, 178. — *Chamaeraphis glauca* Kuntze (1891) 767. — *Ixophorus glaucus* Nash (1895) 423. — *Chaetochloa glauca* Scribn. (1897) 39. — *Setariopsis glauca* Samp. (1914) 4. — Lectotype: *Herb. Hermann 3, 17, fol. 44* (holo BM), designated by Rauschert (1973: 662).

Holcus spicatus L. (1759) 1305. — [*Gramen alopecuroides spica maxima Ind. orient.* Pluk. (1691) 174, t. 32, f. 4. — *Gramen paniceum s. Panicum sylvestre maximum indiae orient.* Pluk. (1696) 164, nom. inval.]. — *Alopecurus typhoides* Burm.f. (1768) 27, nom. superfl. — *Cenchrus spicatus* Cav. (1802) 304; Kuntze (1898) 346, isonym. — *Pennisetum typhoides* Rich. (1805) 72 ('typhoideum'); Stapf & C.E.Hubb. (1933) 271, isonym, nom. superfl. — *Penicillaria spicata* Willd. (1809) 1037. — *Panicum spicatum* Roxb. (1814) 7. — *Penicillaria plukenetii* Link (1827) 221, nom. superfl. ('plukenetii'). — *Penicillaria typhoides* Schtdl. (June 1853) 559, nom. superfl.; Fig. & De Not. (1853) 55 ('typhoidea'), isonym. — *Penicillaria indica* A.Braun (1855) 26, nom. superfl. — *Pennisetum spicatum* Korn. in

Korn. & Werner (1885) 284. — *Pennisetum spicatum* Korn. var. *typhoideum* T.Durand & Schinz (1894) 785. — *Pennisetum americanum* K.Schum. ex Leeke subsp. *typhoideum* Maire & Weiller (1952) 339. — *Pennisetum americanum* K.Schum. ex Leeke convar. *spicatum* et *typhoides* Tzvelev (1971) 72. — Lectotype: Plukenet, Phytographia 1 (1691) t. 32, f. 4, designated by Davidse (1994: 363), to be replaced by *Herb. Linn. 1212.1* (holo LINN), designated here.

Annuals. *Culms* erect to geniculate at base, not rooting in the decumbent nodes, 0.6–3 m long (or more), nodes glabrous to pilose (the lower sometimes with prop roots). *Ligule* a setose rim, c. 0.15 mm long, setae c. 2.25 mm long. *Blades* flat, 15–100 (or more) cm by 8–70 mm, margins scaberulous. *Peduncle* pilose below the panicle. Panicle exerted, many-spikeled, cigar-shaped, 3–200 or more cm long, common axis pubescent. Involucre stipitate, not disarticulating at base. Bristles many, rather stiff, the inner ones pilose, one often distinctly longer than the others, 2–7 mm long, longest bristle 5–25 mm long. *Spikelets* 1–9 within the involucre, disarticulating in between, pedicelled, 3–6 mm long. Lower glume 0–1.5 mm long, 0–0.6 times as long as the upper glume; upper glume 0.5–2 mm long, faintly 1–3-nerved. First lemma epaleate to paleate, male, emarginate to acuminate, membranous, 3–5-nerved, pubescent on the margins, nerves scaberulous; second lemma 1.5–4 mm long, emarginate to obtuse, indurated. Anthers 2–4 mm long, apex penicillate. $2n = 14$, also 15, 21, 28.

Distribution — This grain crop has probably evolved between 3000–2000 BC in the Sahel area of Africa by domestication of *C. violaceus* (Lam.) Morrone, an aggressive weed from W Africa, still used as a so-called famine cereal. Except for some specimens from experimental plots I have seen no field records from Malesia.

Some strains are very tolerant to drought, more than *Sorghum bicolor* (L.) Moench.

Habitat — Fields.

Uses — See also De Wet (1995), Oyen & Andrews (1996) and Lost crops of Africa (National Research Council, USA, 1996). Sixth most important cereal of the world, domesticated 4000–5000 years ago in the Sahel area, South of the Sahara. Thought to have crossed over to Asia 3000 years ago, and now in India the fourth most important cereal. Presently in Africa, India, and some other parts of the world an important staple food grain comparable to maize, rice, sorghum, and wheat. Best cereal under marginal conditions in harsh, hot (above 30 °C), arid areas, needing relatively low moisture, possibly because it roots deeper than most other plants. Easy to grow, suffering less from various pests. The green ears may be roasted like young maize cobs. Grains used roasted, in porridges, couscous, for chest disorders, as an anthelmintic; used to treat leprosy, blennorrhoea, and poisonings. They can also be popped for snacks. The flour is used for unleavened bread ('chupatty'), and fermented foods 'kisra' or 'galettes'. Dark coloured grains are used for beer and other beverages. However, its dehulling produces relatively low yields of flour, and it has poor storage stability. As a fodder it is considered to be mediocre to good. Sometimes infected by ergot and some forms produce hydrocyanic acid. *Culms* used for screens, divans, roofing, fuel, basketry, paper. Red and purple flowered forms produce a red dye. Bran is used in poultices, and in a massage for kidney pains.

Vernacular names — Bajra (India), Bulrush millet, Cattail millet, Pearl millet, Spiked millet.

Notes — A very polymorphic species with a very involved nomenclature, which at present seems best resolved by adopting the name used here. See also Schlechtendal (1853), Terrell (1976), and Brunken (1977).

Hybrids with *P. purpureum* have been cultivated as fodder, e.g. in the Philippines.

3. *Cenchrus brownii* Roem. & Schult.

Cenchrus brownii Roem. & Schult. (1817) 258. — *Cenchrus inflexus* R.Br. (1810) 195, non Poir. (1804). — Type: *R. Brown 6140* (holo BM; E, K, P, US, fragm.).

Cenchrus viridis Spreng. (1824) 301. — *Cenchrus echinatus* L. var. *viridis* Spreng. ex Griseb. (1864) 556. — Type: *Bertero s.n.* (holo B; US, fragm.).

Cenchrus hexafflorus Blanco (1837) 36. — Type: not extant. — Neotype: *Merrill Sp. Blancoan. 811* (holo US; BO, K, L, MO, NSW, P; expected in A, B, BM, CAL, F, GH, NY, U, UC, W), here designated.

Cenchrus echinatus auct. non L.

Cenchrus echinatus L. var. *glabratus* auct. non F.Br.: F.Br. (1931) 66, quoad *BS 5995* (*Ramos*) (BISH).

Pennisetum macrostachys auct. non Trin. ('*macrostachyum*').

Pennisetum nigricans auct. non Miq.

Annuals. *Culms* 0.25–1 m long, erect to geniculate at base, rooting in the decumbent nodes. *Ligule* 0.75–1.7 mm long. Leaf blades 8–38 cm by 4–15 mm. Inflorescence 3–8(–12) cm long. Common axis scaberulous, internodes 0.8–2.25 mm long. Stipe 1–1.5 by 0.45–1.5 mm, base obconical, pubescent. Burs crowded, 4.7–7 by 2.4–4.9 mm, tawny and becoming purple. Outer main bristles subequal to longer than the inner spines, retrorsely barbed. Inner spines 6–10, connate for more than halfway above the base, forming a closed bur, erect to interlocking, subequal, puberulous to margins pilose. *Spikelets* 2–4 per bur, 4.3–6.45 mm long. Lower glume absent to 2.5 mm long, 1-nerved; upper glume 3.15–5.25 mm long, 3–5-nerved. First lemma epaleate to paleate, sterile to male, 4–6 mm long, 3–5-nerved; second lemma 4.3–6.45 mm long. Anthers 0.8–1.5 mm long. $2n = 34, 36$.

Distribution — Originally from Central and South America, introduced elsewhere, e.g. Malesia: widespread, but local.

Habitat — Sandy beaches, waste places, roadsides, railroads, rice fields, 0–600(–1800) m altitude.

Uses — Highly palatable and nutritious when not in fruit, then an obnoxious weed, because of its clinging burs. Roots pounded and applied to wounds. Grains edible.

Vernacular names — Burr grass, Fine-bristle sandbur, Green sandbur, Slimbristle sandbur.

Note — Very similar to *C. echinatus* and often confused with it. It differs from that mainly by the more dense inflorescence and the longer outer main bristles, but some specimens remained difficult to place. Nearly all records for Malesia of *C. echinatus* belong to the present species.

4. *Cenchrus caliculatus* Cav.

Cenchrus caliculatus Cav. (1799b) 39, t. 463. — Type: *Née in Herb. Cavanilles* (holo MA 475502; ISC, fragm.), see Garilleti (1993: 49).

Cenchrus australis R.Br. (1810) 196. — Type: *R. Brown 6141* (holo BM; E, K; *Herb. Trinius 1077.2*, left-hand specimen, LE, microfiche IDC BT-16/1; P, US, fragm.).

Perennials. *Culms* 1–2(–3) m long, erect to geniculate at base, not rooting. *Ligule* 0.75–1.6 mm long. Leaf blades 10–20(–55) cm by 3–14(–19) mm. Inflorescence 8–27 cm long. Common axis puberulous, internodes 1–3.4 mm long. Stipe 1–3 by 0.75–3 mm, base obconical, pubescent. Burs loosely spaced, 5.1–11 by 1.9–4.5 mm (excl. bristles), dark pink to wine red, becoming purple. Outer main bristles shorter than the inner spines, retrorsely barbed. Inner spines 8–9, connate only at the very base, forming a small disc or cup, subterete, erect, subequal, margins densely pilose. *Spikelets* 1 per bur, 3.8–6.5 mm long. Lower glume present (very inconspicuous, easily tearing), 1.2–3.5 mm long, 0–1-nerved; upper glume 3–4.95 mm long, 0–5-nerved. First lemma paleate, sterile to paleate, male, 5–6.5 mm long, 5–7-nerved. Second lemma 3.8–6.15 mm long. Anthers 1.7–2.25 mm long. $2n = ?$.

Distribution — Malesia: Lesser Sunda Isl. (Timor, Alor), Philippines (Mindanao), Papua New Guinea (Central, Morobe Prov.),

Australia (Queensland, New South Wales), New Caledonia, New Zealand, C Pacific (Micronesia East to the Society Isl.).

Habitat — Roadsides, dry rocky places, locally common, perhaps salt-resistant, 0–1400 m altitude.

Uses — Coarse herbage when young, possibly a good soil binder.

Vernacular names — Hillside-, large-, tall bur grass.

Notes — As it is a native species in Australia, New Zealand, and the Pacific, it may well be native in Alor, Timor, and New Guinea as well.

In non-Malesian specimens one inner spine may be considerably longer than the others.

Webster (1987: 20) regarded *C. australis* distinct from *C. caliculatus* because of smaller involucre and spikelets. A specimen in P labelled “Java, Labillardière” is the larger form with an elongated spine and so must have come from the Pacific. It may even be an isotype of *C. anomoplexis* Labill. (1824; = *C. caliculatus* Cav.).

5. *Cenchrus ciliaris* L.

Cenchrus ciliaris L. (1771) 302. — *Pennisetum cenchroides* Rich. (1805) 72, nom. superfl. — *Pennisetum ciliare* Link (1827) 213. — [*Pennisetum ciliare* Link var. *genuinum* Leeke (1907) 21, nom. inval. — *Cenchrus ciliaris* L. var. *genuinus* Chiov. (1908) 325 ('*genuinum*'), nom. inval.]. — Lectotype: König in *Herb. Linn.* 1217.9 (holo LINN, microfiche IDC), designated by Clayton & Renvoize (1982: 691).

Cenchrus setigerus Vahl (1805) 395. — *Pennisetum vahlii* Kunth (1829) 49, nom. superfl. — *Pennisetum ciliare* (L.) Link var. *setigerum* Leeke (1907) 22 ('*setigera*'). — *Cenchrus ciliaris* L. var. *setigera* Maire & Weiller (1952) 342. — *Pennisetum setigerum* Wipff (2001) 526. — Type: *Forsskähl s.n.* in *Herb. Vahl* (holo C, microfiche IDC 2201).

For the numerous other synonyms see DeLisle (1963: 259).

Perennials. *Culms* 0.25–1 m long, erect to geniculate at base, rooting in the decumbent nodes. *Ligule* 0.6–1.5 mm long. Leaf blades 9.5–40 cm by 2–7 mm. Inflorescence 4–8.5 cm long. Common axis puberulous, internodes 0.75–3 mm long. Stipe 0.2–1.5 by 0.2–2 mm, base obtriangular, puberulous. Burs crowded, 7.5–10 by 1.7–2.5 mm, tawny to purplish. Outer bristles shorter than the inner ones, antrorsely barbed, one exserted, 10–12 mm long. Inner bristles free to connate only at the very base, forming a small flat disc or cup, 7–15, erect, one spine distinctly longer than the others, margins densely antrorsely pilose. *Spikelets* 1–3 per bur, 3.4–4.5 mm long. Lower glume 0–1.5 mm long, 1-nerved; upper glume 1.9–2.25 mm long, 1-nerved. First lemma rarely epaleate, usually paleate, sterile or male, 3–3.9 mm long, 3–5-nerved; second lemma 3.4–4.5 mm long, 5-nerved. Anthers 2–2.4 mm long. $2n$ = usually 36, 44, also 18, 29, 32, 34, 35, 38, 40, 43, 45, 48, 50, 52, 54, 56.

Distribution — S Africa to N India, introduced elsewhere, and escaping, e.g. in Malesia: Malay Pen. (Selangor), Java (Bogor), Cocos Keeling, Lesser Sunda Isl. (Sumba, Timor), Philippines (Luzon, Mindanao), New Guinea: Irian Jaya (Manokwari), Papua New Guinea (Morobe, Central Prov.), probably much wider spread.

Habitat — Dry, sandy areas, roadsides, 0–800 m altitude.

Uses — Good fodder in dry areas, tolerant of heavy grazing and quickly recovering; useful because of its good soil binding capacity in sandy, especially low-rainfall areas; grains sometimes eaten in famine periods: however, they may contain cyanidin-diglycoside! Pollen allergenic.

Vernacular names — African foxtail, Anjan (grass), (Black or Blue) Buffel grass.

Notes — The inner spines are free to only shortly connate at base, antrorsely pilose. It hybridizes with *P. glaucum* (L.) R.Br. (National Research Council, USA (1996: 121)).

The form often distinguished as *C. setigerus* (Birdwood grass) has been cultivated near Manila in 1951 (*Santos 5139*, L). This is generally maintained as a species distinct from *C. ciliaris* because of its flattened, distinctly connate inner bristles, though material is sometimes difficult to name. Wipff (2001) reported that when examined across their range there is a complete intergradient of morphological characters.

6. *Cenchrus clandestinus* (Hochst. ex Chiov.) Morrone

Cenchrus clandestinus (Hochst. ex Chiov.) Morrone in Chemisquy et al. (2010) 127. — *Pennisetum clandestinum* Hochst. ex Chiov. (1903) 41, t. 5, f. 2. — *Pennisetum longistylum* Hochst. var. *clandestinum* Leeke (? early 1907) 23 ('*clandestina*'); Chiov. (? medio 1907) 319, isonym. — *Kikuyuochloa clandestina* H.Scholz (2006) 513. — Type: *Schimper 2084* (holo FI; G, K, TUB).

Perennials. *Culms* mat-forming, stoloniferous, rhizomatous, 0.03–0.15 m long, nodes glabrous. *Ligule* a setose rim, c. 0.15 mm long, setae 1.5–3.4 mm long. *Blades* flat, 2–15 cm by 2–4.5 mm, margins smooth. *Peduncle* virtually absent, glabrous below the panicle. Panicle enclosed in the uppermost sheath, 2–4(–6)-spikeled, common axis glabrous. Involucre not stipitate, disarticulating at base. Bristles few, soft, scaberulous, unequal, 2–8.5 mm long, longest bristle 4–8.5 mm long. *Spikelets* 1 within the involucre, sessile, 16–17 mm long. Glumes absent. First lemma epaleate, acuminate, membranous, 9–11-nerved, glabrous, nerves smooth; second lemma 16–17 mm long, acuminate, membranous. Anthers 3.9–5.5 mm long, apex glabrous. $2n$ = 36, 54.

Distribution — Originally from the mountains of E Africa, introduced elsewhere, e.g. Malesia: Malay Pen. (Pahang: Cameron Highlands), Sumatra (Palembang), Java (Cibeureum), Sabah (Pinosok Plateau), Philippines (Luzon), Papua New Guinea (Enga, W Highlands Prov.), and no doubt elsewhere: the plants are not easy to recognise as one usually only sees the thick, prostrate culms forming bands on the soil, but not the inconspicuous inflorescences with only the white stigmas protruding.

Habitat — Grasslands on fertile soil subjected to grazing, trampling, and mowing, along paths, in fallow gardens, locally vegetation-forming, choking out other vegetation and preventing regeneration, it can form dense mats, the new shoots growing over the dead, old ones, which are then fire-prone, (0–)460–2745 m altitude.

Uses — Grown for coarse lawns, pastures (nutritious fodder), and soil binding. Propagated from runners, once established difficult to eradicate! Therefore in the USA listed as a Federal Noxious Weed. In Africa the whole plant or bruised leaves are used as a styptic.

Vernacular name — Kikuyu grass.

7. *Cenchrus echinatus* L.

Cenchrus echinatus L. (1753) 1050; Cav. (1799b) 39, t. 462. — Lectotype: *Herb. Van Royen s.n.* (holo L, sh. 912.356-116; microfiche IDC BT-341), designated by Veldkamp (1993).

Cenchrus echinatus L. var. *glabratus* F.Br. (1931) 66. — Lectotype: *F. Brown 745* (holo BISH), designated by St. John (1976).

Annuals. *Culms* 0.15–0.6(–1) m long, erect to geniculate at base, rooting in the decumbent nodes (sometimes). *Ligule* 0.7–1.7 mm long. Leaf blades 4–26(–35) cm by 3.5–8(–12) mm. Inflorescence 3–7(–10) cm long. Common axis scaberulous, internodes 2–3 mm long. Stipe 1–3 by 2.2–3.6 mm, base obconical, pubescent. Burs loosely spaced, 4–7(–10) by 3.5–6 mm, becoming purple. Outer main bristles shorter than the inner spines, retrorsely barbed. Inner spines c. 10, connate for more than halfway above the base, forming a closed bur, flat, erect to sometimes interlocking, subequal, puberulous, margins

densely pilose. *Spikelets* (1–)2–4(–6) per bur, 5–7 mm long. Lower glume present, 1.3–3.4 mm long, 1-nerved; upper glume 3.8–5.7 mm long, 3–5-nerved. First lemma paleate, sterile, 4.5–6.4 mm long, 3–5-nerved. Second lemma 4.7–7 mm long. Anthers 0.8–2.4 mm long. $2n = 34, 68, \text{ also } 70$.

Distribution — Warmer regions of the New World, introduced elsewhere, e.g. Malesia: Malay Pen. (Selangor), Singapore, Lesser Sunda Isl. (Bali), Borneo (Brunei, E Kalimantan), Philippines (Cebu, Luzon, Palawan, Samar), Papua New Guinea (Central, Gulf, Morobe, New Ireland Prov., Manus Isl.), Ashmore Reef, N Australia, Polynesia (Caroline Islands to Easter Island).

Habitat — Waste places, beaches, roadsides, fields, grassy slopes, *Melaleuca* savannah, 0–2000 m altitude.

Vernacular names — Hedgehog grass, Southern sandbur.

8. *Cenchrus elegans* (Hassk.) Veldk., *comb. nov.*

Sericura elegans Hassk., Flora 25, 2, Beibl. 1 (1842) 2; (1843) 116; (1844) 17; non *Pennisetum elegans* Nees ex Steud. (1854). — *Gymnothrix elegans* Buse (Feb. 1854) preprint: 28; (Aug. 1854) 368. — Type: not indicated, not found in BO, L. — Neotype: *Zollinger* 2367 (Steud. (June 1854: 58, 60)) was partly taken from the plants in the Hortus Bogoriensis that provided the type of Hasskarl's species, designated here.

Gymnatrix macrostachys Brongn. (1831) 104, t. 11, f. 1–9. — *Pennisetum macrostachys* Trin. (1834) 177 ('*macrostachyum*'), non *Cenchrus macrostachys* Hochst. ex Steud. (1854). — Type: *Dumont d'Urville* s.n. (holo P). [*Saccharum caninum* Reinw. ex Blume (1823) 38, nomen]. — *Pennisetum caninum* Koord. (1911) 140, nom. superfl. — *Cenchrus caninus* [Reinw. ex Blume] Morrone in Chemisquy et al. (2010) 127, nom. inval. — Type: *Reinwardt* s.n. (holo L, sh. 908.93-710).

Perennials. *Culms* erect to geniculate at base, not rooting in the decumbent nodes, not stoloniferous, rhizomatous, 1–3 m long, solid, nodes glabrous. *Ligule* a ciliolate rim, c. 0.15 mm long. *Blades* flat, 10–65 cm by (6–)8–35 mm, margins scaberulous. *Peduncle* puberulous below the panicle. Panicle exserted, many-spikeled, 15–40 cm long, common axis puberulous. Involucre stipitate, disarticulating at base. Bristles many, rather stiff, scaberulous, unequal, longest ones 32–55 mm long. *Spikelets* 1 within the involucre, pedicelled, 4.5–6.5 mm long. Lower glume 1.25–1.75 mm long, 0.39–0.53 times as long as the upper glume; upper glume 2.5–3.4 mm long, 1-nerved. First lemma epaleate, acuminate, membranous, 3–5-nerved, glabrous, nerves smooth; second lemma membranous. Anthers 1.65–2.1 mm long, apex glabrous. $2n = ?$

Distribution — Widespread in W Malesia into the Pacific (Solomon Isl.), but not in the Malay Peninsula (once cultivated in Penang and Singapore) nor in Australia.

Habitat — Sunny, infertile soil, slopes, along hollow roads, Imperata fields, gravel beds, savannahs, 0–2130 m altitude.

Uses — Cultivated as an ornamental, best below 100 m altitude. In the Eastern Highlands of Papua New Guinea a form with uniformly reddish purple stems, leaves, and panicles occurs between 1500–2100 m altitude. This might be the same as what is known as the cv. Burgundy Giant of horticulturists. See *P. advena*.

Young stems eaten in the Baliem Valley, but otherwise too hard for fodder.

Vernacular name — Pacific fountaingrass.

Notes — Blume's combination had no description and is invalid. He referred to Reinwardt ('R'). Koorders made the combination *Pennisetum caninum* but included the older *P. macrostachys* and *Sericura elegans*, and it is therefore superfluous. Morrone mentioned the specimens cited by Koorders as syntypes: *Reinwardt* s.n., *Junghuhn* s.n., and *Zollinger* s.n. ('types not located'). They are of course in L; the latter two cannot be Blume types, as they were collected many years after 1823. He thus excluded the type of *G. macrostachys* and actually described a new species, which is invalidly published.

For some reason Soreng & Pennington (2003: 532) have equated this species with the older *Pennisetum peruvianum* Trin. (1836) ≡ *Cenchrus peruvianus* (Trin.) Morrone. According to Clayton et al. (2014) they differ:

- *Ligule* a ciliolate rim. Inflorescence terminal and axillary. Involucre base obtuse. *Spikelets* 4.5–6.5 mm long. Lower glume oblong, hyaline; upper glume oblong. First lemma elliptic, chartaceous, acuminate; second lemma 4.5–6.5 mm long, chartaceous, acuminate. — Old World . . . *C. elegans*
- *Ligule* a fringe of hairs. Inflorescence terminal. Involucre base truncate. *Spikelets* 3.7–4.3 mm long. Lower glume ovate, membranous; upper glume ovate. First lemma oblong, membranous, acute; second lemma 3.7–4.2 mm long, coriaceous, acute. — S America *C. peruvianus*

9. *Cenchrus longisetus* M.C. Johnst.

Cenchrus longisetus M.C. Johnst. (1963) 182. — *Pennisetum villosum* R.Br. ((1814) lxiii, nomen) ex Fresen. (1836) 134. — *Cenchrus villosus* Kunzke (1898) 347, non Spreng. (1824). — Type: *Salt* s.n. (holo FR; ? BM). *Pennisetum longistylum* auct. non A. Rich.

Perennials. *Culms* erect, not stoloniferous, rhizomatous, 0.15–0.75 m long, nodes glabrous. *Ligule* a setose rim, c. 0.15 mm long, setae 0.7–1.1 mm long. *Blades* involute, 3.5–65 cm by 1.5–5 mm, margins scaberulous. *Peduncle* pilose below the panicle. Panicle exserted, many-spikeled, 4–12 cm long, common axis scaberulous to pubescent. Involucre stipitate, disarticulating at base. Bristles many, rather stiff, pilose (some outer ones excepted), unequal, 15–30 mm long, longest bristle 25–45 mm long. *Spikelets* 1–2 within the involucre, sessile, 8.25–11 mm long. Lower glume 0–1.35 mm long, 0–0.53 times as long as the upper glume; upper glume 1.65–4.1 mm long, 1-nerved. First lemma epaleate to paleate, male, acuminate to aristate, membranous, 7–11-nerved, glabrous, nerves scaberulous; second lemma 8.25–11 mm long, acuminate to aristate, membranous. Anthers 3.6–5 mm long, apex glabrous. Styles and stigmas more or less completely fused, apically exserted, yellowish. $2n = (18, 27) 36, 45 (54)$.

Distribution — E Africa, Arabia, introduced elsewhere, e.g. Malesia: Java (Cibodas).

Habitat — Lawns, along paths, c. 1450 m altitude in Java.

Uses — Ornamental (as *P. longistylum* auct.), escaping.

Vernacular names — Feathertop, White foxtail.

10. *Cenchrus orientalis* (Rich.) Morrone

Cenchrus orientalis (Rich.) Morrone in Chemisquy et al. (2010) 128. — *Pennisetum orientale* Rich. (1805) 72. — *Panicum orientale* Willd. (1809) 1031. — *Pennisetum setaceum* (Forssk.) Chiov. subsp. & var. *orientale* Maire (1940) 45. — Lectotype: *Herb. Willdenow* 1477-01 (holo B, IDC microfiche 7440), designated here.

Pennisetum triflorum Nees ex Steud. (1854) 107. — *Pennisetum orientale* Rich. var. *triflorum* Stapf (1896) 86. — Type: *Royle* 59 (holo P; B extant?), K, LIV, K neg. 18368).

Perennials. *Culms* erect to geniculate at base, not rooting in the decumbent nodes, not stoloniferous, rhizomatous, 0.5–1 m long, nodes glabrous to pilose. *Ligule* a ciliolate rim, c. 0.15 mm long, setae c. 0.6 mm long. *Blades* flat, 10–50 cm by 3–12 mm, margins scaberulous. *Peduncle* glabrous to pilose below the panicle. Panicle exserted, many-spikeled, 18–25 cm long, common axis puberulous to pubescent. Involucre stipitate, disarticulating at base. Bristles many, rather stiff, pilose (some outer ones excepted), 8–15 mm long, one distinctly longer than the others, longest bristle 16–25 mm long. *Spikelets* 1–4 within the involucre (the terminal one bisexual, the others male, rarely bisexual), pedicelled, the bisexual ones 5–7 mm long. Lower glume 1.5–2.5 mm long, 0.39–0.48 times as long as the upper glume; upper glume 3–5 mm long, 1–3-nerved. First lemma

paleate, male, acuminate to aristate, membranous, 5-nerved, glabrous, nerves scaberulous; second lemma 4.8–6.4 mm long, aristate, membranous. Anthers 2.6–3.5 mm long, apex glabrous. $2n = 18, 36, 45?, 54$.

Distribution — E Africa, cultivated elsewhere, e.g. Malasia: Java, Philippines (Luzon: Manila), ? Papua New Guinea (Morobe, *NGF 27826* (Streimann & Kairo), BO, fide Ms Sadsoeitoeboen, Manokwari, pers. comm.; the specimen in L is *P. polystachion*).

Habitat — Up to 1000 m altitude.

Uses — As a fodder plant, soil binder, ornamental.

Notes — Monod de Froideville (1968: 575) has misapplied the name *P. orientale* to *P. setaceum*, and *P. triflorum* to *P. orientale*. In most accounts the latter two are kept distinct, but the differences given appear to be untenable.

A puzzling population was found in an abandoned field near Desa Tonasa near Malino, SW Celebes, *Veldkamp 8917*, 14 Aug. 2008 (L), that keys out to *P. orientale*, but is not it. Superficially, it also resembles *P. pedicellatum*, but is not that, either.

Description

Plants perennial. Culms geniculate at base, not rooting in the decumbent nodes, not stoloniferous, rhizomatous, c. 1.5 m long, nodes pilose, but soon glabrous. Ligule a setose collar, c. 0.15 mm long, setae 1.8 mm long. Blades flat, 30 cm long, 4 mm wide, margins scaberulous. Panicle exerted, many-spikeled, 9 cm long, common axis pubescent. Involucre not stipitate, disarticulating at base. Bristles many, rather stiff, the inner ones pilose (some outer ones excepted), one distinctly longer than the others, 9–10 mm long, longest bristle 13–17 mm long. Spikelets 1 within the involucre, pedicelled, 5.2 mm long. Lower glume well-developed, 1.3 mm long, 0.28 times as long as the upper glume. Upper glume 4.6 mm long, 3-nerved. First lemma acuminate, membranous, 5-nerved, glabrous, nerves smooth. Second lemma not indurated, c. 4 mm long, obtuse. Anthers apex glabrous, apiculate.

–. Culms 0.5–1 m long. Ligule setae c. 0.6 mm long. Panicle 18–25 cm long. Involucre stipitate. Lower glume 1.5–2.5 mm long, 0.39–0.48 times as long as the upper glume. First lemma nerves scaberulous. Second lemma 4.8–6.4 mm long *C. orientalis*

–. Culms 1.5 m long. Ligule setae c. 1.8 mm long. Panicle c. 9 cm long. Involucre not stipitate. Lower glume c. 1.3 mm long, c. 0.28 times as long as the upper glume. First lemma nerves smooth. Second lemma c. 4 mm long *Cenchrus Veldkamp 8917*

–. Plants annual, not rhizomatous. Culms erect. Ligule a ciliate rim, 0.4–1.3 mm long. Involucral bristles a few distinctly longer than the others, densely crinkly pilose around the spikelet (some outer ones excepted). Upper glume 5-nerved. First lemma erosely truncate. Second lemma 2.1–3.2 mm long *C. pedicellatus*

–. Plants perennial, rhizomatous. Culms geniculate at base. Ligule a setose collar, 0.15 mm long, setae c. 1.8 mm long. Involucral bristles one only distinctly longer than the others, the inner ones pilose. Upper glume 3-nerved. First lemma acuminate. Second lemma c. 4 mm long. *Cenchrus Veldkamp 8917*

11. *Cenchrus pedicellatus* (Trin.) Morrone

Cenchrus pedicellatus (Trin.) Morrone in Chemisquy et al. (2010) 128. — *Pennisetum pedicellatum* Trin. (1834) 184. — Type: *Peters in Herb. Trinius 1102.1* (holo LE, microfiche IDC BT-16/1).

Pennisetum holcooides auct. non Schult. (see note).

Annuals. Culms erect, 0.3–1.5 m long, nodes glabrous. Ligule a setose rim to collar, 0.4–1.3 mm long, setae 0.6–1.5 mm long.

Blades flat, 5–30 cm by 4–20 mm, margins scaberulous. Peduncle glabrous to pilose below the panicle. Panicle exerted, many-spikeled, 5–15 cm long, common axis scaberulous to pubescent. Involucre not stipitate, disarticulating at base. Bristles many, rather stiff, densely crinkly pilose around the spikelet (some outer ones excepted), a few distinctly longer than the others, 5–10 mm long, longest bristle 13–18 mm long. Spikelets 1–5 within the involucre, pedicelled (at least the basal one), 3.5–6 mm long. Lower glume 0–3.2 mm long, 0–0.6 times as long as the upper glume; upper glume 3.5–6 mm long, faintly 5-nerved. First lemma paleate, sterile, erosely truncate, membranous, faintly 5-nerved, glabrous, nerves smooth; second lemma 2.1–3.2 mm long, obtuse, chartaceous. Anthers 1.8–3.45 mm long, apex glabrous. $2n =$ usually 36, also 18, 42, 45, 48, 50, 54.

Distribution — Disjunct in W Africa and India to Burma. Cultivated elsewhere, Malasia: e.g. Philippines (Luzon: La Union).

Habitat — Roadsides, abandoned fields, rubber-, oil palm-, and sugar cane plantations, 0–1100 m altitude in Africa.

Uses — Cultivated for forage and naturalizing. Culms may be woven onto mats, or for thatching. A decoction is considered diuretic, externally as a haemostatic. In the USA considered as a noxious weed.

Vernacular names — Barra grass, Dinanath grass, Hairy fountaingrass, Matting grass.

Notes — Leake (1907) used the name *P. holcooides* [Roxb.] Schult. (1824), based on *Panicum holcooides* Roxb. (1820), non Jacq. (1814)] for this, which names are not mentioned by Bor (1960). Stapf & Hubbard (1934: 1067) noted that there is no Roxburgh type specimen, while Roxburgh's drawing (Icon. Ined. 784: CAL, K) 'probably' represents *P. polystachion*.

The differences with *P. polystachion* are but slight and consist mainly of involucre with the lowermost spikelet distinctly pedicelled. The bristles are generally more densely plumose.

12. *Cenchrus polystachios* (L.) Morrone

Cenchrus polystachios (L.) Morrone in Chemisquy et al. (2010) 129. — *Panicum polystachion* L. (1759) 870, quoad descr., excl. *Gramen vulpinum* Rumph. — *Pennisetum polystachion* Schult. (1824) 146. — *Gymnotrix polystachya* Sw. ex Trin. (1826) 66. — Lectotype: *P. Browne in Herb. Linn. 80.4* (holo LINN, microfiche IDC), designated by Van der Zon (1992). *Cenchrus setosum* Sw. (1788) 26. — *Pennisetum setosum* Rich. (1805) 72. — *Pennisetum polystachion* (L.) Schult. subsp. *setosum* Brunken (1979) 63. — Type: Swartz s.n. (holo S).

Pennisetum polystachion (L.) Schult. forma *viviparum* Fosberg & Sachet (1984 '1982') 86. — Type: *Fosberg 59748* (holo US; BISH).

Pennisetum holcooides auct. non Schult.

Pennisetum indicum auct. non Kuntze.

For further synonymy see Soreng & Pennington (2003).

Annuals or perennials. Culms erect to geniculate at base, not rooting in the decumbent nodes, not stoloniferous, shortly rhizomatous, 1–3 m long, lower ones hollow, upper ones filled with marrow, nodes glabrous. Ligule a setose rim, setae 1.3–3.5 mm long. Blades flat, 5–45 cm by 4–18 mm, margins scaberulous. Peduncle glabrous below the panicle. Panicle exerted, many-spikeled, 5–25 cm long, common axis scaberulous. Involucre not stipitate, disarticulating at base. Bristles many, rather stiff, densely crinkly pilose around the spikelet (some outer ones excepted), a few distinctly longer than the others, 5–11 mm long, longest bristle 10–25 mm long. Spikelets 1 within the involucre, sessile, 3.15–4.5 mm long. Lower glume 0–1 mm long; upper glume 3.2–4 mm long, faintly 5-nerved. First lemma paleate, sterile, erosely truncate, membranous, faintly 5-nerved, glabrous, nerves smooth; second lemma 1.8–2.25 mm long, acute, chartaceous. Anthers 1.1–1.8 mm long, apex glabrous. $2n = 18, 36, 54$, also 32, 34, 45, 52, 53, 56, 63, 78.

Distribution — Originally from tropical Africa, introduced elsewhere, Malesia: Malay Pen. (widespread), Singapore (already in cult. in 1929!), Sumatra (Lampung), Java (Bogor), Sabah, Lesser Sunda Isl. (Timor), Philippines (Cuyo Isl.: Pamalican Isl., Luzon, Mindanao, Mindoro, Palawan), New Guinea: Irian Jaya (Jayapura), Papua New Guinea (Manus, Morobe). Undoubtedly much more widespread.

Habitat — Roadsides, abandoned fields, rubber-, oil palm-, and sugar cane plantations, upland rice fields, replacing *Imperata cylindrica* (!), 0–900 m altitude.

Uses — Introduced as a fodder grass, but developed into a major pest. Culms used for thatching and the weaving of mats. Juice from young culms promotes healing of cuts, wounds, and sores, conjunctivitis. Decoction of the root is antiemetic, of the inflorescence against ear aches, a poultice of the grain for pain in the sides, dislocation of the shoulder, internal pains.

Vernacular names — Barra grass, Feather pennisetum, Matting grass, Mission grass.

Notes — The reference to this species by Miquel (1857) as *P. holcooides* seems a misidentification of Rumphius's "*Gramen caricosum prima species*" which is *Imperata cylindrica* (L.) P.Beauv.

Gramen vulpinum Rumph. cited by Linnaeus (1759) belongs to *Setaria parviflora* (Poir.) Kerguélen.

PNH 20447 (Mendoza) has proliferating spikelets, which form has been described by Fosberg & Sachet (1984 '1982') as forma *viviparum*.

13. *Cenchrus purpurascens* Thunb.

[*Panicum hordeiforme* (L.) Thunb. var. γ Thunb. (1784) 48]. — *Cenchrus purpurascens* Thunb. (1794) 329. — *Pennisetum iaponicum* Trin. (1821) 76, non *P. purpurascens* Kunth (1816). — *Gymnotrix japonica* Kunth (1833) 158, nom. superfl. — *Pennisetum purpurascens* Kuntze (1891) 787, non Kunth (1816b); Makino (1912) 294, isonym. — Lectotype: *Herb. Thunberg 1922* (holo UPS; microfiche IDC 1036), designated by Cope (2000) 245). *Panicum alopecuroides* L. (1753) 55 ('*alopecuroid.*'), non *Cenchrus alopecuroides* Thunb. (1794). — *Alopecurus indicus* L. (1774) 92, nom. superfl. — *Penicillaria ciliata* Willd. (1809) 1037 (ref. to the Sp. Pl. is to p. 356, not 336), nom. superfl. — *Penicillaria cylindrica* Roem. & Schult. (1817) 498, nom. superfl. — *Pennisetum alopecuroides* Spreng. (1824) 303. — *Pennisetum linnaei* Kunth (1829) 49, nom. superfl. — *Penicillaria alopecuroides* Sweet (1826) 440; A. Braun (1855) 25, isonym. — *Pennisetum indicum* Kuntze (1891) 787, nom. superfl. (incl. var. *purpurascens* Kuntze, nom. inval.). — Lectotype: *Herb. Linn. 80.1* (holo LINN), designated by Veldkamp (2000). *Pennisetum compressum* R.Br. (1810) 195. — *Setaria compressa* Kunth (1829) 46. — *Gymnotrix compressa* Brongn. (1831) 103, t. 9. — *Cenchrus compressus* Morrone in Chemisquy et al. (2010) 127. — Type: *R. Brown 6139* (holo BM; E, K; *Herb. Trinius 1093.5*, LE, microfiche IDC BT-16/1). *Gymnotrix nigricans* J.Presl (1830) 315. — *Pennisetum nigricans* Trin. ex Steud. (1840) 713. — Type: *Haenke s.n.* (holo PR). *Pennisetum sordidum* Koidz. (1919) 112. — *Pennisetum alopecuroides* (L.) Spreng. subsp. *sordidum* T.Koyama (1987) 379, 521. — Type: *Nishimura s.n.* (holo TI). *Pennisetum javanicum* Ohwi (1947) 13. — Type: *Mousset 1101* (holo BO).

Perennials. Culms erect to geniculate at base, not rooting in the decumbent nodes, not stoloniferous, rhizomatous, 0.2–0.8 m long, nodes glabrous. Ligule a setose rim, 0.15–0.3 mm long, setae 1.9–3.4 mm long. Blades involute, 10–45 cm by 0.75–3 mm, margins smooth. Peduncle puberulous to pilose below the panicle. Panicle exerted, few- to many-spikelet, 3–12 cm long, common axis scaberulous to pubescent. Involucre stipitate, disarticulating at base. Stipe glabrous. Bristles few to many, rather stiff, scaberulous, unequal, 8–18 mm long, longest bristle 18–30 mm long. Spikelets 1 within the involucre, sessile, 6.4–9.25 mm long. Lower glume 0.5–2 mm long, 0.17–0.5 times as long as the upper glume; upper glume 2.6–3.9 mm long, 0–1-nerved. First lemma epaleate, acuminate, membranous, 5–7-nerved, glabrous, nerves smooth; second lemma

6.3–9.25 mm long, membranous. Anthers 3–5.5 mm long, apex glabrous. $2n = 18, 36$.

Distribution — Andamans to S China, Japan, to Australia (Queensland to Tasmania), Malesia: Java (Pasuruan, Besuki), Philippines (Luzon: Benguet, Ilicos, Nueva Vizcaya; Mindanao: Zamboanga del Norte). Introduced elsewhere as an ornamental.

Habitat — Sunny, open slopes in *Casuarina* and *Pinus* forests, roadsides, locally vegetation-forming, (250–)915–2400 m altitude. Frost-resistant (Van Steenis on *Coert 1203*, L).

Uses — Satisfactory grazing for sheep and horses when young, too tough for cattle. Grain a famine food in India. An ornamental.

Vernacular names — Chinese pennisetum, Foxtail fountain-grass, Swamp foxtail (it would grow in moister places than *P. setaceum*, which is not supported by the Malesian field data).

Note — Distribution disjunct.

14. *Cenchrus purpureus* (Schumach.) Morrone

Cenchrus purpureus (Schumach.) Morrone in Chemisquy et al. (2010) 129. — *Pennisetum purpureum* Schumach. (1827) 44. — Type: *Thonning 355* (holo C; BM).

Perennials. Culms erect to geniculate at base, rooting in the decumbent nodes, stoloniferous (stolons up to 1 m long), rhizomatous, 1–4(–6) m long, solid, nodes glabrous or rarely pilose. Ligule a setose rim, c. 0.2 mm long, setae 2–3 mm long. Blades flat, 16–150 cm by 4–40 mm, margins spinulose. Peduncle pilose below the panicle. Panicle exerted, many-spikelet, 7–30 cm long, common axis pubescent. Involucre stipitate, disarticulating at base. Bristles many, rather stiff, the inner ones pilose, one distinctly longer than the others, 5–12 mm long, longest bristle 14–25 mm long. Spikelets 1–4 within the involucre (1–2 bisexual, the others male, shortly pedicelled, 1-flowered), pedicelled, the bisexual ones 5.5–6.5 mm long. Lower glume 0–1 mm long, 0–0.1 times as long as the upper glume; upper glume 1–3 mm long, 0–1-nerved. First lemma usually epaleate, sterile, sometimes paleate, male, rarely bisexual, acute to acuminate, membranous, 3–5-nerved, glabrous, nerves scaberulous; second lemma 5.5–6.5 mm long, acuminate, membranous. Anthers 2.25–3.75 mm long, apex penicillate. $2n = (14, 21, 27) 28, 32, 56$.

Distribution — Native to tropical Africa, cultivated and escaping elsewhere, in Malesia widely cultivated and escaping along roadsides, fallow fields, etc.

Habitat — Pioneering species in wet, disturbed sites, stream banks, roadsides, fallow fields, gaps in tropical rain forest, but also drought tolerant, 0–1900 m altitude.

Uses — Cultivation started in southern Africa. Grown below 1400 m altitude as a valuable forage crop, but will not stand intensive grazing; also as carp food, windbreaks, thatching, etc. Suitable for paper making. Culms used for fences, walls of huts, etc. When uncontrolled may choke young tree and sugarcane plantations.

Young leaves are rich in protein, carbohydrates, fat, vitamins, but cyanic acid has been reported.

Extracts are strongly diuretic. An infusion of foliage and culms is used in anuria, a root decoction for blennorrhoea, a leaf infusion for gargle and mouthwash. Sap from young shoots is used for cataracts, healing wounds, and ear trouble. The caryopses are used to cure headache.

Vernacular names — Elephant grass, Merker grass, Napier fodder or -grass.

Notes — A collection from near Wanariset, SE Borneo (*Am-briansyah 1419*, L, WAN) perhaps belongs here, but differs in a number of features. Unfortunately anthers are lacking:

Ligular setae c. 1.5 mm long. Margins of blades scaberulous. Longest bristle 12–13 mm long. Lower glume c. 1.35 mm long, acute, 0.28–0.3 times as long as the 4.65–4.9 mm long, 5-nerved upper glume.

15. *Cenchrus setaceus* (Forssk.) Morrone

Cenchrus setaceus (Forssk.) Morrone in Chemisquy et al. (2010) 129. — *Phalaris setacea* Forssk. (1775) 17. — *Pennisetum phalaroideum* Schult. (1824) 147, nom. superfl. — *Pennisetum setaceum* Chiov. (1923) 113. — Type: Forsskåhl 117 (holo C, IDC microfiche 2200; BM, LD).

Pennisetum macrostachyon Fresen. (1836) 135, non *P. macrostachyum* Trin. (1834). — *Pennisetum ruppelii* Steud. (1841) 298. — *Pennisetum ruppelianum* Hochst. ex Penz. (1893) 366 ('*rueppellianum*'). — Type: Ruppel s.n. (holo FR).

Pennisetum orientale auct. non Rich.

Perennials. Culms erect to geniculate at base, not rooting in the decumbent nodes, not stoloniferous, rhizomatous, 0.25–1.25 m long, nodes glabrous. Ligule a setose rim, c. 0.15 mm long, setae c. 0.75 mm long. Blades involute, 30–100 cm by 1–3.7 mm, margins scaberulous. Peduncle glabrous below the panicle. Panicle exserted, many-spikeled, 10–26 cm long, common axis pubescent. Involucre stipitate, disarticulating at base. Stipe pubescent, 1–3 mm long. Bristles many, rather stiff, pilose (some outer ones excepted), a few distinctly longer than the others, 15–27 mm long, longest bristle 17–42 mm long. Spikelets 1–3 within the involucre (the basal one bisexual, the others male), sessile (the basal one) or pedicelled (the others), 4.7–6.8 mm long. Lower glume absent to obsolete, rarely to c. 0.3 times as long as the upper; upper glume 1–3.5 (–5.25) mm long, 0–1-nerved. First lemma epaleate (rarely paleate, male), acuminate to aristate, membranous, 3–5-nerved, glabrous, nerves scaberulous; second lemma 4.7–6.8 mm long, acuminate to aristate, membranous. Anthers 2.6–3.7 mm long, apex glabrous. $2n = 9, 17$.

Distribution — N and E Africa, Near East, cultivated elsewhere and escaping, Malesia: Singapore, Java (Priangan, Tengger; none in L).

Habitat — Stony slopes, roadsides, c. 600 m altitude in Java, 300–1600 m in Africa.

Uses — Cultivated as *P. 'rueppellii'* for its inflorescences. Not very suitable as a fodder because of the harshness of the foliage. An invasive weed in many places in the (sub)tropics.

Vernacular name — (Tender) Fountain grass.

Notes — Occasionally the rachilla is prolonged beyond the second lemma, an exceptional occurrence in the *Panicaceae*.

Similar to *P. alopecuroides*:

- . Ligular setae 1.9–3.4 mm long. Blade margins smooth. Peduncle puberulous to pilose below the panicle. Involucral stipe glabrous; bristles scaberulous, unequal. Lower glume well-developed, 0.5–2 mm long *C. alopecuroides*
- . Ligular setae c. 0.75 mm long. Blade margins scaberulous. Peduncle glabrous below the panicle. Involucral stipe pubescent; bristles pilose (some outer ones excepted), a few distinctly longer than the others. Lower glume absent to obsolete *C. setaceus*

16. *Cenchrus unisetus* (Nees) Morrone

Cenchrus unisetus (Nees) Morrone in Chemisquy et al. (2010) 130. — *Gymnotrix uniseta* Nees (1841) 66. — *Beckera dioica* Nees (1842) 219, nom. superfl. — *Beckera uniseta* Hochst. (1844) 512. — *Pennisetum unisetum* Benth. (1881) 47. — *Beckeropsis uniseta* K.Schum. [in Engl. (July 1895a) 52, ibid. C (Aug. 1895b) 105, comb. inval.] ex Stapf & Hubb. (1933) 269. — Type: Drège 4334 (holo B; K, L, S).

Perennials. Culms erect, not stoloniferous, rhizomatous, 0.5–4 m long, nodes glabrous. Ligule a setose collar, 0.7–1 mm long,

setae c. 0.8 mm long. Blades flat, 15–29 cm by 5–30 mm, margins scaberulous. Peduncle scabrous below the panicle. Panicle exserted, many-spikeled, 2–4.5 cm long, common axis scabrous. Involucre not stipitate, disarticulating at base. Bristles 1, rather stiff, smooth, 7–40 mm long. Spikelets 1 within the involucre, sessile, 2.5–3 mm long. Lower glume 0.2–0.5 mm long, 0.4–0.62 times as long as the upper glume; upper glume 0.5–0.8 mm long, 0-nerved. First lemma epaleate, acute, membranous, 5-nerved, glabrous, nerves smooth; second lemma 2.5–3 mm long, acuminate, membranous. Anthers 1.5–1.8 mm long, apex glabrous. $2n = 18$.

Distribution — South to tropical Africa, introduced elsewhere, e.g. in Malesia: Papua New Guinea (E Highlands, Aiyura).

Habitat — Shaded woodlands and moist places, at c. 1675 m altitude in Papua New Guinea.

Uses — A high-yielding pasture grass when young, withstanding mowing and cutting. A decoction with ginger may be used for sore throat and tonsillitis. A famine cereal, and a base for beer.

Vernacular names — Duncan, Natal, or Silky grass.

NEW COMBINATIONS

1. *Cenchrus cafer* (Bory) Veldk., *comb. nov.*

Aristida cafra Bory, Voy. Îles Afrique 2 (1804) 376. — *Pennisetum cafrum* (Bory) Leeke (1907) 39 ('*cafrum*'). — Type: Bory s.n. (holo presumably in P [Henrard (1928: 697) mentions to have seen a specimen in LE]).

Gymnotrix thuarii P.Beauv. (1812) 60, 164, t. 13, f. 6. — *Panicum thuarii* (P.Beauv.) Raspail (1825) 299. — [*Gymnotrix thouarsii* Steud. (1821) 386, nom. inval., in syn.] — Type: Du Petit-Thouars s.n. (holo P 3365883?).

Note — The original orthography is 'cafra' for the Plaine des Cafres, Réunion (Bourbon), which is not correctable to 'caffra'.

2. *Cenchrus elegans* (Hassk.) Veldk., *comb. nov.*, see above.

3. *Cenchrus triticoides* (Poir.) Veldk., *comb. nov.*

Panicum triticoides Poir., Encycl., Suppl. 4 (1816) 274. — *Pennisetum triticoides* (Poir.) Roem. & Schult. (1817) 877. — Type: Anonymous of unknown origin in Herb. Desfontaines (FI, possibly isotypes in B-W, BM, C, CGE, LIV, MPU, PC, P-JU, P-LA. None were found on the internet; accessed 1 December 2013).

EXCLUDED SPECIES

1. *Cenchrus incertus* M.A.Curtis (1827) 135. — Lectotype: Curtis s.n. (holo NY 00380381; fragm. in US), designated by DeLisle (1963: 316; 'holotype'), N Carolina, Cape Fear River, S of Wilmington.

This is shown to occur in Luzon on a distribution map of the species by DeLisle (1963: f. 15) without further comment. It has been cultivated as *C. pauciflorus* Benth. in Bogor in 1921 (Anon., BO, L). If this is identical with *C. spinifex* Cav. (1799) a conservation proposal should be considered (Soreng & Pennington 2003: 147, 150). Garilleti (1993: 50) mentioned the presence of four syntypes in MA, but did not lectotypify or identify. Only three were found on the internet: MA 475503-1, 475504-1, 475505-1. The latter number was cited by Garilleti and is labelled as "Este ejemplar es el tipo" by Parodi in May 1935. It was collected by Née in Longaví, Chile. It seems the best collection with original labels, etc. and is here designated as the lectotype.

Acknowledgements The lectotype of *C. frutescens* L. is here reproduced with the kind permission of the Muséum National d'Histoire Naturelle, Paris. Mr. C.-H. Chen (TAIE) and H.-J. Esser (M) are thanked for looking up literature unavailable in Leiden. Two anonymous reviewers are much thanked for their thorough reading and helpful suggestions.

REFERENCES

- Adanson M. 1763. Familles des plantes 2: 31, 35, 581, 597. Vincent, Paris.
- Allioni C. 1785. Flora pedemontana 2: 241. Brioli, Torino.
- Alpino P. 1627. De plantis exoticis: 104–105. Guerilium, Venice.
- Anton AM. 1981. The genus *Tragus* (Gramineae). Kew Bulletin 36: 55–61.
- Backer CA. 1936. Verklarend woordenboek van wetenschappelijke plantennamen: 183. Noordhoff, Groningen; Noordhoff-Kolff, Batavia; Visser & Co, Batavia.
- Beauvois AMFJ Palisot de. 1812. Essai d'une nouvelle Agrostographie. Fain, Paris.
- Bentham G. 1881. Notes on Gramineae. Journal of the Linnean Society, Botany 19: 47.
- Blanco FM. 1837. Flora de Filipinas: 36. Lopez, Manila.
- Blume CL. 1823. Catalogus van eenige der merkwaardigste zoo in- als uitheemse gewassen te vinden in 's Lands Plantentuin te Buitenzorg: 38. Batavia.
- Boldingh I. 1914. The flora of the Dutch West Indian Islands. 2. The flora of Curaçao, Aruba and Bonaire: 6. Brill, Leiden.
- Bor NL. 1960. The grasses of Burma, Ceylon, India and Pakistan: 346. Pergamon Press, Oxford etc.
- Bory de St Vincent JBG. 1804. Voyage dans les quatre principaux îles des mers d'Afrique 2: 376. Buisson, Paris.
- Braun A. 1855. Penicillariae species novae. Appendix generum et specierum novarum et minus cognitarum quae in horto region botanico berlinensi coluntur 1855: 25–26. Feister, Berlin.
- Brink M. 2006. *Cenchrus biflorus*. PROTA 1, Cereals and pulses: 40–41. Backhuys Publishers, Wageningen.
- Briquet J, Ginzberger A, Schiffner V, Von Weinzierl T, Von Wettstein R, Zahlbruckner A (eds). 1905. Verhandlungen des internationalen botanischen Kongresses in Wien 1905: 73. Fischer, Jena.
- Brongniart AT. 1831. In: Duperrey LI, Voyage autour du monde ... La Coquille..., Phan.: 103–105, t. 9, 11, f. 1–9. Bertrand, Paris.
- Brown FBH. 1931. Flora of Southeastern Polynesia. I. Monocotyledons. Bulletin of the Bernice P. Bishop Museum 84: 66.
- Brown R. 1810. Prodomus florae Novae Hollandiae 1: 195–196. Johnson & Co., London.
- Brown R. 1814. List of new and rare plants, collected in Abyssinia. In: Salt H, A voyage to Abyssinia, App. 4: lxiii. Rivington, London.
- Brummitt RK (ed). 1998. Report of the Committee for Spermatophyta: 47. Taxon 47: 863.
- Brunken JN. 1977. A systematic study of *Pennisetum* sect. *Pennisetum* (Gramineae). American Journal of Botany 64: 168.
- Brunken JN. 1979. Morphometric variation and the classification of *Pennisetum* section *Brevivalvula* (Gramineae) in tropical Africa. Botanical Journal of the Linnean Society 79: 51–64.
- Bubani P. 1901. Flora pyrenaica 4: e.g. 261. Hoepli, Milan (Mediolanus).
- Burman NL. 1768. Flora indica: 27. Haek, Leiden; Schreuder, Amsterdam.
- Buse LH. 1854. Gramineae. In: Miquel FAW, Plantae junghuhnianae 3: preprint: 28 (Feb. 1854); 368 (Aug. 1854). Sythoff, Leiden.
- Buysman M. 1912. Kulturproeven met exotische planten. Teysmannia 23: 770.
- Cavanilles AJ. 1799. Icones descriptione plantarum 5: 38–40, t. 461–463. Typographia Regia, Madrid.
- Cavanilles AJ. 1802. Descripción de las plantas 2: 304. Imprenta Real, Madrid.
- Chase A. 1920. The North American species of *Cenchrus*. Contributions from the United States National Herbarium 22, 1: 45–77.
- Chase A. 1921. The North American species of *Pennisetum*. Contributions from the United States National Herbarium 22, 4: 209–210.
- Chemisquy MA, Giussani LM, Scataglini MA, Kellogg EA, Morrone O. 2010. Phylogenetic studies favour the unification of *Pennisetum*, *Cenchrus* and *Odontolytrum* (Poaceae): a combined nuclear, plastid and morphological analysis, and nomenclatural combinations in *Cenchrus*. Annals of Botany 106: 107–130.
- Chiovenda E. 1903. Gramineae. In: Pirota R, Flora della colonia Eritrea. Annuario del Reale Istituto Botanico di Roma 8: 41, t. 5, f. 2.
- Chiovenda E. 1907. Gramineae. In: Pirota R, Flora della colonia Eritrea. Annuario del Reale Istituto Botanico di Roma 8: 319.
- Chiovenda E. 1923. Nota sulla flora Ægyptiaco-Arabica di Pietro Forskal, pubblicata nel 1775. Bollettino della Società Botanica Italiana 1923: 113.
- Chrtěk J, Osbornova J. 1996. A proposal for subdivision of the genus *Cenchrus* (Gramineae). Acta Universitatis Carolinae. Biologica 39: 85–94.
- Clayton WD. 1967. *Beckeropsis laxior* W.D. Clayton. Hooker's Icones Plantarum: t. 3643.
- Clayton WD. 1980. *Cenchrus*. Flora Europaea 5: 264. Cambridge University Press, Cambridge, etc.
- Clayton WD, Renvoize SA. 1982. Flora of Tropical East Africa, Gramineae 3: 672, 691. Balkema, Rotterdam.
- Clayton WD, Renvoize SA. 1986. Genera graminum. Kew Bulletin, Additional Series 13: 304.
- Clayton WD, Vorontsova MS, Harman KT, Williamson H. GrassBase - The online world grass flora. <http://www.kew.org/data/grasses-db.html> (accessed 3 April 2014).
- Clusius C. 1601. Rariorum plantarum historia 2: 215, f. Plantijn, Antwerp.
- Cohn F. Deutsche Biographie. <http://www.deutsche-biographie.de/xfsz3154.html> (accessed 16 May 2013).
- Cope TA. 2000. In: Cafferty S, et al., Typification of Linnaean plant names in the Poaceae. Taxon 49: 245.
- Curtis MA. 1827. Enumeration of plants growing spontaneously around Wilmington, North Carolina, with remarks on some new and obscure species. Boston Journal of Natural History 1: 135.
- Davidse G. 1994. *Pennisetum*. In: Dassanayake MD, Fosberg FR, Clayton WD, A revised handbook to the flora of Ceylon 8. Amerind Publishing Co, New Delhi; Balkema, Rotterdam, Brookfield.
- De Jussieu AL. 1789. Genera plantarum: 34. Herissant, Paris; Barrois, Paris.
- De Lamarck JBAPM. 1791. Tableau encyclopédique 1: 169. Panckoucke, Paris.
- De Tournefort JP. 1689. Horti regii parisiensis: 258. See Sherard.
- De Tournefort JP. 1703. Corollarium institutionum rei herbarii: 39. Typographia regii, Paris.
- De Wet JM. 1995. Pearl millet, *Pennisetum glaucum* (Gramineae-Panicaceae). In: Smartt J, Simmonds NW, Evolution of crop plants, ed. 2. Longman Scientific & Technical, Harlow.
- DeLisle DG. 1963. Taxonomy and distribution of the genus *Cenchrus*. Iowa State College Journal of Science 37: 259–351.
- Desfontaines R. 1799. Flora atlantica 2: 385. Desgranges, Paris.
- Dioscorides P. 50–70 AD. [J. Ruellius (ed.). 1552]. De medicinali materia libri sex: 93. Arnollet, Lyon.
- Donadio S, Giussani LM, Kellogg EA, Zuloaga FO. 2009. A preliminary phylogeny of *Pennisetum* and *Cenchrus* (Poaceae–Panicaceae) based on trnL-F, rpl16 chloroplast markers. Taxon 58: 392–404.
- Dujardin M, Hanna WW. 1984. Microsporogenesis, reproductive behaviour, and fertility of five *Pennisetum* species. Theoretical and Applied Genetics 67: 197–201.
- Durand T, Schinz H. 1894. Conspectus florae Africae 5: 785. Jardin Botanique, Bruxelles, etc.
- Fabricius PC. 1759. Enumeratio methodica plantarum: 206. Drimborn, Helmstedt.
- Fielding J, Turland N. 2005. Flowers of Crete: 48, 488. Royal Botanic Gardens, Kew.
- Figari A, De Notaris J. 1853. Agrostographiae aegyptiacae fragmenta: 55. Officina Regia, Torino.
- Figari A, De Notaris J. 1853. Agrostographiae aegyptiacae fragmenta. Pars II. Gramina Aegypti et Nubiae. Memorie della Reale Accademia delle Scienze di Torino II, 14: 365.
- Filgueiras TS. 1984. O gênero *Cenchrus* L. no Brasil (Gramineae: Panicaceae). Acta Amazonica 14: 95–127.
- Forsskåhl P. 1775. Flora Aegyptiaco-Arabica: 17. Möller, Copenhagen.
- Fosberg FR, Sacht MH. 1984 ('1982'). Micronesian Poaceae: critical and distributional notes. Micronesica 18, 2: 86.
- Fresenius JBGW. 1836. Beiträge zur Flora von Abyssinien. Museum Senckenbergianum 2: 134–135.
- Garilletti R. 1993. Herbarium cavanillesianum. Fontqueria 38: 49–50.
- Gayle EE. 1892. The spines of *Cenchrus tribuloides*. Botanical Gazette 17: 126–127.
- Gledhill D. 2008. The names of plants, ed. 4: 97. Cambridge University Press, Cambridge (UK), etc.
- Greuter W, Scholz H. 1996. Phragmites in Crete, *Cenchrus frutescens*, and the nomenclature of the common reed (Gramineae). Taxon 45: 521–523.
- Grisebach AHR. 1864. Flora of the British West Indian islands: 556. Reeve & Co., London.
- Hackel E. 1887. Gramineae. In: Engler A, Prantl K, Natürlichen Pflanzenfamilien II, 2: 38. Engelmann, Leipzig.
- Haller A. 1768. Historia stirpium indigenarum Helvetiae inchoate 2: 203. Societas Typographica, Bern.
- Hasskarl JK. 1842. Plantarum genera et species novae aut reformatae javenses. Flora 25, 2, Beibl. 1: 2.
- Hasskarl JK. 1843. Adnotationes de plantis quibusdam javanicis nonnullisque japonicis, haud rite cognitiss, e Catalogo Horti bogoriensis excerptae. Accedunt nonnullae novae species. Tijdschrift voor Natuurlijke Geschiedenis en Physiologie 10: 116.
- Hasskarl JK. 1844. Catalogus plantarum in horto botanico bogoriensi cultarum alter: 17. Landsdrukkerij, Batavia.

- Henrard JT. 1926–1933. A critical revision of the genus *Aristida*. Mededeelingen van 's Rijks-Herbarium 54 (1926) 1–220; 54A (1927) 221–464; 54B (1928) 465–701; 54C (1933) 702–747.
- Henschel AWET. 1837. Zur Geschichte der botanischen Gärten und der Botanik überhaupt in Schlesien im XV. und XVI. Jahrhundert. *Catalogus Horti Scholiziani* 1587 (Schluß). *Allgemeine Gartenzeitung* 5: 177–181, 187–191.
- Hitchcock AS. 1920. The genera of grasses of the United States, with special reference to the economic species. *Bulletin, United States Department of Agriculture, Washington* 772: 245.
- Hochstetter CF. 1844. Ueber die Arten von *Beckera* und über *Ophiurus pillosus* Hochst. *Flora* 27: 512.
- Jacquin JF. 1814. *Eclogae plantarum rariorum* 1: 31, t. 22. Strauss & Sommer, Vienna.
- Johnston MC. 1963. *Notes. Sida* 1: 182.
- Koidzumi G. 1919. *Contributions ad Floram Asiae orientalis. Botanical Magazine (Tokyo)* 33: 112.
- Koorders SH. 1911. *Exkursionsflora von Java* 1: 140. Fischer, Jena.
- Körnigke H, Werner H. 1885. *Handbuch des Getreidebaus* 1: 284. Körnicke, Bonn.
- Koyama T. 1987. Grasses of Japan and its neighboring regions: 379, 521. Kodansha, Tokyo.
- Kunth CS. 1816a ('1815'). *Considérations générales sur les Graminées. Mémoires du Muséum d'Histoire Naturelle* 2: 69, 71.
- Kunth CS. 1816b. *Nova genera et species* 1: 107, 113. *Libraria graeco-latini-germanica*, Paris.
- Kunth CS. 1829. *Révision des Graminées*: 46, 49. Gide fils, Paris.
- Kunth CS. 1833. *Agrostographia synoptica sive enumeratio graminearum*: 158, 162. Cotta, Stuttgart, Tübingen.
- Kuntze O. 1891. *Revisio generum plantarum* 2: 767, 787. Felix, Leipzig, etc.
- Kuntze O. 1898. *Revisio generum plantarum* 3: 346–347. Felix, Leipzig, etc.
- Labillardière J-J. 1824. *Sertum austro-caledonicum*: 14, t. 19. Huzard, Paris.
- Lamson-Scribner, F. 1897. See Scribner.
- Leeke GGP. 1907. Untersuchungen über Abstammung und Heimat der Negerhirsche *Pennisetum americanum* (L.) K. Schum. *Zeitschrift für die gesammten Naturwissenschaften* 79: 1, 9–10, 21–23, 28, 39, 52.
- Link JHF. 1827. *Hortus regius botanicus berolinensis* 1: 213, 221. Reimer, Berlin.
- Linnaeus C. 1742. *Genera plantarum*, ed. 2: 493. Wishoff & Wishoff, Leiden.
- Linnaeus C. 1753. *Species plantarum*: 42, 55–56, 480, 1049–1050. *Salvius*, Stockholm.
- Linnaeus C. 1759. *Systema naturae*, ed. 10, 2: 870, 1305. *Salvius*, Stockholm.
- Linnaeus C. 1762. *Species plantarum*, ed. 2, 1: 82. *Salvius*, Stockholm.
- Linnaeus C. 1763. *Species plantarum*, ed. 2, 2: 1489. *Salvius*, Stockholm.
- Linnaeus C. 1771. *Mantissa plantarum altera*: 302, 322. *Salvius*, Stockholm.
- Linnaeus C. 1774. *Systema vegetabilium*, ed. 13 (J.A. Murray, ed): 92. Göttingen.
- Lunell J. 1915. *Enumerantur plantae Dakotae Septentrionalis vasculares* – II. *American Midland Naturalist* 4: 214.
- Mabberley DJ. 2004. More French "firsts" in Australia ignored: Dumont de Courset's *Le Botaniste Cultivateur*. *Taxon* 53: 187–192.
- MacBryde B. 1970. Rediscovery of G. Marcgrave's Brazilian collections (1638–1644). *Taxon* 19: 349.
- Maire RCJE. 1940. *Contributions à l'étude de la flore de l'Afrique du Nord* 31: 45.
- Maire RCJE, Weiller M. 1952. *Flore d'Afrique du Nord* 1: 339, 342. Chevalier, Paris.
- Makino T. 1912. Observations on the flora of Japan. *Botanical Magazine (Tokyo)* 26: 294.
- Martel E, Poncet V, Lamy F, Siljak-Yakovlev S, Lejeune B, Sarr A. 2004. Chromosome evolution of *Pennisetum* species (Poaceae): implications of ITS phylogeny. *Plant Systematics and Evolution* 249: 139.
- Merrill ED. 1917. An interpretation of Rumphius' herbarium amboinense. *Bureau of Science, Manila, Publication* 9: 91.
- McNeill J (ed). 2012. *International Code of Nomenclature for algae, fungi, and plants (Melbourne Code)*. *Regnum Vegetabile* 154.
- Micheli PA. 1729. *Nova plantarum genera*: 36, t. 31. Paperini, Florence.
- Miquel FAW. 1857. *Flora van Nederlandsch Indië* 3: 470. Van der Post, Amsterdam; Van der Post Jr, Utrecht; Fleischer, Leipzig.
- Moench C. 1794. *Methodus*: 205–206. *Nova Libraria Academiae*, Marburg.
- Monod de Froideville C. 1968. Gramineae. In: Backer CA, Bakhuizen van den Brink Jr RC, *Flora van Java* 3. Wolters-Noordhoff, Groningen.
- Morison R. 1699. *Plantarum historiae universalis* 3: 195. Sheldon, Oxford.
- Morrone O. 2010. See Chemisquy, et al.
- Mudaliar CR, Sundararaj DD. 1957. In: Sundararaj DD, Ramakrishnan V, *New plant records for South India* – II. *Journal of the Bombay Natural History Society* 54: 926.
- Murray A. 1784. *Systema vegetabilium*, ed. 14: 105. Dieterich, Göttingen.
- Nash GV. 1895. New or noteworthy American grasses – I. *Bulletin of the Torrey Botanical Club* 22: 423.
- Nash GV. 1913. *Cenchrus*. In: Britton NL, Brown A, *An illustrated flora of the Northern United States*, ed. 2, 1: 166. Scribner's Sons, New York.
- National Research Council, USA. 1996. *Lost crops of Africa: 177–125*. National Academy Press, Washington.
- Nees CGD. 1841. *Flora Africae australioris illustrationes monographicae*: 66. Prausnitz, Glogow.
- Nees CGD. 1842. In: Nees CGD, Schauer JC, *Annotationes ad indicem seminum horti vratislaviensis A. 1841*. *Linnaea* 16: 219.
- Ng FSP. 2006. *Tropical horticulture and gardening*: 80, f. Clearwater Publications, Kuala Lumpur.
- Ohwi J. 1947. New or noteworthy grasses from Asia. *Bulletin of the Tokyo Science Museum* 18: 13.
- Oyen LPA, Andrews DJ. 1996. *Pennisetum glaucum*. *PROSEA* 10: 119–123.
- Penzig AJO. 1893. *Atti del Congresso Botanico Internazionale, Genova*: 366. (n.v.).
- Phillips EP. 1951. *Genera of South African flowering plants*, ed. 2. *Memoirs of the Botanical Survey of South Africa* 25: 107.
- Pilger R. 1940. Gramineae III. Unterfamilie Panicoideae. In: Engler A, Prantl K, *Natürlichen Pflanzenfamilien* II, 14e: 80. Engelmann, Leipzig.
- Piso W. 1648. *De medicina brasiliensis*: 120, f. Haak, Leiden & Elsevier, Amsterdam.
- Plukenet L. 1691. *Phytographia*: t. 32, f. 4; t. 92, f. 3. Plukenet, London.
- Plukenet L. 1696. *Almagestum botanicum* 2: 164, 174, 177. Plukenet, London.
- Poiret JLM. 1804. In: De Lamarck JBAPM, *Tableau encyclopédie et méthodique* 6: 50. Panckoucke, Paris.
- Poiret JLM. 1816. In: De Lamarck JBAPM, *Encyclopédie méthodique. Botanique, Supplement* 4: 274–275. Agasse, Paris.
- Presl J. 1830. In: Presl CB, *Reliquiae haenkeanae* 1: 315. Calve, Prague.
- Pritzl GA. 1848. *Thesaurus literaturae botanicae*: 266. Broickhaus, Leipzig.
- Raspail FV. 1825. *Classification générale des Graminées. Annales des sciences naturelles (Paris)* 5: 299.
- Rauschert S. 1973. Zur Nomenklatur der Fam- und Blütenpflanzen Deutschlands (III). *Feddes Repertorium* 83: 662.
- Richard LCM. 1805. *Pennisetum*. In: Persoon CH, *Synopsis plantarum* 1: 72. Cramer, Paris; Cotta, Tübingen.
- Roemer JJ, Schultes JA. 1817. *Systema vegetabilium* 2: 258, 498, 877. Cotta, Stuttgart.
- Roxburgh W. 1814. *Hortus Bengalensis*: 7. Mission Press. Serampore.
- Roxburgh W. 1820. *Flora indica* 1: 288. Mission Press. Serampore.
- Rumphius GE. 1750. *Herbarium amboinense* 6: 18, t. 7, f. 2B. Changuion, etc., The Hague, etc.
- Sampaio GA. 1914. *Lista das espécies representadas no Herbário português*: 4. Carragal, Porto.
- Schlechtendal FL. 1853. *Holcus spicatus* L. Ein kritischer Versuch. *Linnaea* 25: 559.
- Schmelzer GH. 1997. Review of *Pennisetum* section *Brevivalvula* (Poaceae). *Euphytica* 97: 63.
- Scholz H. 2006. *Kikuyuochloa*, genus novum (Poaceae: Paniceae). *Feddes Repertorium* 117: 513.
- Scholz de Rosenau L. 1857. *Hortus Vratislaviae situs et rarioribus plantis consitus, carmine celebratus, cum ejusdem horti catalogus*. Scharfenberg, Breslau.
- Scholz de Rosenau L. 1854. *Catalogus arborum, fruticum ac plantarum tam indigenarum quam exoticarum horti medici D. Laur. Scholzii med. Vratisl. Baumann, Breslau*.
- Schreber JCD. 1789. *Genera plantarum* ed. 8, 1: 55. Varrentrap & Wenner, Frankfurt a/M.
- Schultes JA. 1824. *Mantissa* 2: 146–147, 277. Cotta, Stuttgart.
- Schumacher HCF. 1827. *Beskrivelse af Guineiske planter*: 44. Popps, Copenhagen.
- Schumann K. 1895a. Die Gräser Ostafrikas und ihre Verwerthung. In: Engler A, *Die Pflanzenwelt Ost-Afrikas* B: 51–52. Reimer, Berlin.
- Schumann K. 1895b. Gramineae. In: Engler A, *Die Pflanzenwelt Ost-Afrikas* C: 105. Reimer, Berlin.
- Scribner FL. 1897. *Miscellaneous notes and descriptions of new species. Bulletin, Division of Agrostology, United States Department of Agriculture* 4: 39.
- Sherard W. 1689. *Schola botanica*: 258, 338. Wetsten, Amsterdam.
- Sieber FW. 1822. Bemerkungen über *Cenchrus frutescens* L., *Eryngium trifolium* Alpin. und *Campanula pelviformis* Lamarck. *Flora* 5: 14–16.
- Sloane H. 1696. *Catalogus plantarum quae in insula Jamaica sponte proveniunt*: 30. Brown, London.
- Sloane H. 1707. *A voyage to the islands Madera, Barbados, Nieves, S. Christophers and Jamaica*: 108, t. 65, f. 1. B.M., London.
- Smith JE. 1806. *Florae graecae prodromus*: 76. Taylor & Son, London.

- Soreng RJ, Pennington SJ. 2003. Catalogue of New World grasses (Poaceae: III. Subfamilies Panicoideae, Aristidoideae, Arundinoideae, and Danthonioideae. Contributions from the United States National Herbarium 46: 147, 150, 312, 532.
- Sprengel K. 1817. Anleitung zur Kenntniss der Gewächse, ed. 2, 2: 154. Kummel, Halle.
- Sprengel K. 1824. Systema vegetabilium 1: 301–309. Libraria Dieterichiana, Göttingen.
- St John H. 1976. Lectotypes for Brown's Flora of Southeastern Polynesia. Phytologia 33: 419.
- Stapf O. 1896. Pennisetum. Flora of British India 7: 86. Reeve & Co., Brook nr. Ashford.
- Stapf O, Hubbard CE. 1933. Notes on African grasses: XIII. Bulletin of Miscellaneous Information: 269, 271.
- Stapf O, Hubbard CE. 1934. Gramineae. Flora Tropical Africa 9: 1067. Reeve & Co., Ashford
- Steudel EG. 1821. Nomenclator botanicus: 386, 589. Cotta, Stuttgart, Tübingen.
- Steudel EG. 1840. Nomenclator botanicus, ed. 2, 1: 713. Cotta, Stuttgart, Tübingen.
- Steudel EG. 1841. Nomenclator botanicus, ed. 2, 2: 261, 298. Cotta, Stuttgart, Tübingen.
- Steudel EG. 1854. Synopsis plantarum glumacearum: 81, 107, 461. Metzler, Stuttgart.
- Steudel EG. June 1854. Gramineae. In: Zollinger H, Systematisches Verzeichniss 1: 58, 60. Kiesling, Ulrich.
- Sulekic AA, Zapater MA. 2001. El género *Tragus* (Poaceae, Zoisieae) en la Argentina. Darwiniana 39: 247–254.
- Swartz O. 1788. Nova genera & species plantarum seu Prodromus: 26. Sweder, Stockholm, etc.
- Swartz O. 1797. Flora Indiae occidentalis: 211. Palm, Erlangen; White & fil., London.
- Sweet R. 1826. Hortus britannicus: 440. Ridgway, London.
- Terrell EE. 1976. The correct names for Pearl millet and Yellow foxtail. Taxon 25: 297–304.
- Thunberg CP. 1784. Flora Japonica: 48. Müller, Leipzig.
- Thunberg CP. 1794. Botanical observations on the Flora Japonica. Transactions of the Linnean Society of London 2: 329.
- Trinius CB. 1821. Agrostographische Beiträge. In: Sprengel K, Neue Entdeckungen in ganzen Umfang der Pflanzenkunde 2: 76.
- Trinius CB. 1822. Clavis agrostographiae antiquioris: 327. Biedermann, Coburg.
- Trinius CB. 1826. De graminibus paniceis. Dissertatio botanica altera: 65–66, 68. Academia imperialis scientiarum, St. Petersburg.
- Trinius CB. 1834. Panicearum genera. Mémoires de l'Académie Impériale des Sciences de St.-Petersbourg. Sixième Série, Sciences Mathématiques, Physiques et Naturelles, Seconde Partie: Sciences Naturelles 3: 177, 183–184.
- Trinius J[=C]B. 1836. Graminum in America calidiore ab E. Poeppig lectorum pugillus primus. Linnaea 10: 295.
- Turland N. 1995. Proposal to reject the name *Cenchrus frutescens* L. (Gramineae). Taxon 44: 419–420.
- Tzvelev NN. 1971. Notae de gramineis florum URSS, 6. Novosti Sistematiki Vysshikh Rastenii 8: 72.
- Vahl M. 1805. Enumeratio plantarum 2: 395. Möller & fil., Copenhagen.
- Van der Zon APM. 1992. Graminées du Cameroun 2, flore. Wageningen Agricultural University Papers 92-1: 335.
- Veldkamp JF. 1993. *Cenchrus*. In: Jarvis CE et al., A list of Linnaean generic names and their types. Regnum Vegetabile 127: 31.
- Veldkamp JF. 2000. In: Cafferty S, Jarvis CE, Turland NJ (eds), Typification of Linnaean plant names in the Poaceae. Taxon 49: 253.
- Webster RD. 1987. The Australian Paniceae (Poaceae): 20. Cramer, Berlin, Stuttgart.
- Willdenow CL. 1809. Enumeratio plantarum: 1031, 1036–1037. Libraria Scholae Realis, Berlin.
- Wipff JK. 2001. Nomenclatural changes in Pennisetum (Poaceae: Paniceae). Sida 19: 526.
- Wipff JK, Veldkamp JF. 1999. Pennisetum advena sp. nov. (Poaceae: Paniceae): a common ornamental throughout the southern United States. Sida 18: 1031–1036.
- Youngken HW, La Wall CH. 1922. Anatomical and chemical studies of the sand spur (*Cenchrus tribuloides* L.). American Journal of Pharmacy 94: 567–583.

INDEX TO SPECIMENS

Cenchrus

ame = <i>C. americanus</i>	ech = <i>C. echinatus</i>	pns = <i>C. purpurascens</i>
bro = <i>C. brownii</i>	ele = <i>C. elegans</i>	pol = <i>C. polystachios</i>
cal = <i>C. caliculatus</i>	lon = <i>C. longisetus</i>	pur = <i>C. purpureus</i>
cil = <i>C. ciliaris</i>	ori = <i>C. orientalis</i>	set = <i>C. setaceus</i>
cla = <i>C. clandestinus</i>	ped = <i>C. pedicellatus</i>	uni = <i>C. unisetus</i>

- A.O. Cameroon Highlands SP/En: pur – Adj. Veearts Gorontalo 5: bro – Aet & Idjan 129: ele; 255: bro; 592: bro – Afriastini 760: ele; 1618: bro – Alder 6/1979: cla – Alston 12513: lon – Ambriansyah 1060: ech – Ambriansyah AA 1419: pur? – Ambriansyah & Adriansyah AA 2091: pol – Anang 140: bro; 156: bro; 388: ele; 587: bro – ANU 1582 (Anon.): ele; 2520 (Flenley): cla; 13024 (Wace): ele; 13076 (Wace): cla – Atjeh 215: ele.
- Backer 4/5/1908: ele; 7/5/1908: ele; 9708: pns; 24163: ele; 24174: set; 31163-bis: ele; 31750: ele; 36672: lon; 37190: bro; 37399: pns; 37441: ele; 37501: cil – Bakhuizen v.d. Brink 1968: ele; 2716: set; 3023: pur – Bakia 518: pol – Banfield 6/8/1928: pur – Beach M-49: bro – Beaman et al. 10794: cla – Beguin 1/12/1926: pur; 39: bro; 47: ele; 64: ele; 70: bro; 125: bro; 611: ele; 1750: ele; 1849: bro – BF 15675 (Merritt & Darling): bro; 27686 (De Mesa): bro – Bicknell 189: bro; 264: pur; 314: ech – Blackwood 183: ele – Bloembergen 3683: bro; 4435: ele; 4730: bro; 4750: ele – Boden Kloss 1/1913: ele – Bodner 139: pol – Boerlage 29/9/1896: ele; 17/3/1897: ele; 536: ele – Bouman 1: bro – Bradtke 126: ele – Brass 538: ele; 3610: ele; 5513: ele; 6395: bro; 6397: ele; 8893: ele; 11777: ele; 22081: bro; 23912: ele; 24430: bro; 25524: ele; 28663: ele; 32227: ele – Brinkman 835: ele – BS 162 (Foxworthy): bro; 2861 (Mearns): pns; 4435 (Merrill): pns; 4484 (Mearns): pns; 5217 (Ramos): ele; 5932 (Ramos): pns; 5995 (Ramos) (ST): bro; 7704: pns; 8763 (McGregor): pns; 12708 (Fénix): pns; 17412 (Ramos): ech; 24939 (Fénix): ele; 27422 (Ramos): pns; 27686 (De Mesa): bro; 30900 (Oro): pur; 31306 (Ramos & Edaño): ele; 31898 (Santos): pns; 38043 (Ramos & Edaño): pns; 42960 (Ramos): ele; 44273 (Ramos & Edaño): bro; 49012 (Ramos & Edaño): bro; 49204 (Ramos & Edaño): bro; 85197 (Ramos & Edaño): cal – Bulmer 10/8/1964: ele – Bunnemeijer 8284: ele – Burkill 719: cla; 1921: bro – Buwalda 4106: bro; 5220: bro; 6061: bro – Buysman 1: pur; 2938: set – BW 5233 (Iwanggin): bro; 5281 (Iwanggin): bro; 8368 (Versteegh & Vink): ele; 12529 (Versteegh): ele.
- Cadigan G-10: bro; G-11: bro – Callo 8/2/1983: pol; 24/10/1999: pol; 13: pur – Carni 37: bro – Carr 11180: bro/ech; 11364: ele; 11658: ele; 16386: ele – Chan 23/8/1984: pol; 25/8/1984: pur – Chandapillai 30/12/1976: ech – Cinatti 83: bro; 125: pol; 176: pol; 258: pol – Clemens 1608: ele; 9029-A: ele; 17657: pur; 17759: bro – Co 3098: pol – Coert 1203: pns; 1403: bro – Corlett 85/4: pol – Creagh 7/4/1895: bro – Cruttwell 23: bro; 1643: ele. Dahlia P33: pol – Darbyshire 616: bro; 1152: ele – Darbyshire & Hoogland 7790: bro – De Boo 2011-1278: pur – De Voogd 1777: bro – De Wilde & Vervoort 386-A: ele; 402: bro – De Wit 4040: bro – Deguchi et al. 6335: ech – Demoulin & Smeets 5842: ele – Den Hoed 3098: bro – Dissing 2567: ele; 2717: bro – Docters van Leeuwen 9727: ele; 12827: ele – Dorgelo 3151: pur – Dransfield 2397: lon – Du Puy & Du Puy Cl-103: bro – Duistermaat S 12: ech; S 90: bro; S 120: ech; S 126: pol; S 149: ech; S 224: ech; S 230: ech. Eballo 861: ele; 996: bro – Elbert 2074: bro; 2519: bro; 3414: ele; 3474: ele; 4270: ele; 4279: ele; 4310: bro – Elmer 83: bro; 5756: pns; 9674: ele; 11954: ele; 15327: ele; 18324: ele – Eyma 4026: pur.
- Fallen & Kaupa 453: ele – Forbes 2548: ele – Forman & Blewett 858: ech; 1102 p.p.: ech – Forman & Lasut 278: ele – Forster 17: bro – Fosberg 35050: bro; 35180: pns – Franck 1/1924: ele; 32: pns – Fraser 70: uni – FRI 16783 (Kochummen): pol; 35767 (Ng): pur; 51865 (Chew et al.): pol; 51918 (Duistermaat et al.): pol; 51984 (Phoon): ech; 53113 (Yao et al.): pol; 53118 (Yao et al.): pur; 53156 (Yao et al.): pol; 57898 (Yao & Yeap): set; 63364 (Chew et al.): pol; 63392 (Chew et al.): pol; 63458 (Chew et al.): pol; 63640 (Chen et al.): pol; 70401 (Kiew et al.): pol; 70416 (Kiew et al.): pol – Froggatt 9: bro – Frost 9: bro – Furtado 10/4/1929: mac, pol.
- Gibbs 2742: bro – Gilliland 5253: bro; 5298: pur – Gisius 4: pns; 12: pns – Gjellerup 245: ele – Goering 172: ele – Goetghebeur & Coppejans 3438: bro; 3446: pur; 3891: ele – Goetghebeur & Vyverman 6467: cla.

- Hamzah 13: cil – Hardial & Samsuri 288: pur – Hellwig 47: ele – Henty 292: pol – Heyligers 1030: ele – Hiepkot & Schultze-Motel 537: ele – Hitchcock 18040: bro – Hoekstra 3: bro – Höft 2872: pur; 3078: pur – Hollrung 582: ele – Holtum 11/8/1931: pur – Hoogerwerf 12: bro; 188: bro – Hoogland 3341: ele; 4533: ele; 5108: bro – Hoogland & Pullen 6235: ele.
- I Gusti Raka Panji Tisna 16: bro – Iboet 124: ele; 300: ele – Ibrahim 223: ech; 224: ech; 327: ech – Ibrahim & Chin 224: ech – Iwatsuki et al. P-914: pol; P-1129: pur.
- Jaag 359: bro; 720: ele; 1020: cal – Jacobs 7177: pns; 7381: pns – Janowsky 513: bro – Jensen 58: bro; 236: bro – Jeswiet 8/1918: pns; 49: bro – Jibrin 72: pol – Johanssen et al. 556: ele – Jowett & Jowett 2: bro – Jumali 12/2/1965: pur; 8/1967: pur; 12/1968: bro; 599: pur; 757 p.p.: ame.
- Kajewski 2245: ele – Kakah 49: pur – Kalkman 4251: ele – Kasaim 555: cil – Kassim 117: pur – Kaudern 154: ele – Keng & Jumali 650: pur – Keng & Keng 16/6/1985: bro; 27/9/1987: bro – King 1044: ele; 1052: bro – Kjellberg 257: ele; 1205: ele; 3713: ele – Kneucker 833 (McGregor): bro – KNP 8819 (Johnny G. et al.): bro – Koh 33: pol – Kjøie 1872: ele – Koorders 19777: ele; 19799: ele; 19804: ele; 20971: ele; 37542: pns; 37544: pns; 41007: lon; 43470: pns; 43630: pns – Kooy 278: bro; 324: pol; 686: bro; 769: pol – Kornassi 433: bro; 449: ele; 1300: pur; 1349: ele – Kostermans 2850: ele – Kostermans & Soegeng 824: bro – Kostermans & Wirawan 380: bro – Kurz 506: ele.
- LAE 60576 (Croft & Lelean): pur; 67658 (Barker): ele; 77472 (Kerenga et al.): pol – Lahaie 1525: bro – Lam 3393: bro – Lambinon 87/172: bro – Lauterbach 24: ele; 81: ele – Leach & Dunlop 9556: bro – Lim S.P. et al.: bro – Loher 1689: bro; 1753: pns; 1754: pns; 1755: pns; 1756: ele – Lörzing 12666: ele; 16368: pur.
- Main 387: bro; 390: bro – Main & Aden 1580: bro – Mangen 370: ele – Maner & Street 409: ele – Marsden 203: pur – McDonald & Sunaryo 4546: bro – McGregor 5: bro; 34: bro; 59: bro – McKee 1812: pur – Meijer 9256: ele – Merrill 52: bro; 83: bro; 266: bro; 366: bro; 493: bro; 3381: ele – Merrill Philip. Pl. 188: bro – Merrill Sp. Blancoan. 811: bro (T) – Metzner 165: bro; 167: pol – Milliken 1306: ele – Millspaugh 2796: bro – Mitchell 113: bro – Mitchell & Pane 5280: cil – Monod de Froideville 1308: cil; 1880: ele – Mousset 690: pns; 1101 (T): pns – Murata et al. J-2115: pol.
- Nauen 3/6/1941: ame – Nedi 233: ele; 409: bro – Ng 23/3/1999: pol – NGF 1114 (Smith): ele; 3106 (–): ech; 3535 (Floyd): ele; 3580 (McIntosh): ele; 3635 (Fryar): ech; 3940 (Fryar): ele; 4731 (Womersley): cal; 7395 (Wells): bro; 7559 (Wells): ele; 10566 (Henty): cil; 17411 (Epstein): bro; 18761 (Millar): pur; 20981 (Henty): bro; 27826 (Streimann & Kairo): pol; 29750 (Coode et al.): bro; 37610 (Millar): pur; 38448 (Millar): bro; 40121 (Coode & Katik): bro; 41339 (Croft): bro; 41941 (Henty): ame; 44004 (Streimann & Kairo): pur; 47707 (Streimann & Kairo): ele; 49821 (Henty & Katik): bro; 49822 (Henty & Katik): ech; 49858 (Henty & Laravita): cil – NIFS 32: pns – Niniek 75: pol – Noerkas 381: bro – Noor = Nur 17/8/1918: set; 17/10/1929: mac, set; 26/10/1929: mac, pol.
- Ogata 10972: bro – Olsen 769: pns; 1009: ele.
- Pancho & Hernaez 1214: bro – Parker 2247: pol; 2262: pol – Peekel 19: (mac in BO) – Pereira A^o 1896: bro – Pereira et al. 108: pol; 122: pur – Platenkamp 10: ele – PNH 1005 (Edaño): ele; 1286 (Edaño): ele; 2184 (Quisumbing): pns; 2885 (Convocar): ele; 3095 (Mendoza): bro; 3819 (Edaño): bro; 4112 (Edaño): pol; 4255 (Edaño): pol; 4275 (Sulit): pol; 4453 (Celestino et al.): pur; 7000 (Sulit): pur; 7003 (Sulit): pol; 7355 (Edaño): ele; 7636 (Sulit): pns; 7930 (Celestino): pns; 9394 (Paniza): ele; 10004 (Sulit): ele; 10697 (Mendoza & Convocar): ele; 11391 (Bur. Pl. Ind. employee): pol; 11403 (Farinas & Refuerzo): pol; 11972 (Edaño): ele; 12196 (Mendoza): bro; 13473 (Anonuevo): pol; 13513 (Anonuevo): ele; 15630 (Edaño): ele; 17459 (Conklin): ele; 18918 (Powels): ele; 20380 (Mendoza): pns; 20447 (Mendoza): pol; 21794 (Edaño): ele; 22602 (Steiner): pol; 22971 (Steiner): pns; 33636 (Gachalian): bro; 34729 (Pancho): pns; 34936 (Garcia): pns; 34998 (Garcia): cla; 35061 (Garcia): pur; 36281 (Frake): bro; 37574 (Conklin): ele; 37998 (Frake): ele; 38055 (Frake): pns; 38905 (Kondo & Edaño): bro; 38928 (Kondo & Edaño): bro; 39687 (Steiner): pur; 39730 (Steiner): cla; 40411 (Arganosa & Generoso): cil; 40418 (Arganosa & Generoso): pol; 40426 (Arganosa & Generoso): pur; 40939 (Mendoza): pns; 41320 (Mendoza & Reynoso): pol; 41326 (Mendoza & Reynoso): bro; 41586 (Steiner): cla; 41771 (Dickson): pol; 41820 (Sinclair & Edaño): bro; 41854 (Mendoza): ele; 55243 (Sinclair & Edaño): ele; 76725 (Conklin et al.): pns; 81870 (Mendoza): pns; 97973 (Mendoza): ele; 108592 (Madulid & Hamoy): cil; 108639 (Madulid & Hamoy): cla; 108694 (Madulid & Hamoy): cla; 118312 (Madulid et al.): bro; 123838 (Nojadera): pol; 150552 (Bodner): ech; 152271 (Payawal): bro; 152272 (Payawal): bro; 152273 (Payawal): bro; 152274 (Payawal): bro; 152275 (Payawal): bro; 152371 (Payawal): pol; 152372 (Payawal): pol; 152373 (Payawal): pol; 152374 (Payawal): pol; 152375 (Payawal): pol – Politon 2: bro – Poore 471: cla – Popta 134/31: pur; 966: ele – Posthumus 2400: ele – Powell 340: bro; 2466: ele – PPI 692 (Stone et al.): ele; 4402 (Reynoso et al.): mac; 14834 (Reynoso et al.): pur; 15340 (Garcia et al.): pol; 17147 (Reynoso et al.): ele; 17303 (Reynoso et al.): pol; 18613 (Madulid et al.): ech; 21790 (Reynoso & Majaducon): pur; 29396 (Romero & Chavez): bro; 38408 (Pipoly et al.): pol; 108702 (Madulid & Hamoy): pns; 113254 (Madulid et al.): pns – Pulle 26/4/1906: ele – Pullen 1158: bro; 1326: bro; 3250: cal; 6858: bro; 7686: pur.
- Rachmat 414: ele – Rahman 6758: bro – Rahmat si Boeea 6165: ele; 8338: pur – Ramlanto 394: bro – Rao B11: pur – Raynal 16689: ele – Retaune 55: ele – Ridley 9040: bro – Robbins 73: ele – Roberts 12/2/1930: bro – Robinson 1643: ele – Rodway 13304: ech; 15247: bro; 15297: bro; 15308: ele – Rogerson 1103: pol; 1108: bro – Rumke 21/3/1930: pur.
- S 72902 (Rantai et al.): pol – Saanan 130: ele – Samsuri 120: ele – SAN 82340 (Saikhe & Aban): bro; 121931 (Mantor): pol; 151190 (Laegaard et al.): pol – Sands 699: bro; 1206: ele; 3041: pol – Santos J.K. 18: bro – Santos J.V. 3989: pol; 3995: bro; 4046: pur; 4096: ele; 4492: bro; 4897: ele; 4924: bro; 4928: pol; 4965: pol; 5044: pol; 5060: cla; 5068: cla; 5106: ped; 5113: cil; 5115: cil; 5135: pur; 5139: cil; 5530a: pns; 5746: bro; 5862: bro; 5863: pol; 5908: pns; 5940: pns; 6007: pol; 6319: cil; 6320: ori; 6321: pur; 6326: cil; 6588: pol; 6603: pur; 6647: bro; 6648: pol; 6649: pur; 6765: pur; 6778: pol; 6890: ele; 6922: pol; 7328: pur; 7330: pns; 7359: pur; 7360: ped; 7362: ped; 7363: cil; 7519: pol; 7542: cla; 7547: pur; 7586: bro; 7621: gla X pur; 7631: gla X pur; 7649: pol; 7657: bro; 7690: pur; 7697: pol; 7720: bro; 7722: bro; 7781: bro; 7810: pur; 7846: pur; 7847: cla; 7859: pns; 8001: pns; 8020: cla; 8065: ele; 8099: bro; 8244: ele; 8258: bro – Sauveur & Sinke 2500: ele; 2563: ele – Sawyer 82: ech – Schiffner 1498: ele – Schlechter 16893: ele – Schmutz 1582: pur; 2108: bro; 2196: pol; 3897: bro – Schodde 4098: ele – Schodde & Craven 4592: bro – Seidenschwarz L11: bro – SF 9726 (Sinclair & Edaño): bro; 38223 (Henderson): pur; 38881 (Sinclair): bro – Shah 138: pur – Sillitoe 82/14: ele – Simpson 10/1946: pur – Sinclair & Edaño 9497: ele; 9699: pns; 9801: pns – Sinclair & Tassim 10423: bro – SNP 20819 (Veldkamp): pol – Soekisman 143: ele – Steiner 123: pol; 1886: pol – Stone 15472: pur – Stresemann 213: ele – Sunarti & Prawiroatmodjo 9: pol.
- t Hart & van Leeuwen H-2: bro; MA-2: pur; MA-31: cil – Takahashi 410232: pol – Takeuchi 10798: ele; 13780: pur; 16857: ele – Takeuchi & Kulang 11586: ele – Tan et al. 2043a: ech – Taylor 8/10/1974: cla – Teo 11: ech – Tieman 7/1968: pol.
- UPNG 204 (Pulsford): ele; 302: bro; 1339: bro; 3212 (Vinas): pur; 20215 (Piskaut): pol.
- Van der Meer 10/11/1950: bro – Van Heusden & Steeman 2: pur – Van Leeuwen KEB-27: ele; PAM 4: bro; RAN-4: ele – Van Niel 3489: bro – Van Ooststroom 13551: pur – Van Royen 3354: bro; 5077: ele – Van Royen & Sleumer 5685: ele – Van Steenis 7269: pns; 10873: pns; 11928: pns; 17850: lon; 17898: pol; 17915: bro; 17961: pns; 18342: bro; 18472: cal; 18555: pol – Van Valkenburg 390: ele – Van Zanten H-17: ele; H-44: bro – Vanoverbergh 2179: bro; 2772: pns – Veldkamp 6945: pur; 8896: ech – Veldkamp & Kuduk 8567: cil – Veldkamp & Stevens 5544: ele – Verdcourt 5156A: ele – Verheijen 428: pur; 439: pur; 2296: bro; 2395: bro; 3654: ele; 3796: bro; 3862: bro; 4461: bro; 4938: bro; 5455: bro; 5510: bro; 5515: bro; 5552: bro – Versteegh 78: bro; 1495: ele – Vidal 3993: ele; 4006: bro.
- Walker 7476: bro – Walsh 30: bro – Watson 36: ele – Wester 3: cil – Wheeler 3/1983: pol – Whitford 716: ele – Widjaja 2917: pol; 3878: pol – Widjaja & Hamzah 2906: pol – Widjaja et al. 6011: bro; 6883: ele; 7069: ele – Williams 2368: bro; 2622: ele – Winkler, Hub. 2529: ele – Wiradinata 455: bro; 2967: bro – Wong K.M. et al. 2530: bro – Wong P.W. 22/5/1959: bro; 16/6/1959: pol; 18/8/1959: bro – Worthington 12326: bro; 12481: pur.
- Yoshida 2331: bro.
- Zainudin & H. Salleh 4078: pol – Zainudin et al. 1595: bro – Zollinger 2186?: pns; 2367: ele; 2589?: pns – Zwickey 406: ele.