The LINNEAN SOCIETY of London BOTANICAL Journal of the Linnean Society

Botanical Journal of the Linnean Society, 2010, **164**, 178–220. With 21 figures

A taxonomic revision of *Miscanthus s.l.* (Poaceae) from China

QIAN SUN[1,2], QI LIN[1]*, ZI-LI YI[3], ZHI-RONG YANG[1] and FA-SONG ZHOU[4]

[1]*State Key Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Beijing 100093, China*
[2]*Graduate University of Chinese Academy of Sciences, Beijing 100049, China*
[3]*College of Bioscience and Biotechnology, Hunan Agricultural University, Changsha 410128, Hunan, China*
[4]*Mendel Biotechnology Inc., 3935 Point Eden Way, Hayward, CA 94545, USA*

Received 29 January 2010; revised 19 July 2010; accepted for publication 19 August 2010

On the basis of morphological examination, field investigation, observation of cultivated accessions and statistical analysis, the genus *Miscanthus s.l.* (Poaceae) from China was taxonomically revised. Two subgenera (*Miscanthus* subgenus *Miscanthus* and *Miscanthus* subgenus *Diandranthus*), two sections [*Miscanthus* subgenus *Miscanthus* section *Miscanthus* and *Miscanthus* subgenus *Miscanthus* section *Triarrhena* (Maximowicz) Honda], six species, two subspecies and four varieties in this genus were recognized in this report. *Miscanthus sacchariflorus* ssp. *lutarioriparius* and *Miscanthus nudipes* var. *yunnanensis* were also recognized. A key to the taxa of *Miscanthus* from China is provided. A morphological description, distribution, and habit and phenology are summarized for each species. Distribution maps and morphological illustrations of each species are also provided. *Botanical Journal of the Linnean Society*, 2010, **164**, 178–220.

ADDITIONAL KEYWORDS: energy – new combination – new state – plant taxonomy – statistical analysis.

INTRODUCTION

Miscanthus Andersson *s.l.*, with about 14 species, belongs to subtribe Saccharinae Griseb., tribe Andropogoneae Dumort. of Poaceae. Various species of *Miscanthus* occur naturally in South-east Asia, the Pacific Islands and tropical Africa (Chen & Renvoize, 2006). *Miscanthus* has been introduced into Europe and North America as a potential energy crop because of its high biomass yield, C_4 photosynthesis, stress tolerance, perennial growth and sustainable production. *Miscanthus* biomass can be used for feedstock, electricity generation or liquid biofuel production, such as ethanol (Heaton, Voigt & Long, 2004).

The taxonomic study of *Miscanthus s.l.* began in 1856, when Andersson placed *Erianthus capensis* Nees, *Eulalia japonica* Trinius, *Miscanthus luzonensis* Andersson, *M. purpurascens* Andersson and *M. sinensis* Andersson in the new genus *Miscanthus*. Bentham (1882) argued that awned or awnless spikelets could not be used to differentiate genera, and proposed that *Miscanthus* and *Imperata* Cyrillo could be identified by characters such as the loose or narrow panicles, long or short racemes and number of stamens. He also included *M. cotulifera* (Thunberg) Bentham and *M. fuscus* (Roxburgh) Bentham. Hackel (1889) later transferred *Imperata sacchariflora* Maximowicz, *Saccharum tinctorium* Steudel, *Eulalia nepalensis* Trinius and *Erianthus nudipes* Grisebach to *Miscanthus*. Honda (1930) separated *Miscanthus* (comprising 20 species, 10 varieties and one form) into two sections, *Eumiscanthus* Honda [= *Miscanthus*] and *Triarrhena* (Maximowicz) Honda, based on awned or awnless spikelets and shorter or longer callus hairs than glumes. Section *Miscanthus* comprised two subsections, X*anthandra* Honda and *Porphyrandra* Honda. They are different in terms of stamen colour. Pilger (1940) set up the new section

*Corresponding author. E-mail: linqi@ibcas.ac.cn

Miscanthidium (Stapf) Pilger [= *Miscanthus*], which included *M. capensis* (Nees) Andersson, *M. gossweileri* (Stapf) Pilger, *M. junceus* (Stapf) Pilger, *M. sorghum* (Stapf) Pilger, *M. teretifolius* (Stapf) Pilger and *M. violaceus* (K.Schumann) Pilger. After that, Keng (1959) proposed that *Miscanthus s.l.* consisted of about 20 species, eight of which and one variety occur in China. Moreover, he established the section *Diandra* Keng (nom. nud.), including *M. brevipilus* Hand.-Mazz., *M. eulalioides* Keng, *M. nudipes* (Griseb ach) Hackel, *M. nepalensis* (Trinius) Hackel and *M. szechuanensis* Keng (nom. nud.). Adati & Shiotani (1962) recognized four sections of *Miscanthus*, *Diandra* Keng, *Eumiscanthus* Honda [= *Miscanthus*], *Kariyasua* Ohwi ex Hirayoshi, K.Nishikawa & M.Kubono and *Triarrhena* (Maximowicz) Honda, based on their cytological study results. Lee (1964a, b, c, d, e) proposed that *Miscanthus s.l.* contained 13 species, 29 varieties and three forms in four sections, *Diandra*, *Miscanthus* (comprising subsection *Condensati* Y.N.Lee, subsection *Miscanthus* and subsection *Sinensis* Y.N.Lee), section *Kariyasua* Ohwi ex Hirayoshi, K.Nishikawa & M.Kubono and section *Triarrhena* (Maximowicz) Honda. Liou (1987) and Liu (1994, 1997) classified *Miscanthus s.l.* into three genera: seven species in *Miscanthus s.s.*, ten species in *Diandranthus* (Keng) L.Liou and three species, eight varieties and eight forms in *Triarrhena* Nakai. Ibaragi (2003) recognized the genus *Diandranthus*, with two species and two subspecies. Although Renvoize (2003) acknowledged four sections and 24 species in *Miscanthus s.l.*, he pointed out that the taxonomic status of *M. fuscus* and the four African species [*M. ecklonii* (Nees) Mabberley, *M. junceus*, *M. sorghum* and *M. violaceus*] needed more study, because they had not been included in any section of *Miscanthus s.l.* Chen & Renvoize (2005, 2006) identified 14 species in *Miscanthus s.l.*, with seven species in China, but they did not separate section *Diandra* from *Miscanthus* or establish any intraspecific taxa. Furthermore, all the new species described by Liou (1987) in *Diandranthus* were treated as synonyms of *M. nudipes*, without the examination of type specimens, and they pointed out that the taxonomic status of *M. condensatus* Hackel, *M. purpurascens* Andersson and *M. transmorrisonensis* Hayata was resolved conclusively.

Recently, molecular phylogenetic studies have provided important genetic evidence. Sequence data for the nuclear ribosomal DNA (nrDNA) internal transcribed spacer (ITS) region and the *trnL* intron and *trnL–F* intergenic spacer of plastid DNA (Hodkinson *et al*., 2002a, b, c) supported the hypothesis that *M.* × *giganteus* Greef & Deuter ex Hodkinson & Renvoize (Hodkinson & Renvoize, 2001) is an allopolyploid hybrid between *M. sinensis* and *M. sacchariflorus*, and: (1) *M. transmorrisonensis* is distinct from *M. sinensis*, whereas *M. floridulus* and *M. condensatus* cannot be differentiated from *M. sinensis*, and more studies are needed to clarify the taxonomic status of these species; (2) sections *Kariyasua*, *Miscanthus* and *Triarrhena* form a well-supported monophyletic group with a basic chromosome number of $x = 19$, and *M.* × *giganteus* would be a component of this group; (3) section *Diandra*, represented by *M. nepalensis*, did not group with any member of *Miscanthus s.l.* Moreover, the Himalayan species *M. fuscus* and African species are clearly excluded from *Miscanthus s.s.* The phylogenetic study of Chen *et al*. (2007) did not support the recognition of the genus *Triarrhena*.

There is no consensus yet on the definition of *Miscanthus* (*s.l.* or *s.s.*), the taxonomic system to be used or the number of species, subspecies, varieties and forms to be recognized. The distribution of each *Miscanthus* species has also not been fully investigated. In this report, we describe the taxonomy of *Miscanthus* in mainland China based on morphological and anatomical characteristics, phenology and principal components analysis (PCA), as the basis for further research of *Miscanthus* worldwide. The results of our research provide systematic support for germplasm selection and directed breeding of new energy plants.

MATERIAL AND METHODS

The revisions presented here are based on field work, cultivation observations and extensive examination of over 3500 herbarium specimens from the herbaria of CCNU, E, GH, HIB, HNNU, IFP, KUN, LBG, N, NAS, NAU, NY, PE, US, WH, YAU and YUKU. Over 500 specimens of *Miscanthus* were selected as representatives of all geographical regions in mainland China and were carefully examined, and morphological characteristics were recorded (Table 1). Furthermore, 290 photographs of specimens preserved in K, HAST, IBK and IBSC were compared with our specimens.

Field observations took place in Liaoning and Hunan Provinces. *Miscanthus* accessions cultivated in Hunan Agricultural University, Changsha, were introduced from Anhui, Beijing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hebei, Helongjiang, Hubei, Hunan, Jiangsu, Jinlin, Liaoning, Neimenggu, Shandong, Shanxi, Sichuan, Yunnan and Zhejiang.

From the 500 representative specimens mentioned above, scatter graphs were drawn to show the variation trend and correlation of the key characters. A subset of 294 case specimens was used for PCA. We carefully examined and measured samples to obtain data on 41 morphological characters, including 17 qualitative and 24 quantitative traits (Table 1). Our data cover the full range of morphological variation

Table 1. Morphological characters and codes of *Miscanthus s.l.* from China

No.	Character	Code of character state
Morphological qualitative characters		
1	Habit	Tufted (0), rhizomatous (1)
2	Rhizome	Sympodial (0), monopodial (1)
3	Adventitious roots	Absent (0), present (1)
4	Branches of culms	Branching (0), unbranched (1)
5	Colour of old leaf blades	Yellow (0), red–brown (1)
6	Hairs of leaf blades	Glabrous (0), pilose on abaxial surface (1), pilose on both surfaces (2), pilose on adaxial surface (3)
7	Shape of inflorescence	Panicle ovate-lanceolate (0), panicle corymbous (1)
8	Panicle compact	Panicle compact (0), panicle patent (1)
9	Length of axis/length of panicle	Less than 2/3 (0), more than 2/3 (1)
10	Colour of spikelets	Yellow or brown (0), golden-brown (1)
11	Colour of callus hairs	White or purple (0), yellow (1)
12	Hairs of the lower glume	Glabrous (0), glabrous on abaxial surface, margins pilose (1), sparsely pilose on abaxial surface, margins pilose (2), densely pilose on abaxial surface (3)
13	Shape of lower glume	Apex acuminate (0), apex truncate or obtuse (1)
14	Hairs of the upper glume	Glabrous (0), glabrous on abaxial surface, margins pilose (1), sparsely pilose on abaxial surface, margins pilose (2), densely pilose on abaxial surface (3)
15	Awn	Absent (0), straight (1), geniculate (2)
16	Number of stamens	3 (0), 2 (1)
17	Exserted position of stigmas	Latter part of spikelets (0), apex of spikelets (1)
Morphological quantitative characters		
18	Height	
19	Diameter of upper part of culm	
20	Number of racemes	
21	Length of the shortest raceme	
22	Length of the longest raceme	
23	Length of axis	
24	Length of panicle	
25	Length of spikelets	
26	Length of callus hairs	
27	Length of callus hairs/length of the spikelet	
28	Length of lower glume	
29	Number of veins on the lower glume	
30	Length of upper glume	
31	Number of veins on the upper glume	
32	Length of lower lemma	
33	Length of upper lemma	
34	Length of awn	
35	Length of awn/length of the spikelet	
36	Length of anthers	
37	Length of style	
38	Length of stigmas	
39	Length of stigmas/length of the style	
40	Length of caryopsis	
41	Length of embryo	

reported in previous reports on *Miscanthus* taxonomy. The independence of each measurement was assumed for all of the recorded characters. Qualitative characters were coded, and the codes were evolution independent. The representative value of each quantitative character for spikelets is the mean of ten independent measurements, and the representative value for each anatomical quantitative character is

the mean of three independent measurements. Statistical analyses of the recoded data were conducted using the Statistica software package (StatSoft, Inc., 2008).

MORPHOLOGICAL OBSERVATIONS AND ANALYSIS

GROWTH HABIT

Miscanthus spp. are giant tufted or rhizomatous grasses. Taxonomists have all separated section *Triarrhena* from other taxa of *Miscanthus* by the character 'tufted or rhizomatous', which can also be represented as 'rhizome sympodial or monopodial'. Our observations confirm that the rhizomatous form is a stable distinguishing taxonomic feature of section *Triarrhena*.

CULMS

Miscanthus usually does not have adventitious roots, except in section *Triarrhena*, and therefore the absence or presence of adventitious roots can also differentiate section *Triarrhena* from other *Miscanthus* taxa.

Branched or unbranched culms have been considered as an important taxonomic character (Liou, 1987; Liu, 1994, 1997; Chen & Renvoize, 2006). However, we found that some *Miscanthus* taxa possessed both features. *Miscanthus sacchariflorus* often has branches at lower nodes when it occurs in wetlands, such as *Q. Sun 142* (PE), *T. N. Liou et al. 4940* (IFP [×3], PE), *T. P. Wang 3598* (NAS, PE), *Y. Zou 7678* (PE), etc., and *M. floridulus* occasionally has branching culms. Ibaragi (2003) indicated that the culms of *M. nepalensis* are sometimes branched. Although branching or unbranched culms should not be used as a main taxonomic criterion, branching at the upper nodes of culms is a valuable identifier, because this feature is stable in *M. lutarioriparius*, and, in this way, it is obviously distinct from *M. sacchariflorus*.

Height has also been used by taxonomists. As shown in Table 2, the heights of different taxa overlap, but *M. lutarioriparius* is consistently much taller than other taxa according to both wild and cultivation observations. Therefore, height could be viewed as a distinct character for *M. lutarioriparius*.

LEAVES

In field investigations and cultivation observations, we found that 'node pilose' recorded by previous researchers is probably 'leaf sheath pilose at throat'. When *M. lutarioriparius* defoliates during the cane-like process, the nodes of its culms appear to be glabrous. However, the nodes of *M. sacchariflorus* appear to be pilose because of its infrequent defoliation.

Variation in leaf hairs is wide. Leaves of section *Triarrhena* are glabrous, whereas those of sections *Miscanthus* and *M. nepalensis* are glabrous or pilose on the abaxial surface, and those of *M. nudipes* are pilose on the abaxial surface or both sides. Although the leaves of *M. floridulus* were considered to be glabrous on both sides, we found that some leaves of *M. floridulus* plants were also pilose on the abaxial surface based on the examination of specimens, including *C. Y. Chiao 2092* (GH, N [×2]), *Z. H. Hu 78059* (NAS, YUKU) and *X. Y. He 6568* (NAS [×2]), *7008* (NAS [×3]).

We also found that the variation in length and width of leaf blades is wide (Table 2), although they have been considered as valid taxonomic characters (Koyama, 1987; Chen & Renvoize, 2005). We recommend that the morphological characters of the leaf should not be used as valid taxonomic features.

Lee (1964b) reported that the epidermis of *Miscanthus* was grouped into the '*sinensis*-type', '*condensatus*-type' and '*floridulus*-type'; the patterns of the cross-section of leaves were grouped into the '*sinensis*-type', '*oligostachyus*-type' and '*condensatus*-type', but we have not referred to their anatomical results in this paper because the material for their study was mostly collected from Japan, and did not include most of the species from China.

PANICLES

The length of the panicle, relative length ratio of the axis/panicle and hair on the axis are also treated as significant taxonomic characters. Although the length of the panicle shows no obvious gaps between taxa, the length of the panicle in sections *Miscanthus* and *Triarrhena* is usually longer than that in the truncate-glume group (Fig. 1). Variation in the length of panicles in *M. sinensis* is so wide that we should not consider it as a valuable trait in taxonomy. The length of the axis in *M. floridulus* and *M. paniculatus* can be more than two-thirds the length of the panicle, which is different from that in other taxa. However, this feature is not stable in *M. floridulus*, because the axis is either longer or shorter than two-thirds of the length of the panicle, for example in *R. C. Ching 8204* (NAS [×2], NY, PE), *S. S. Lai 4687* (KUN, LBG [×2]) and *S. Q. Chen 15453* (KUN [×2], NAS. PE), *16952* (HIB, KUN, NAS, PE). Moreover, the axis can be glabrous, sparsely pilose or densely pilose in a species. Thus 'axis glabrous or pilose' should not be treated as a taxonomic trait, whereas characters such as the 'relative length of axis vs. panicle' and 'panicle patent or compact' are useful taxonomic traits.

Table 2. Variation of characters in *Miscanthus s.l.* from China

Species*	Height of culms (m)	Length of leaves (cm)	Width of leaves (mm)	Number of racemes	Veins of lower glume	Veins of upper glume	Length of anthers (mm)	Length of caryopsis (mm)
D. cor.	0.4–0.7	15–30	5–10	5–8(–17)	4–6	3–4	2–2.5	
D. ram.	1.5	10–20	3–5	7	5–7	3–5	1.5–2	
D. tib.	0.8–1.2	30–40	5–15	(3–)7–18	4–6	3–4(–5)	1.5–2.5(–3)	1.5
M. flo.	(0.6–)1.0–4.0(–4.6)	20–85	(5–)15–40	20–100	2–3(–4)	0–1(–3)	1–1.5(–2)	1–1.5
M. eul.	1.0	20–60	3–6	4–6	4–7	3–5	2–3	2–2.5
M. jin.	1.0	50	10–15	5–15	3–4	3	2.8–3.2	
M. lut.	3.0–5.0(–7.0)	35–100	12–35	(16–)30–70	2–3	0–1	1.5–2	1.5–2.6
M. nep.	(0.3–)0.7–2.0	15–60	3–25	5–45	2–5	0–1(–3)	1–1.5	1–1.5
M. nud.	0.2–1.4	(6–)10–35	2–15	3–20	(4–)5–6(–7)	1–3(–4)	1.5–2.5(–3)	1.5–2
M. pan.	0.3–1.0	10–40	2–8	3–8	4–6(–7)	(1–)3–5	2–3	2–2.5(–3)
M. pur.	(0.7–)1.0–2.6(–4.0)	20–80	10–20(–40)	(4–)10–30(–100)	2–3(–4)	1–3	(1.5–)2–2.5	1.5–2(–3)
M. sac.	(0.5–)0.8–2.5(–3.0)	20–90	5–30	4–40	2–3	0–1	1.5–2.6	1.5–3(–4)
M. sin.	(0.3–)0.8–3.0	16–75	3–20	4–40	2–3(–5)	1–3	(1.2–)1.5–3	(1.5–)1.8–2.3(–3)
M. yun.	(0.3–)0.5–1.5	10–50	4–10	4–20(–30)	4–7	1–5(–6)	1.5–2.8	1.5–2.5(–2.8)

*Abbreviations from top: *Diandranthus corymbosus, D. ramosus, D. tibeticus, Miscanthus floridulus, M. eulalioides, M. jinxianensis, M. lutarioriparius, M. nepalensis, M. nudipe, M. paniculatus, M. purpurascens, M. sacchariflorus, M. sinensis, M. yunnanensis*.

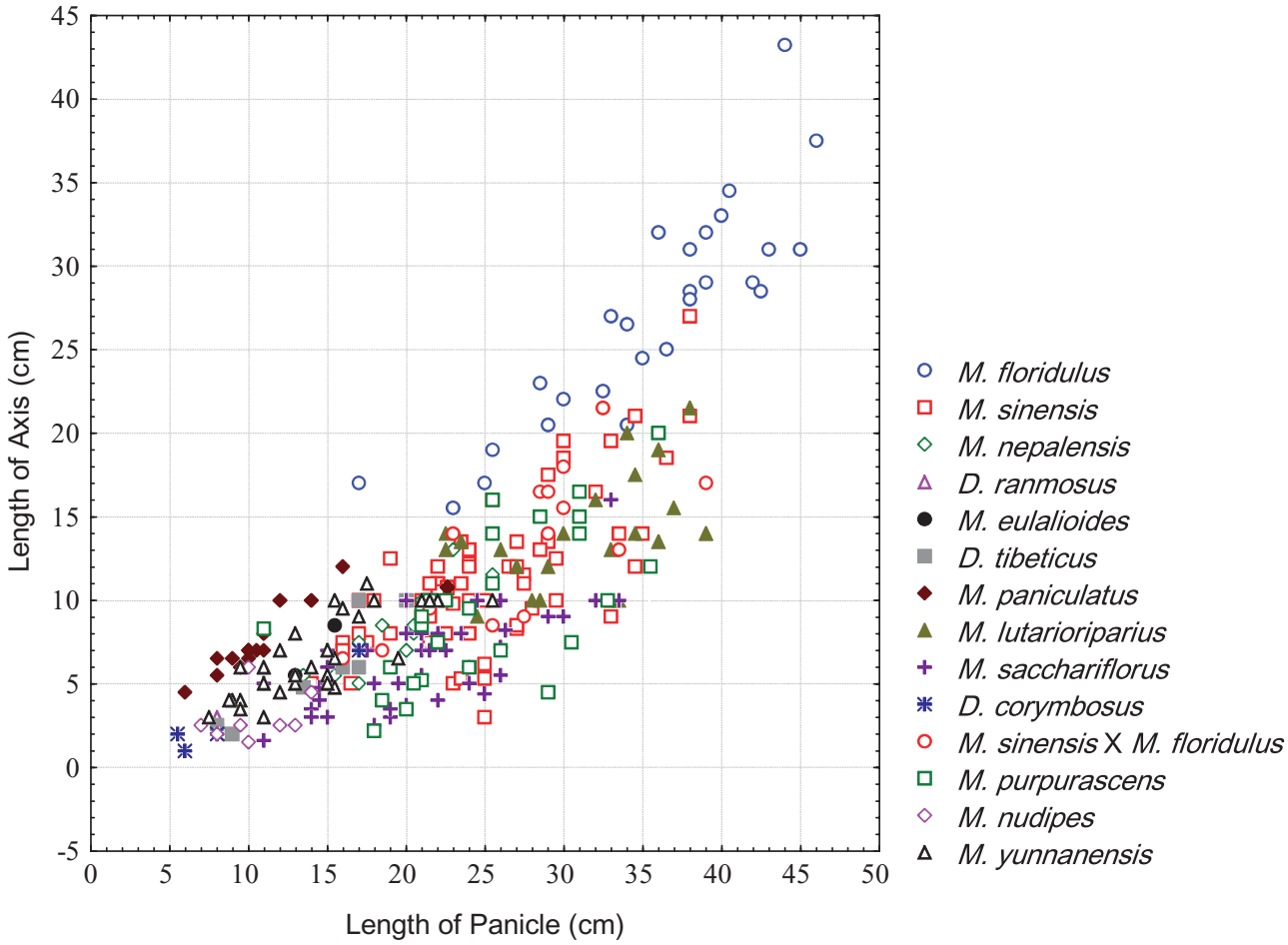

Figure 1. Relationship between length of inflorescence axis and panicle length of *Miscanthus s.l.* from China based on 300 individuals. *D.*, *Diandranthus*; *M.*, *Miscanthus*.

Ibaragi (2003) pointed out that the relationship between the length of the spikelet and the length of the internodes of the axis is variable.

The number of racemes has also attracted the attention of researchers. The truncate-glume group often only has several racemes, whereas *M. floridulus* and *M. lutarioriparius* have large panicles consisting of numerous racemes. Thus, the number of racemes is valuable (Table 2).

SPIKELETS

The length of spikelets, colour of callus hairs, relative length of callus hairs and spikelet, and pilose or glabrous glumes are considered to be important taxonomic features.

In Figure 2, the range in length of spikelets for most taxa overlaps, but *M. nepalensis* and *M. floridulus* both have shorter spikelets than the others, and there are overlaps in the length of spikelets between *M. sinensis* and *M. floridulus*. This phenomenon, observed in southwest China, is related to the wide range of distribution of *M. sinensis*, with the length of spikelets decreasing from north to south, and there are probably natural hybrids between *M. sinensis* and *M. floridulus*. Liu (1997) reported that *M. jinxianensis* is different from *M. sinensis* because of its 6.0–7.5-mm-long spikelets, but this obviously falls within the range of variation for *M. sinensis*. As a result, the length of spikelets has taxonomic significance, but it should not be used as the main criterion for classification.

Callus hairs are white, purple or yellowish, which has been considered as a significant taxonomic character. However, we found that the colour of callus hairs appears to change gradually from purple to white in our cultivation observations. This is probably why the callus hairs are white in the upper part of a panicle, white or purple in the middle and purple in the lower part. As the callus hair colour (purple or

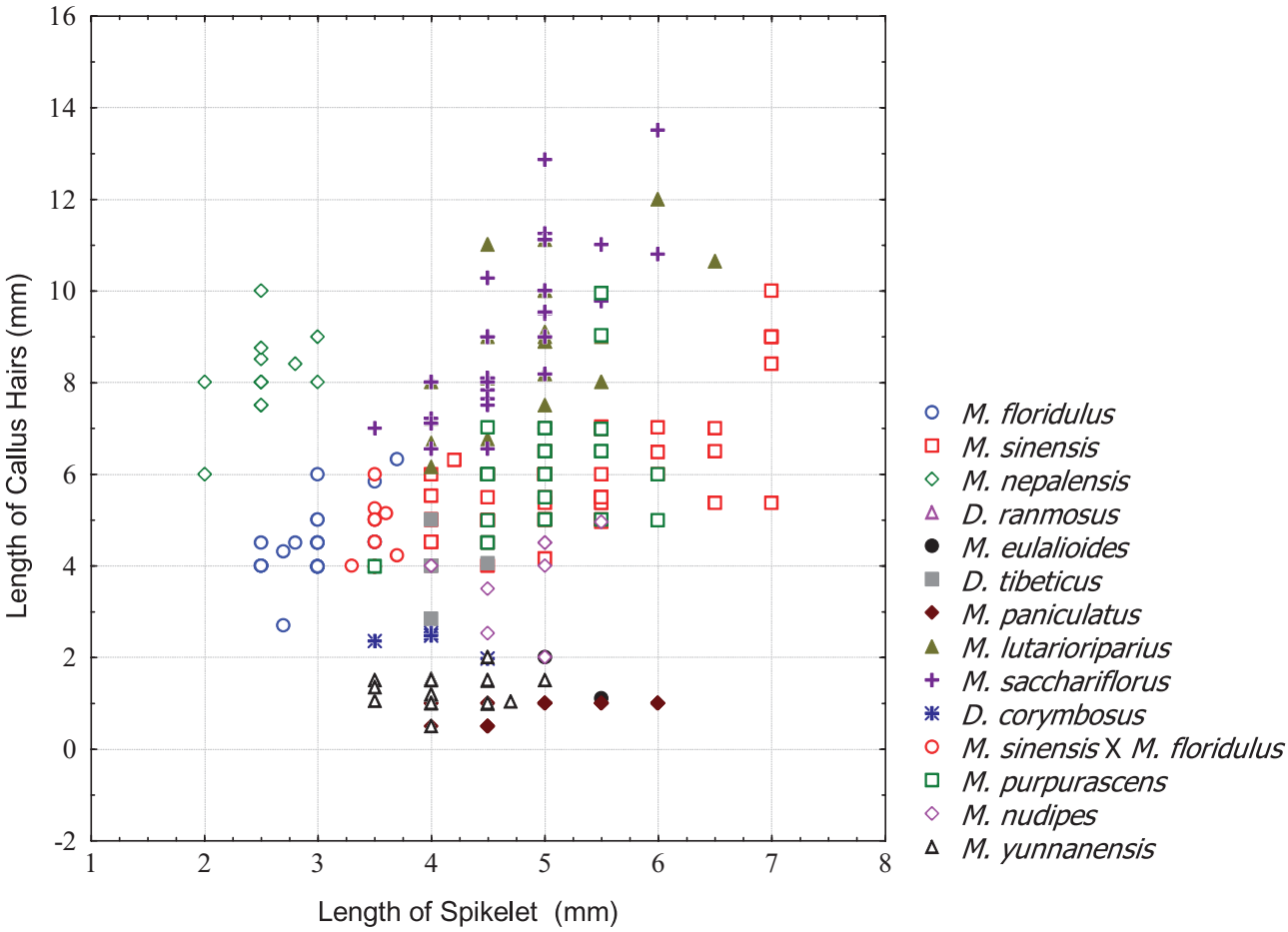

Figure 2. Relationship between length of callus hairs and length of spikelet of *Miscanthus s.l.* from China based on 300 individuals. *D.*, *Diandranthus*; *M.*, *Miscanthus*.

white) is changeable, we cannot use it as a general taxonomic criterion. However, *M. nepalensis* has only yellowish callus hairs which are much longer than the spikelets. These features differentiate it from other *Miscanthus* taxa. The relative length ratio of callus hair/spikelets is a valuable trait for *Miscanthus* taxonomy, as shown in Figure 2. The callus hairs of *M. nepalensis* are 3.0–4.5 times the spikelet length, whereas they are twice the spikelet length in *M. floridulus* and in section *Triarrhena*. In *M. sinensis*, callus hairs are slightly longer than the spikelets or the same length. In *Diandranthus ramosus* and *D. tibeticus*, callus hairs and spikelets are about the same length. Callus hairs can be shorter than the spikelets, and their ratio is a little over one-half in *M. nudipes*, one-quarter to one-half in *M. yunnanensis* (somewhat overlapping with *M. nudipes*) and only one-fifth in *M. paniculatus*.

Glabrous or pilose glumes have been described in *M. purpurascens* and section *Diandra*, and we found in our specimen examination and field work that this characteristic can be used as an important distinguishing characteristic in intraspecific classifications. Although glumes of *D. ramosus*, *D. tibeticus* and *M. wardii* have been recorded as glabrous, we found that glume margins of *D. ramosus* and *D. tibeticus* are sparsely pilose with 1–2-mm-long hairs. Ibaragi (2003) pointed out that the glume margins of *M. wardii* are pilose. The length range of glume abaxial surface hairs in *M. yunnanensis* overlaps with that in *M. nudipes*, but these are much denser in the former than in the latter. The glumes of *M. purpurascens* are pilose on the abaxial surface, different from the glabrous glumes of *M. sinensis*. However, the hairs on the glumes of *M. purpurascens* can be sparse to dense.

Moreover, we found that there are two types of glume in *Miscanthus*. In one type, the lower glume is longer than or the same as the upper one and its apex is acuminate or two-toothed. *Miscanthus floridulus*, *M. lutarioriparius*, *M. purpurascens*, *M. sacchariflorus* and *M. sinensis* have this type of glume. *Diandranthus corymbosus*, *D. ramosus*, *D. tibeticus*, *M.*

nepalensis, *M. nudipes*, *M. paniculatus* and *M. yunnanensis* have the other type of glume, in which the lower glume is shorter than or subequal to the upper one, and its apex is truncate, obtuse or emarginate. These glume features are stable taxonomic characters.

Floret

The midrib of the upper lemma of the *Miscanthus* floret can extend to form a straight or geniculate awn, and the length of the awn reflects differences between *Miscanthus* spp. to some degree. Plants of section *Triarrhena* are awnless or have a 0.5–2.0-mm-long arista. *Miscanthus nepalensis* has an 11–16-mm-long awn, which is nearly five times the spikelet length. *Miscanthus paniculatus* has a 1–4-mm awn which is shorter than the spikelets. The variation range of awn length in other species is overlapping (Fig. 3).

The lower lemma is usually veinless, or occasionally one-veined. The vein can extend to form an awn, and some spikelets can have two awns, one on each lemma. Liu (1997) established *D. aristatus* (nom. Invalid.) on the basis of its two awns. However, we found that this trait also exists in some other species, such as *M. sinensis*, *H. W. Kung 2137* (PE) and *Q. S. Wang 3505* (HIB). Ibaragi (2003) reported that two-awned spikelets often occur at the top of racemes, but we found that the positions of two-awned spikelets appear to be random, although they can be found at the top.

Mature anthers are often yellow, and can gradually turn dark purple. Thus, it is inappropriate to consider anther colour as a valid taxonomic character. Liou (L. Liou, unpubl. data, 1989) and Liu (1997) established *M. lutarioriparius* and gave the 'length of anthers' as one of the key characters. As the lengths of the anthers of *M. lutarioriparius* and *M. sacchariflorus* are (0.5–)1.5–1.8 (–2.1) mm and 1.5–3 mm, respectively, the length range overlaps. Previously, it has been reported that the number of stamens in a species is stable and can be used for classification. However, we found that one specimen of *M. nudipes*

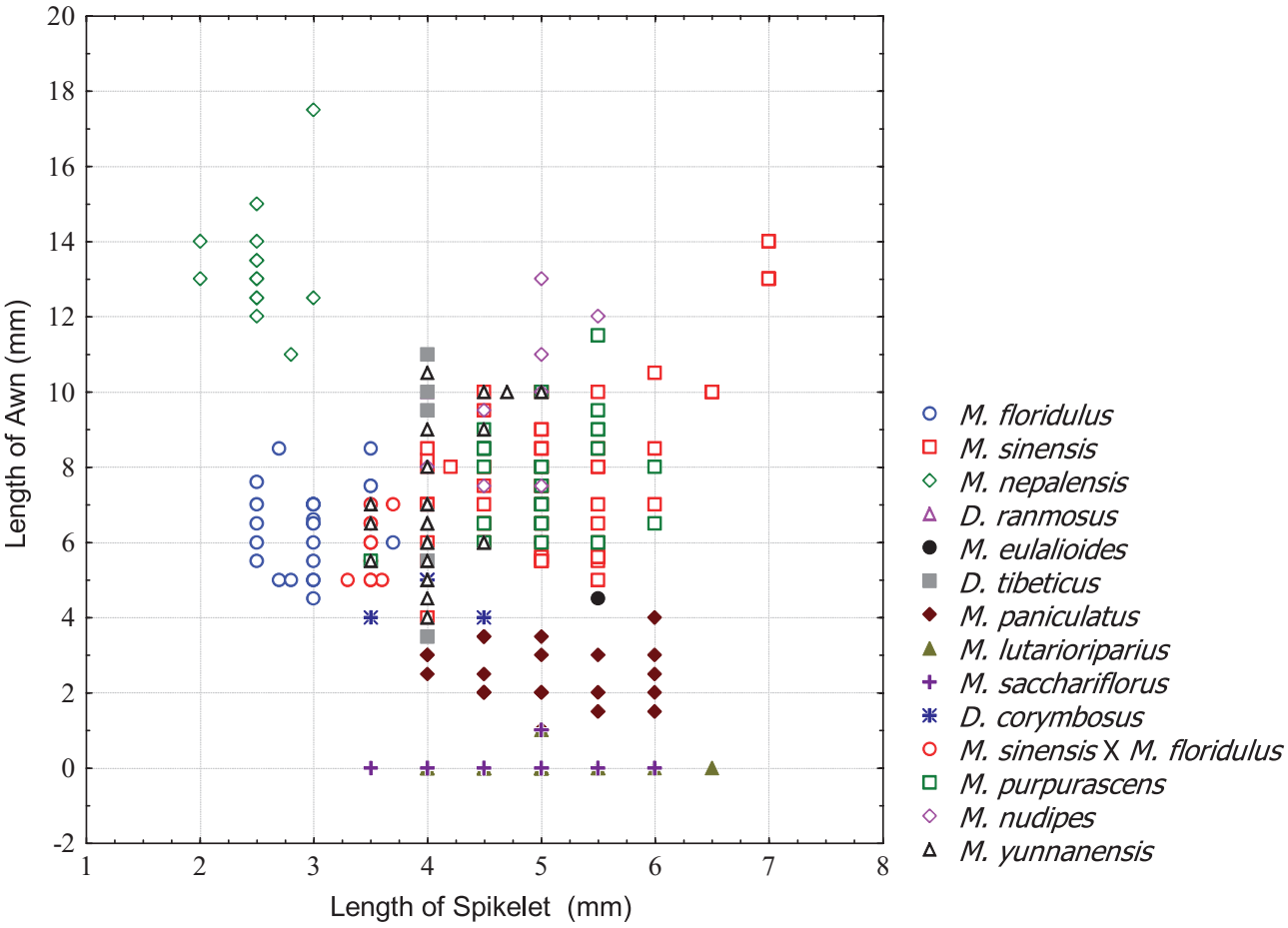

Figure 3. Relationship between length of awn and length of spikelet of *Miscanthus s.l.* from China based on 294 individuals. Abbreviation: *D.*, *Diandranthus*; *M.*, *Miscanthus*.

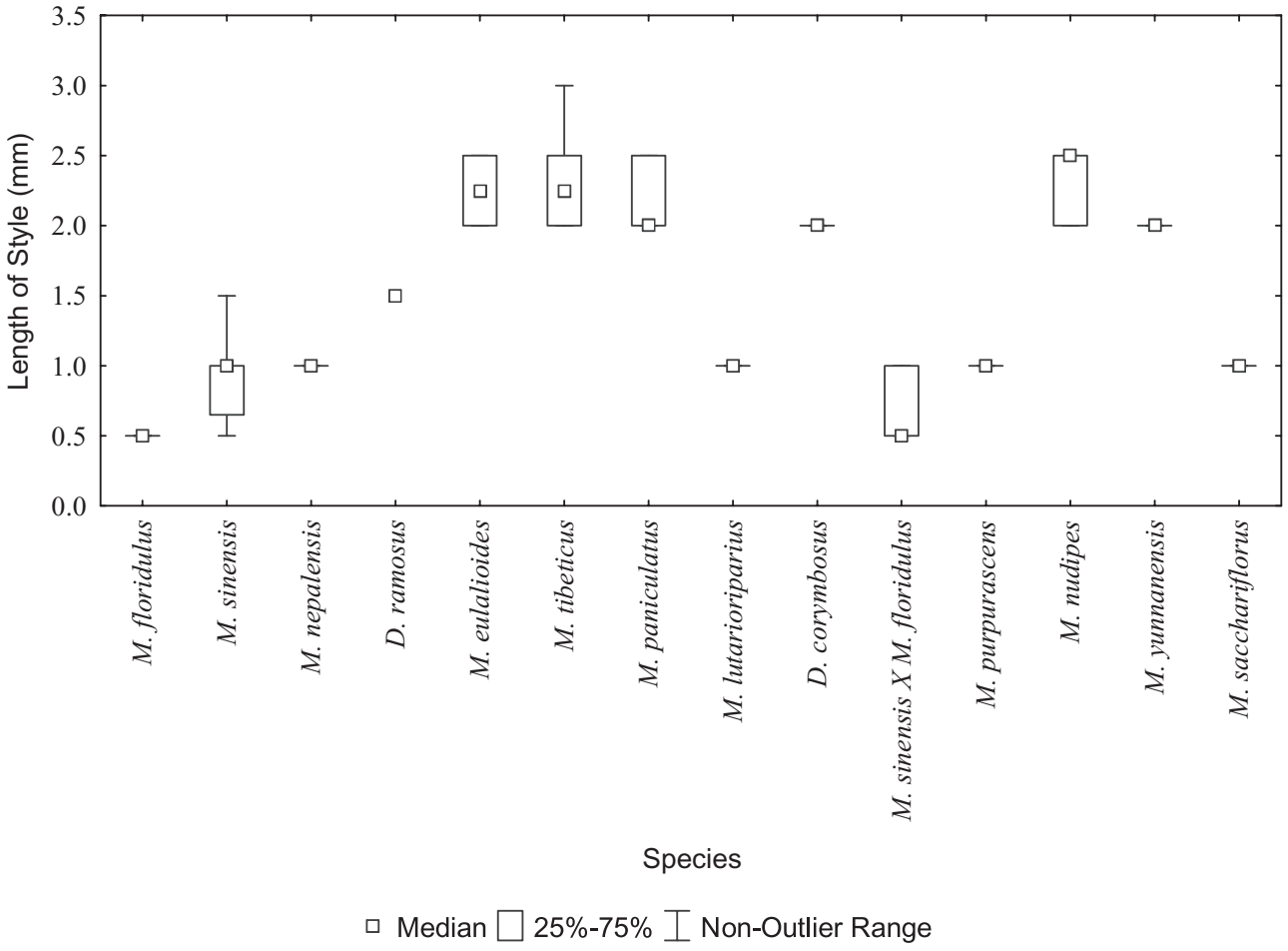

Figure 4. Box plot for length of the style of *Miscanthus s.l.* from China based on 400 individuals. *D.*, *Diandranthus*; *M.*, *Miscanthus*.

(*S. Jiang 9517*, PE) contained both two and three stamens. This makes the number of stamens a controversial trait in *Miscanthus* taxonomy. However, it deserves further investigation.

As shown in Figure 4, the style of section *Miscanthus*, section *Triarrhena* and *M. nepalensis* is 0.5–1.5 mm long; others are (1.5–)2.0–2.5 mm long. The length of stigmas has no obvious gap between species, except for *M. floridulus* and *M. nepalensis*, which have short stigmas. Stigmas of section *Diandra* and *M. paniculatus* are subequal to the style, whereas stigmas of other *Miscanthus* taxa are 1.5–3.0 times longer than the style.

CARYOPSIS

Miscanthus species all have long ellipsoidal caryopses, with no obvious variation in their microstructure and submicrostructure (Xie *et al.*, 1989a, 1989b). Caryopses are 1.5×0.8 mm to 3.0×1.8 mm, but those of *M. nepalensis* and *M. floridulus* are 1.0×0.5 mm. Liou (L. Liou, unpubl. data, 1989) and Liu (1997) treated the length of the caryopsis as a distinctive character in *M. lutarioriparius* and *M. sacchariflorus*. Nevertheless, we found that the caryopses of *M. lutarioriparius* are 1.5–2.6 mm long, and those of *M. sacchariflorus* are 2.0–4.0 mm long. As the length of the caryopsis in the two species largely overlaps, it is not a good criterion for differentiation.

PRINCIPAL COMPONENTS ANALYSIS

The results of the 294×41 data matrix showed that eight eigenvalues are greater than unity, and the first five eigenvectors (principal components, PCs) account for over 70% of the total variance. Here, we analysed and plotted individually the first three PCs. They account for 26.05%, 18.68% and 13.35% of the total variance, respectively. The loadings of the 41 characters on to the components are given in Table 3.

PC1 indicated that three characters (number of veins on the lower glume, shape of the lower glume

Table 3. Loading of the first three principal components for 41 morphological characters from the analysis of 294 individuals of *Miscanthus s.l.* from China

	Component		
Morphological character	1	2	3
Habit	–0.516389	**–0.780137**	–0.316344
Rhizome	–0.516389	**–0.780137**	–0.316344
Adventitious roots	–0.516389	**–0.780137**	–0.316344
Branches of culms	–0.396337	–0.543886	–0.200353
Height	–0.256969	0.110016	0.068997
Diameter of upper part of culm*	–0.639554	0.126465	0.107157
Colour of old leaf blades	–0.342703	–0.642157	–0.305783
Hairs of leaf blades	0.755103	0.134268	0.116477
Shape of inflorescence	–0.081383	–0.241268	–0.077758
Panicle compact	0.471038	–0.162674	0.103598
Number of racemes*	–0.593440	0.309771	–0.106448
Length of the shortest raceme*	–0.536823	0.258652	0.280756
Length of the longest raceme*	–0.609174	0.291957	0.297705
Length of axis*	–0.500066	0.465036	0.228138
Length of panicle*	–0.721577	0.238151	0.292706
Length of axis/length of panicle	–0.016866	0.435952	0.151915
Colour of spikelets	–0.062548	0.418072	**–0.617646**
Length of spikelets*	0.180634	–0.589006	0.597004
Colour of callus hairs	–0.062548	0.418072	**–0.617646**
Length of callus hairs*	–0.745799	–0.323705	–0.117955
Length of callus hairs/length of the spikelet*	–0.737433	0.063355	–0.449126
Length of lower glume*	0.038434	–0.594606	**0.641598**
Hairs of the lower glume	0.642345	–0.348398	–0.272162
Shape of lower glume	**0.832368**	0.116803	–0.460615
Number of veins on the lower glume*	**0.867438**	–0.065608	–0.190073
Length of upper glume*	0.298403	–0.497268	**0.668869**
Hairs of the upper glume	0.747500	–0.238208	–0.139719
Number of veins on the upper glume*	0.660412	0.076739	–0.299396
Length of lower lemma*	0.535002	–0.305930	**0.612545**
Length of upper lemma*	0.589242	–0.210005	0.595271
Awn	0.246177	0.630311	0.581668
Length of awn*	0.254549	**0.747748**	0.110454
Length of awn/length of the spikelet*	0.089429	**0.839718**	–0.280295
Number of stamens	–0.591708	–0.242832	0.547227
Length of anthers*	–0.060206	–0.207261	–0.061893
Length of style*	**0.808538**	–0.191439	–0.119796
Length of stigmas*	0.481416	–0.542563	–0.003921
Length of stigmas/length of the style*	–0.579066	–0.156484	0.181914
Exserted position of stigmas	–0.348911	0.556173	**0.663567**
Length of caryopsis*	–0.042296	–0.078103	0.040223
Length of embryo*	–0.017841	–0.319998	0.275713
Eigenvalue	10.67973	7.65853	5.47298
Variance (%)	26.04812	18.67935	13.34873
Cumulative variance (%)	26.0481	44.7275	58.0762

*Quantitative characters.
The characters with the highest positive or negative loadings are shown in bold.

and length of the style) have high positive loadings (> 0.8). As shown in Table 2, section *Miscanthus* and section *Triarrhena* often have two- to four-veined glumes, whereas *D. corymbosus*, *D. ramosus*, *D. tibeticus*, *M. nudipes*, *M. paniculatus* and *M. yunnanensis* usually have glumes with five to seven veins. The species with the most variation is *M. nepalensis*, which has glumes with two to five veins. As mentioned under 'Spikelets' above, *Miscanthus s.l.* can be split into two groups based on the shape of the lower glumes that are either acuminate (with two teeth) or truncate (obtuse). The first group with acuminate lower glumes includes *M. floridulus*, *M. lutarioriparius*, *M. purpurascens*, *M. sacchariflorus* and *M. sinensis*. *Diandranthus corymbosus*, *D. ramosus*, *D. tibeticus*, *M. nepalensis*, *M. nudipes*, *M. paniculatus* and *M. yunnanensis* belong to the second group. Classification based on the length of the style showed similar results, except for *M. nepalensis* which has a short style. The characters that showed high positive loadings in PC1 can be used to describe the variation between the species, and are strongly recommended for use in classification.

PC2 included four characters that showed high positive or negative loadings (> 0.7). The awn/spikelet length ratio and the length of the awn showed positive loadings, whereas growth habit (rhizomatous or not) and culms with or without adventitious roots showed high negative loadings. Plants of section *Triarrhena* are rhizomatous, have obviously adventitious roots at the base nodes of culms and have awnless spikelets. Other taxa are tufted or have a short rhizome, no adventitious roots and awned spikelets. Apparently, section *Triarrhena* can be well separated from other *Miscanthus* taxa with the aid of PC2 characters.

The exserted position of the stigmas, length of the glumes and lower lemma, colour of the spikelets and colour of the callus hairs showed intermediate loadings (> 0.6), and belong to the third PC. *Miscanthus s.l.* from China can be separated into two groups as mentioned above based on the exserted position of the stigmas and the relative length of the glumes. In section *Miscanthus* and section *Triarrhena*, stigmas are exserted laterally from the spikelets, and the upper glume is shorter than or the same as the lower one. In contrast, stigmas are exserted apically from the spikelets and the upper glume is longer than or subequal to the lower one in the truncate-glume group. However, *M. nepalensis* is different from the others in its yellow callus hairs and short, golden-brown spikelets.

The scatter plot of the first three PCs from the 41 characters showed that individuals are grouped into four distinct clusters (Fig. 5). *Miscanthus lutarioriparius* and *M. sacchariflorus* cluster as the first group, *M. floridulus*, *M. purpurascens*, *M. sinensis* and *M. sinensis* × *M. floridulus* as the second group, *D. corymbosus*, *D. ramosus*, *D. tibeticus*, *M. nudipes*, *M. paniculatus* and *M. yunnanensis* as the third group, and *M. nepalensis* alone as the fourth group. Nevertheless, *M. sinensis* and *M. floridulus* overlap, and *M. purpurascens* cannot be separated from *M. sinensis*. *Diandranthus corymbosus*, *D. ramosus*, *D. tibeticus* and *M. nudipes* cannot be distinguished from each other, and there are no obvious gaps between them and *M. yunnanensis*. Moreover, *M. paniculatus* and *M. yunnanensis* overlap slightly.

Hodkinson *et al*. (2002a, b, c) indicated that sections *Miscanthus*, *Triarrhena* and *Kariyasua* are clustered together, whereas section *Diandra* is obviously separated from these three sections. Our study showed similar results: section *Diandra* cannot be grouped with section *Miscanthus* or *Triarrhena*. Further study of *M. nepalensis* is needed as it is a unique species in *Miscanthus s.l* and quite different from all other *Miscanthus* taxa. *Miscanthus nepalensis* is very different from other taxa in section *Diandra*, and it is inappropriate to treat it as a representative of this section.

On the basis of our results from the morphological characterization of a large number of *Miscanthus* specimens and germplasm collections, PCA, previous reports and unpublished molecular phylogenetic trees, two subgenera, *Miscanthus* and *Diandranthus*, were recommended in *Miscanthus s.l.* Two sections, *Miscanthus* and *Triarrhena*, were also affirmed in subgenus *Miscanthus*.

TAXONOMIC TREATMENT

MISCANTHUS ANDERSSON, ÖFVERS. FÖRH. KONGL. SVENSKA VETENSK.-AKAD. 12: 165 (1855)

Type: Miscanthus capensis (Nees) Andersson, designated by Coville, Contr. U.S. Natl. Herb. 9: 400 (1905).

Imperata subg. *Triarrhena* Maximowicz, Prim. Fl. Amur. 331 (1859). *Triarrhena* (Maximowicz) Nakai, Journ. Jap. Bot. 25(1–2): 7 (1950). *Type*: *Imperata sacchariflora* Maximowicz.

Xiphagrostis Coville in Contr. U.S. Natl. Herb. 9: 399 (1905). *Type*: *Xiphagrostis floridula* (Labill.) Coville [= *Saccharum floridulum* Labill.].

Diandranthus L.Liou, Fl. Xizang 5: 308 (1987). *Type: Diandranthus nudipes* (Grisebach) L.Liou [= *Erianthus nudipes* Grisebach].

Rubimons B.S.Sun, Acta Bot. Yunnan 19(3): 239 (1997). *Type: Rubimons paniculatus* B.S.Sun.

Herbs perennial, tufted or rhizomatous. Culms slender to robust, erect, solid, internodes of cane-like

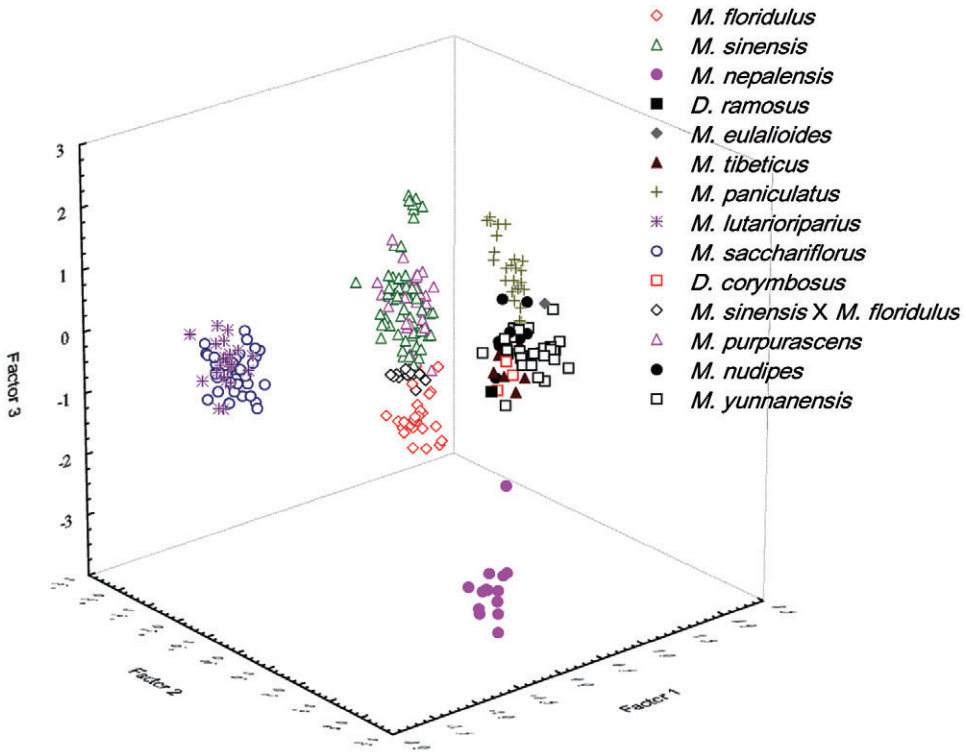

Figure 5. Scatter plot of principal component 1 (PC1), PC2 and PC3 from principal components analysis (PCA) of *Miscanthus s.l.* from China using 41 morphological characters. *D.*, *Diandranthus*; *M.*, *Miscanthus*.

part hollow. Leaves basal and cauline; leaf sheaths striate; leaf blades linear, flat, broad or narrow; ligule membranous. Inflorescence terminal, a panicle of racemes arranged on a long or short axis, contracted or patent; axis tough or slender; spikelets paired on unequal pedicels at nodes of rachis, falling after maturity, pedicels slender, slightly clavate. Spikelets similar, lanceolate or ovate-lanceolate; callus bearded with filaceous hairs shorter than, as long as or longer than the spikelet; glumes thick papery to membranous; lower one dorsiventrally compressed, apex acuminate, two-toothed, truncate, or obtuse, margins involute, two-keeled, zero- to five-veined between the keels; upper one navicular, one- to five-veined; lower floret usually represented by a membranous, hyaline sterile lemma, zero- to one-veined; upper floret bisexual, lemma membranous, hyaline, apex acuminate or two-toothed, one-veined; awnless or midrib extended to be a straight or geniculate awn; palea small, membranous, hyaline; lodicules two, truncate, membranous. Stamens two or three, protandrous. Styles two. Stigmas plumose, purple–black, exserted laterally or apically from the spikelet. Caryopsis long-ellipsoidal, embryo large. About 14 species, mostly in South-east Asia and the Pacific Islands, extending to tropical Africa; six species in China.

SUBGENUS I. *MISCANTHUS*

Herbs tufted or rhizomatous. Panicle patent; axis tough. Lower glume apex acuminate or two-toothed, longer than or as long as the upper one; awnless or midrib on upper lemma spreading to become an awn, straight or geniculate, upper part scabrid, base twisted. Stamens three. Style 0.5–1.5 mm long, nearly half the length of stigmas. Stigmas exserted laterally from the spikelet.

SECTION I. *MISCANTHUS*

Herbs tufted. Rhizome sympodial. Culms usually unbranched, nodes often bearing no buds, no adventitious roots. Leaf blades glabrous or pilose on abaxial surface. Spikelets awned.

1. *MISCANTHUS FLORIDULUS* (FIG. 13)

Miscanthus floridulus (Labill.) Warb. ex K. Schum. & Lauterb. in Fl. Schutzgeb. Südsee 166 (1901).– *Saccharum floridulum* Labill. in Sert. Austro-Caledon. 13, t. 18 (1824). – *Erianthus floridulus* (Labill.) Schult. in Mant. 3 (Add. 1): 563 (1827). *Type*: unknown.

KEY TO TAXA OF *MISCANTHUS* ANDERSSON FROM CHINA

1. Lower glume apex acuminate or two-toothed, longer than or as long as the upper; style 0.5–1.5 mm long, about one-half of the length of the stigmas; stigmas exserted laterally from the spikelet. (Subgenus I. ***Miscanthus***)..... **2**
1. Lower glume apex truncate, obtuse or emarginate, shorter than or as long as the upper; style 1–2 mm long, nearly as long as the stigmas; stigmas exserted apically from the spikelet. (Subgenus II. ***Diandranthus***)..... **6**
2. Tufted or shortly rhizomatous, sympodial; spikelets awned or awnless; callus hairs shorter than, as long as or slightly longer than the spikelet. (Section I. ***Miscanthus***)..... **3**
2. Rhizomatous, rhizome long, monopodial; spikelets awnless or occasionally with a short arista; callus hairs longer than the spikelet. (Section II. ***Triarrhena***)..... **5**
3. Axis often more than two-thirds of the length of the panicle..... **1. *M. floridulus***
3. Axis one-third to one-half of the length of the panicle..... **4**
4. Glumes glabrous..... **2a. *M. sinensis*** var. ***sinensis***
4. Glumes pilose..... **2b. *M. sinensis*** var. ***purpurascens***
5. Culms 50–250 cm tall, 5–10 mm in diameter, over 10 nodes, unbranched or branching at lower nodes; racemes few..... **3a. *M. sacchariflorus*** ssp. ***sacchariflorus***
5. Culms 300–700 cm tall, 8–25 mm in diameter, 20–47 nodes, branching at upper nodes; racemes numerous..... **3b. *M. sacchariflorus*** ssp. ***lutarioriparius***
6. Spikelets 2–3 mm long, golden-brown; callus hairs yellow, longer than the spikelet..... **4. *M. nepalensis***
6. Spikelets 3.5–6.0 mm long, light yellow to yellow–brown; callus hairs white or purple, shorter than to as long as the spikelet..... **7**
7. Panicle patent; callus hairs one-quarter length of to subequal to the spikelet; glumes pilose on abaxial surface; awn 3.5–15 mm long; stamens usually two..... **8**
7. Panicle contracted; callus hairs one-fifth of the length of the spikelet; glumes scabrous or shortly pilose on abaxial surface; awn 1–4 mm long; stamens three..... **6. *M. paniculatus***
8. Callus hairs one-half of the length of to subequal to the spikelet; glumes sparsely pilose, hairs 1.0–3.5 mm long..... **5a. *M. nudipus*** var. ***nudipes***
8. Callus hairs one-quarter to one-half of the length of the spikelet, glumes densely pilose, hairs 2–5 mm long..... **5b. *M. nudipes*** var. ***yunnanensis***

Miscanthus formosanus A.Camus in Bull. Mus. Hist. Nat. Paris 30: 514 (1924). *Type:* CHINA. Taiwan: Kelung, littoral, *Faurie 704* (holotype: P).

Herbs perennial, tufted, robust. Culms erect (60–) 100–400(–460) cm tall, (6–)8–16 mm in diameter at base, usually unbranched, smooth, nodes glabrous, or uppermost sometimes pilose, glaucous below nodes. Leaves basal and cauline, congested; leaf sheaths longer than internodes, overlapping, glabrous or sparsely pilose, pilose at throat; leaf blades linear, flat, broad, tough, 20–85 cm long, (5–)15–40 mm wide, margins serrulate, base gradually tapering or rounded, apex acuminate, green, usually glabrous, abaxial surface occasionally glaucous or pilose, adaxial surface sparingly pilose at base, midrib white, prominent on abaxial surface; ligule semicircular, membranous, 1–3 mm long, margin ciliolate or dentate, densely pilose on abaxial surface; collar glabrous or pilose. Panicle ovate-elliptic, dense, 17–50 cm long, 10–20 cm wide; axis 15.5–45 cm long, usually glabrous, axil pilose or pubescent. Racemes 20–100, 5–30 cm long, appressed to axis or spreading ascendingly; rachis slender, internodes glabrous or puberulent, nodes often glabrous; pedicels unequal, glabrous or scabrous, lower 0.5–3.5 mm long, upper recurved, 2.5–6.0(–8.0) mm long. Spikelets lanceolate to ovate-lanceolate, 2.5–4.0(–6.0) mm long, 0.8–1.0 mm wide, awned; callus hairs 4.0–6.5 mm long, white, spreading, 1.5 times to twice as long as the spikelet; glumes membranous, yellow, lower glume lanceolate to ovate-lanceolate, as long as the spikelet, apex acuminate or two-toothed, margins involute, two-keeled, one-veined or nearly veinless between the keels, glabrous, margins puberulent near apex or glabrous; upper glume navicular, subequal to the lower one, apex acuminate, one- to three-veined, midrib keeled, glabrous or scabrid near apex, margins ciliate; lemmas lanceolate, membranous, hyaline, abaxial surface glabrous, lower lemma 1.5–3.5(–5.0) mm long, apex acuminate, veinless, apex and margins ciliate; upper lemma 1.5–2.7(–4.5) mm long, apex usually deeply two-toothed, margins ciliate; awn exserted between the teeth of the upper lemma, 5–7.5(–10.0) mm long, brown, straight or slightly geniculate, upper part scabrid, lower part slightly twisted; upper palea lanceolate, 1.0–1.5 mm long, membranous, hyaline, glabrous or ciliate at apex. Stamens three, anthers 1–1.5(–2) mm long. Style 0.4–

0.5(–1.0) mm long. Stigmas purple–black, 1–2 mm long, exserted laterally from the spikelet. Caryopsis long-ellipsoidal, 1.0–1.5 mm long. $2n = 38$.

Distribution and habitat: Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hong Kong, Hubei, Hunan, Jiangsu, Jiangxi, Shanghai, Sichuan, Taiwan, Yunnan and Zhejiang (Fig. 6) [Japan, Pacific Islands in South-east Asia and Polynesia], occurring on wasteland, slopes and grassy places or in valleys at altitudes below 2840 m.

Phenology: Flowers and fruits from May to November.

Note: We found that there are overlaps of the studied characteristics between *M. floridulus* and *M. sinensis*, especially in those naturally occurring in Guangdong, Guangxi, Guizhou, Hunan, Sichuan and Yunnan. The morphological characteristics of the intermediate types were either culms tall, panicles large (20–35 cm long and axis/panicle length ratio about one-half to two-thirds) with numerous racemes, spikelets (3.0–) 3.5–4.0(–4.5) mm long; or culms short, panicles small (3.0–3.5 mm long and axis/panicle length ratio over two-thirds) with fewer racemes. Specimens of these intermediate types have been named either *M. floridulus* or *M. sinensis*. The genetic makeup of the intermediate types needs to be investigated to clarify whether or not they are natural interspecific hybrids.

2. *MISCANTHUS SINENSIS*

Miscanthus sinensis Andersson, Öfvers. Kongl. Sv. Vet.-Akad. Förh. Srockh.12: 166 (1855). *Type:* CHINA. Cap Syng–Moon, 1837, *F. J. F. Meyen s. n.* (holotype: B).

Herbs perennial, tufted or shortly rhizomatous. Culms erect (30–)70–300(–400) cm tall, 3–10 mm in diameter at base, usually unbranched, glabrous or pubescent below the panicle, nodes glabrous or pubescent, glaucous below nodes. Leaves basal and cauline; leaf sheaths longer than internodes, overlapping, glabrous or pilose; leaf blades linear, flat, 16–80 cm long, 3–20(–40) mm wide, margins serrulate, base gradually tapering or broad and rounded, apex acuminate, green, glabrous to glaucous or pilose on abaxial surface, adaxial base sparingly hairy, midrib white, prominent, convex on abaxial surface; ligule semicircular, membranous, 0.5–3.0 mm long, margin ciliolate or dentate; collar usually pilose. Panicle corymbose, 10–40 cm long, 8–28 cm wide; axis 3–22 cm long, subglabrous to pilose or puberulent, axil pilose or pubescent. Racemes 4–40(–100), 3–30 cm long, patent to drooping, rachis tough, internodes glabrous or scabrous; pedicels unequal, glabrous or scabrous, lower one (0.5–)1.0–3.5 mm long, upper one 3–6 (–7) mm long, ascending or recurved. Spikelets lanceolate (3.5–)4.0–7.0 mm long, 0.8–1.0 mm wide, awned; callus hairs 4.5–10.0 mm long, white or yellowish, spreading, exceeding the spikelet; glumes membranous, yellow to yellow–brown, lower glume lanceolate, as long as the spikelet, apex acuminate or two-toothed, two-keeled, 1–2(–3)-veined between the keels, glabrous or pilose on abaxial surface, hairs white, margins ciliate or glabrous; upper glume navicular, subequal to the lower one, apex acuminate, one- to three-veined, midrib keeled, glabrous or pilose on abaxial surface, hairs white, margins hyaline, ciliate; lemmas lanceolate, membranous, hyaline, abaxial surface glabrous, lower lemma (2.5–)3.0–6.0 mm long, apex acuminate, veinless, apex and margins ciliate; upper lemma (2–)2.5–5.5 mm long, apex usually deeply two-toothed, margins ciliate; awn exserted between the teeth of the upper lemma, (4–)5.5–13.0 mm long, brown, geniculate, upper part scabrid, lower part twisted; upper palea lanceolate, 1–2 mm long, membranous, hyaline, apex ciliate. Stamens three, anthers (1.2–)1.5–3.0 mm long. Style 0.5–1.5(–2.0) mm long. Stigmas purple–black, (0.5–) 1.5–2.5 mm long, exserted laterally from the spikelet. Caryopsis long-ellipsoidal, 1.5–2.3(–3.0) mm long. $2n = 35, 36, 38, 40, 41, 57$.

Distribution and habitat: Anhui, Beijng, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hong Kong, Hubei, Hunan, Jilin, Jiangsu, Jiangxi, Liaoning, Macao, Shaanxi, Shandong, Shanghai, Sichuan, Taiwan, Yunnan and Zhejiang [Japan, Korea and the Far East], occurring on mountain slopes, highlands, open grassy places and wasteland at altitudes below 2500 m.

2A. VAR. *SINENSIS* (FIG. 14)

Miscanthus sinensis var. *formosanus* Hack., Bull. Herb. Boissier, sér. 2, 4(6): 526 (1904). *Type*: CHINA. Taiwan: Near Polisja, *Matsumarae s. n.* (holotype: Herb. Boiss.).

Miscanthus transmorrisonensis Hayata, Journ. Coll. Sci. Imp. Univ. Tokyo 30(1): 404 (1911). *Type:* CHINA. Taiwan: Nantou, Luandashan, *B. Hayata & U. Mori 1826* (syntype: TI), *7065* (syntype: TI).

Miscanthus depauperatus Merrill, Phillipp. J. Sci. 5: 170 (1910). *Type*: PHILIPPINES. Canlaon Volcano, Negros, *E. D. Merill s. n.* (holotype: K; isotype: NY!).

Glumes glabrous.

Distribution and habitat: Anhui, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hong Kong, Hubei,

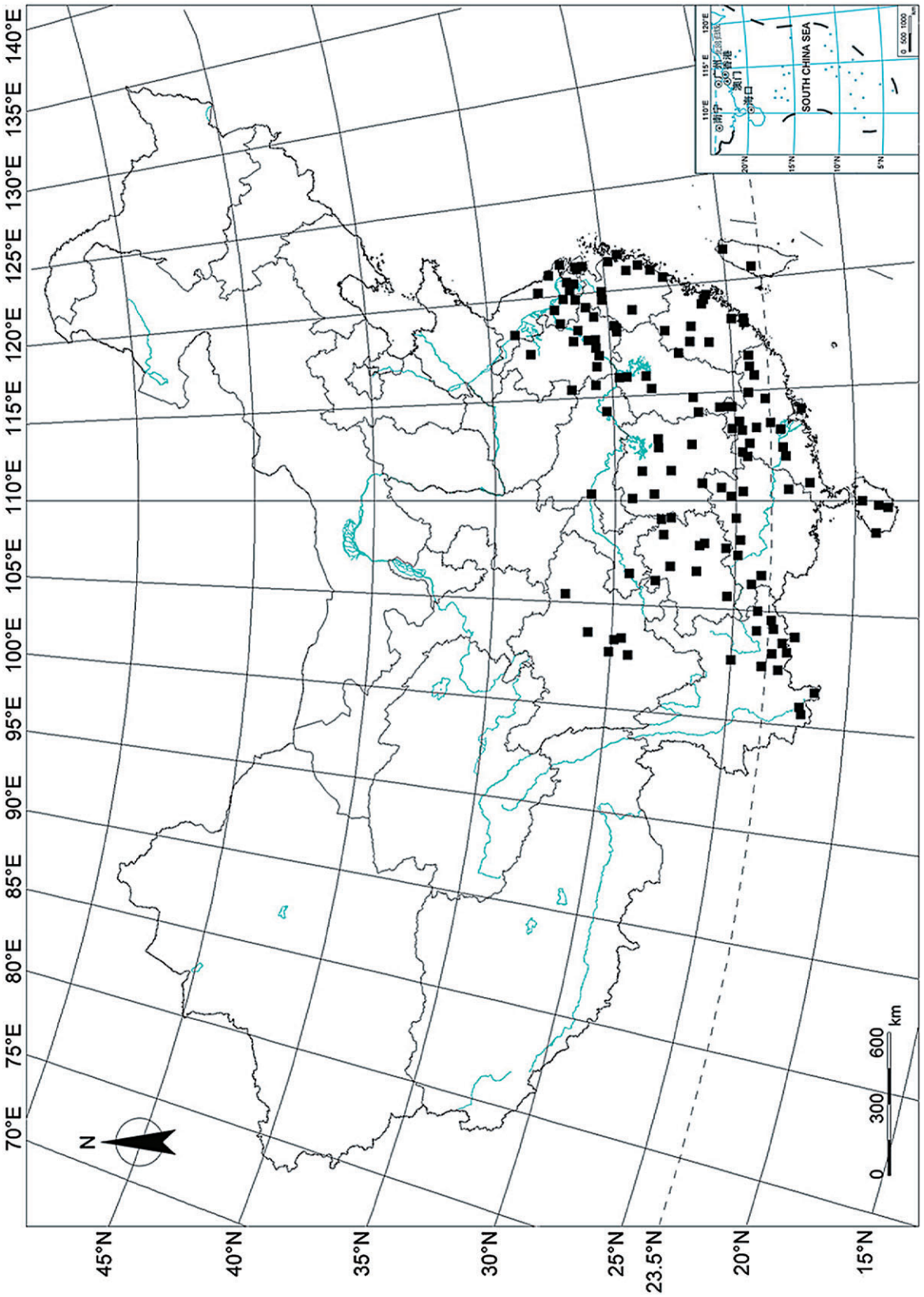

Figure 6. Checked localities of *Miscanthus floridulus* collections.

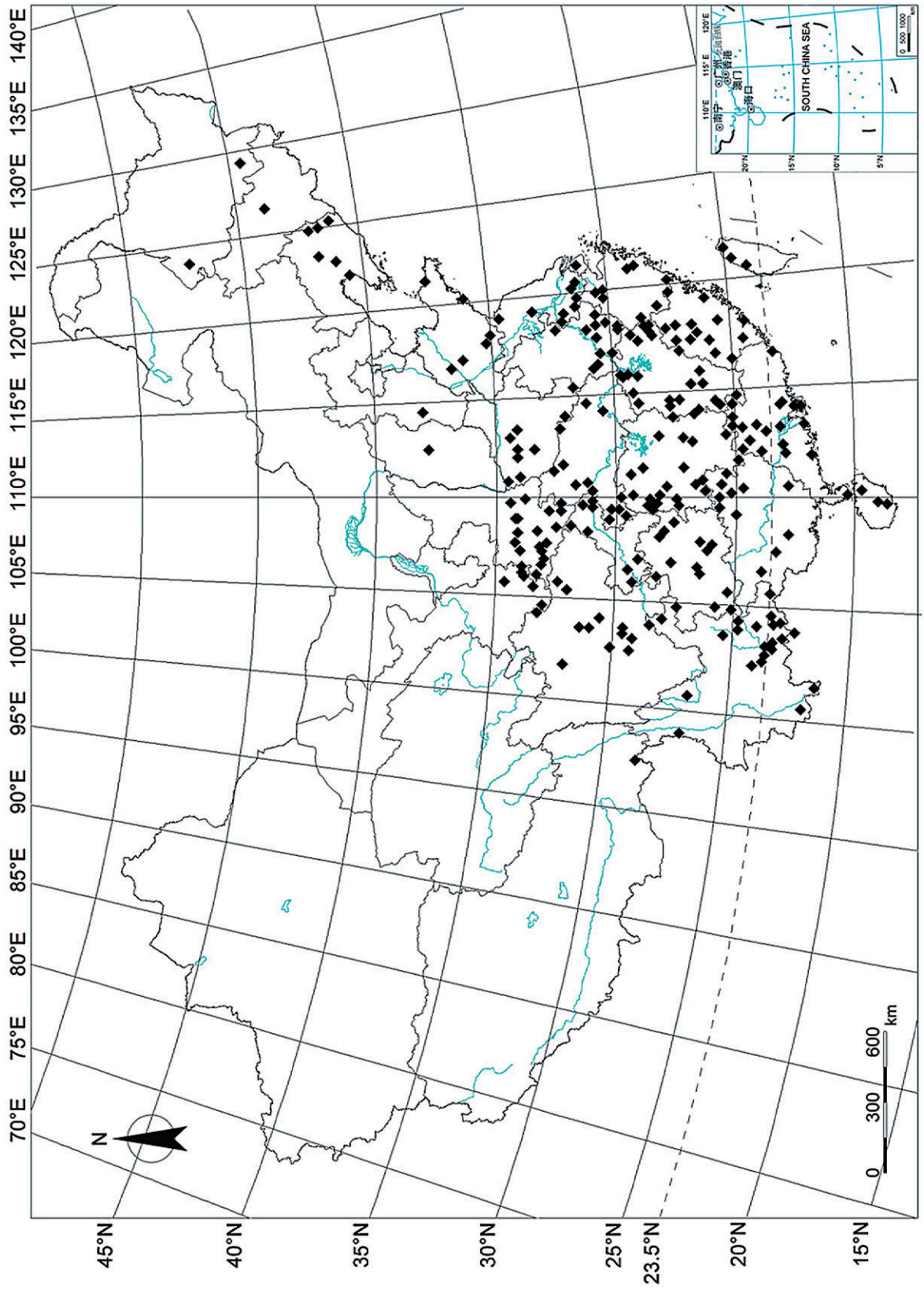

Figure 7. Checked localities of *Miscanthus sinensis* var. *sinensis* collections.

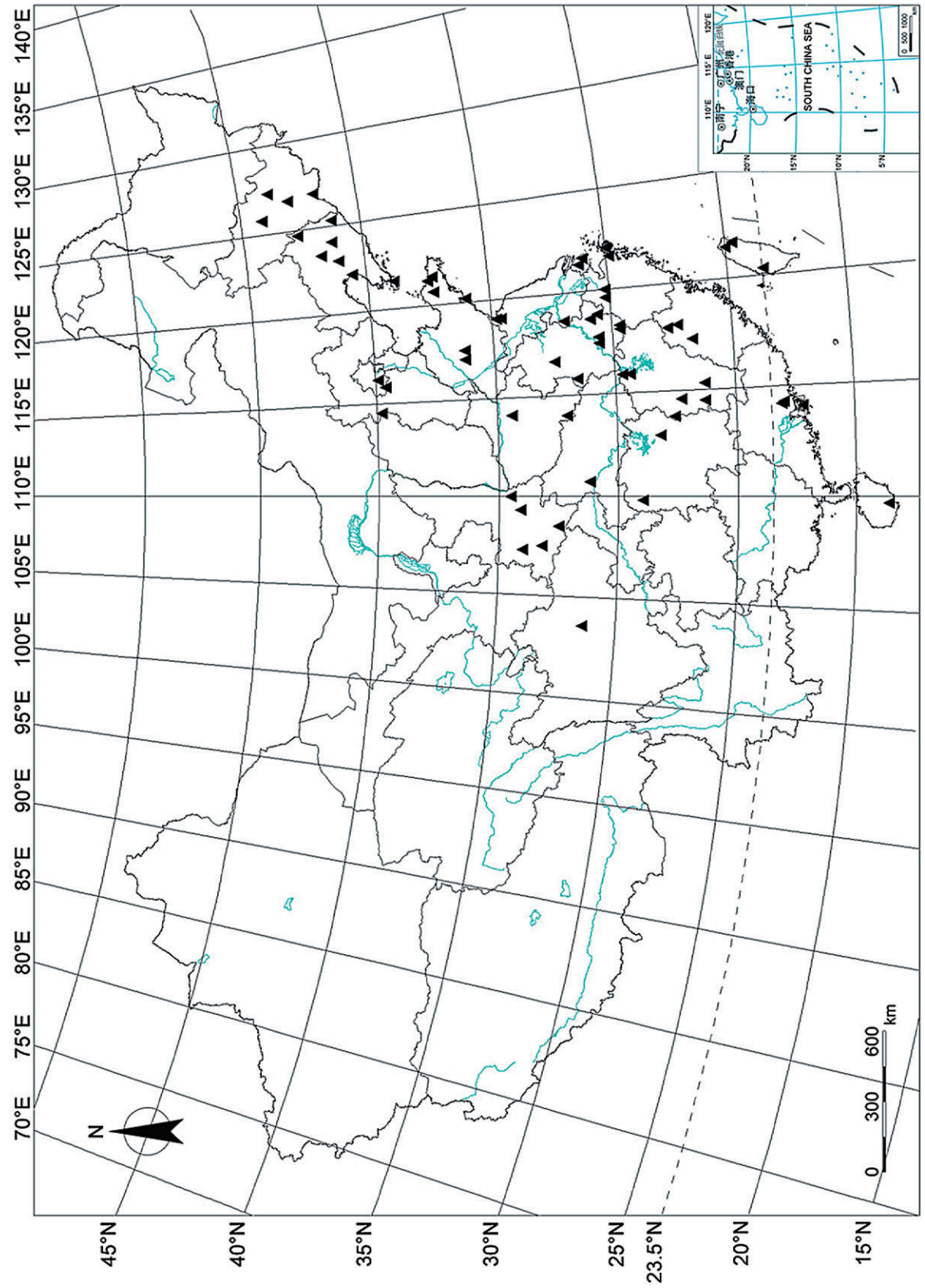

Figure 8. Checked localities of *Miscanthus sinensis* var. *purpurascens* collections.

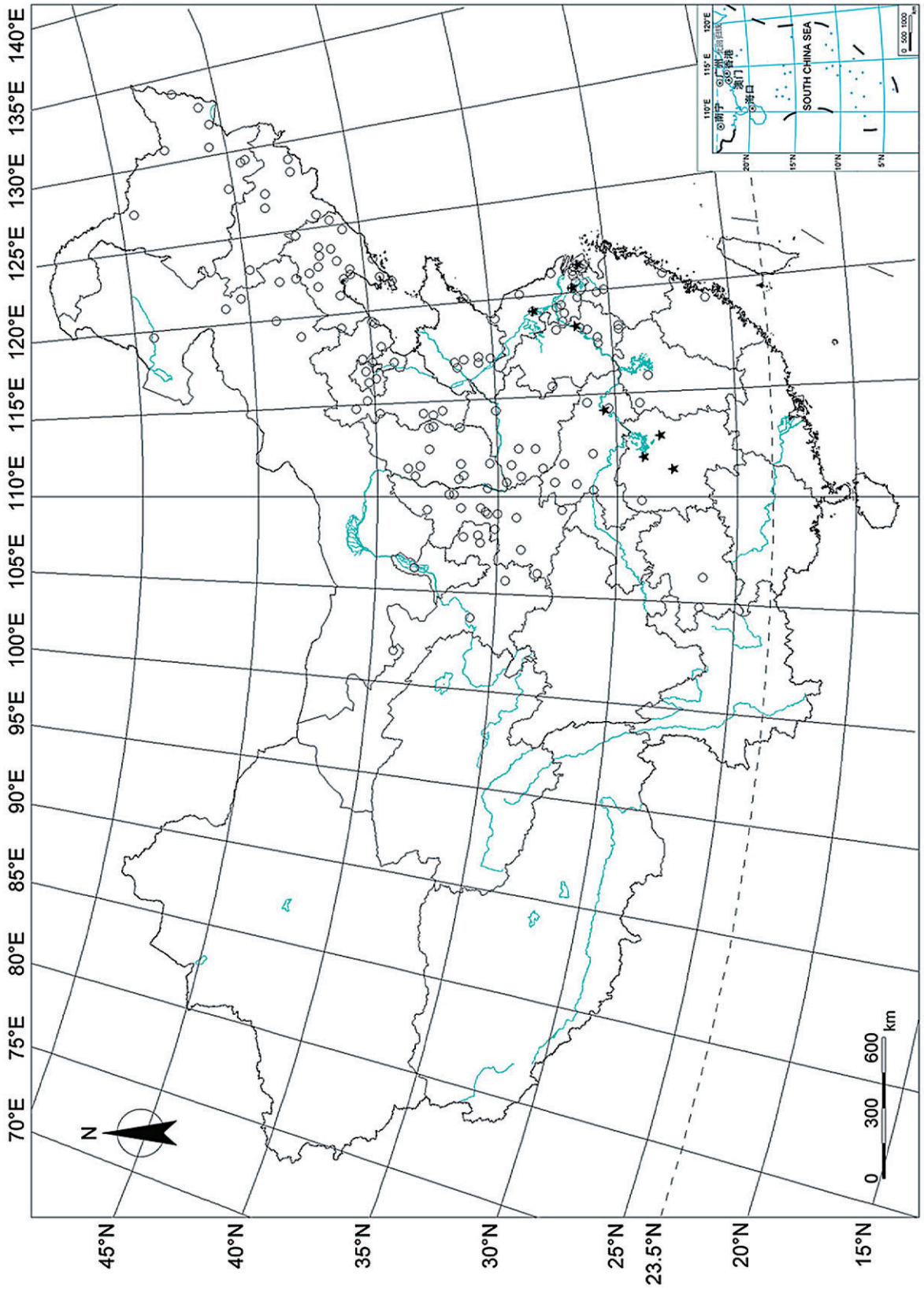

Figure 9. Checked localities of *Miscanthus sacchariflorus* ssp. *lutarioriparius* and *M. sacchariflorus* ssp. *sacchariflorus* collections.

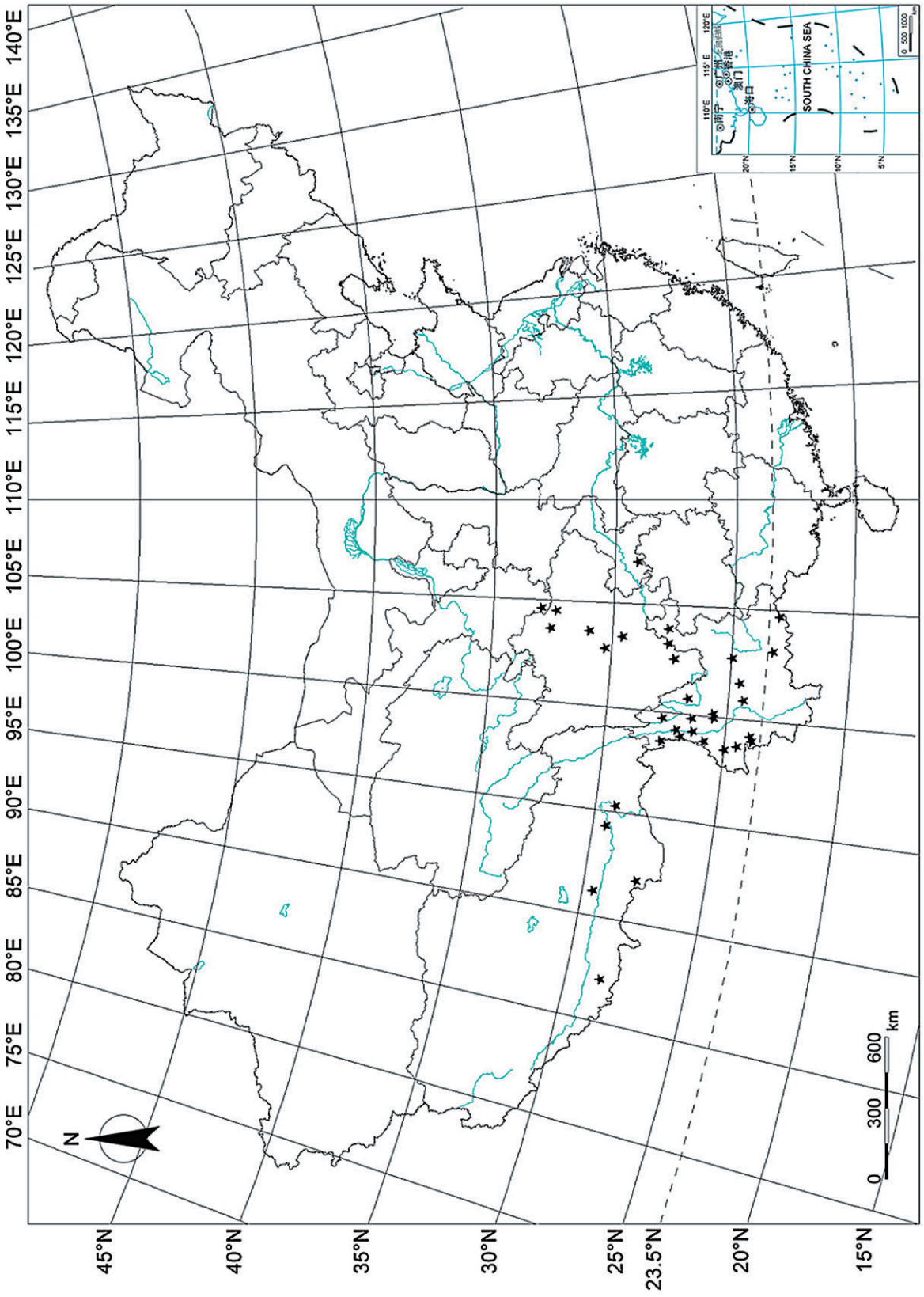

Figure 10. Checked localities of *Miscanthus nepalensis* collections.

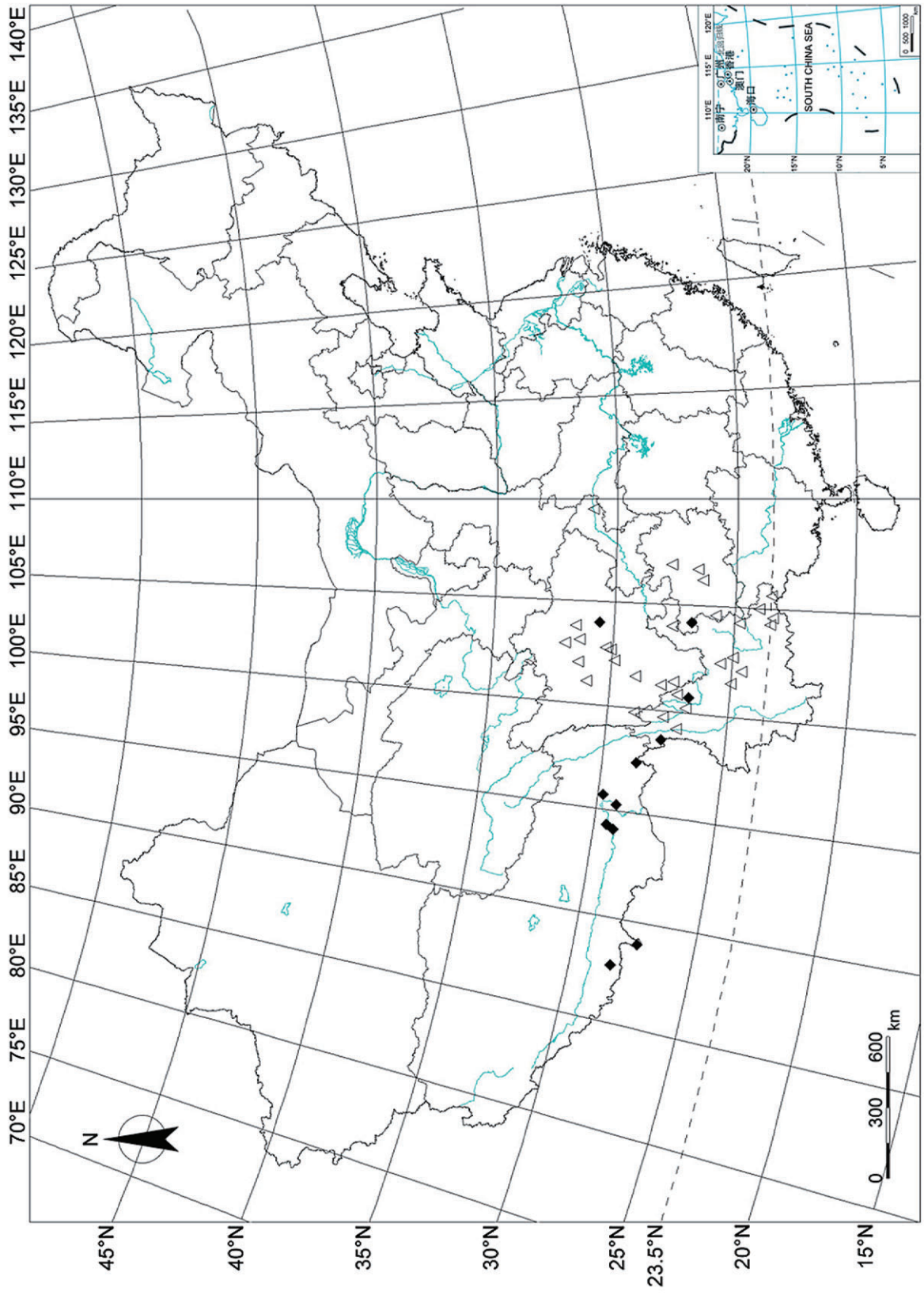

Figure 11. Checked localities of *Miscanthus nudipes* var. *nudipes* and *M. nudipes* var. *yunnanensis* collections.

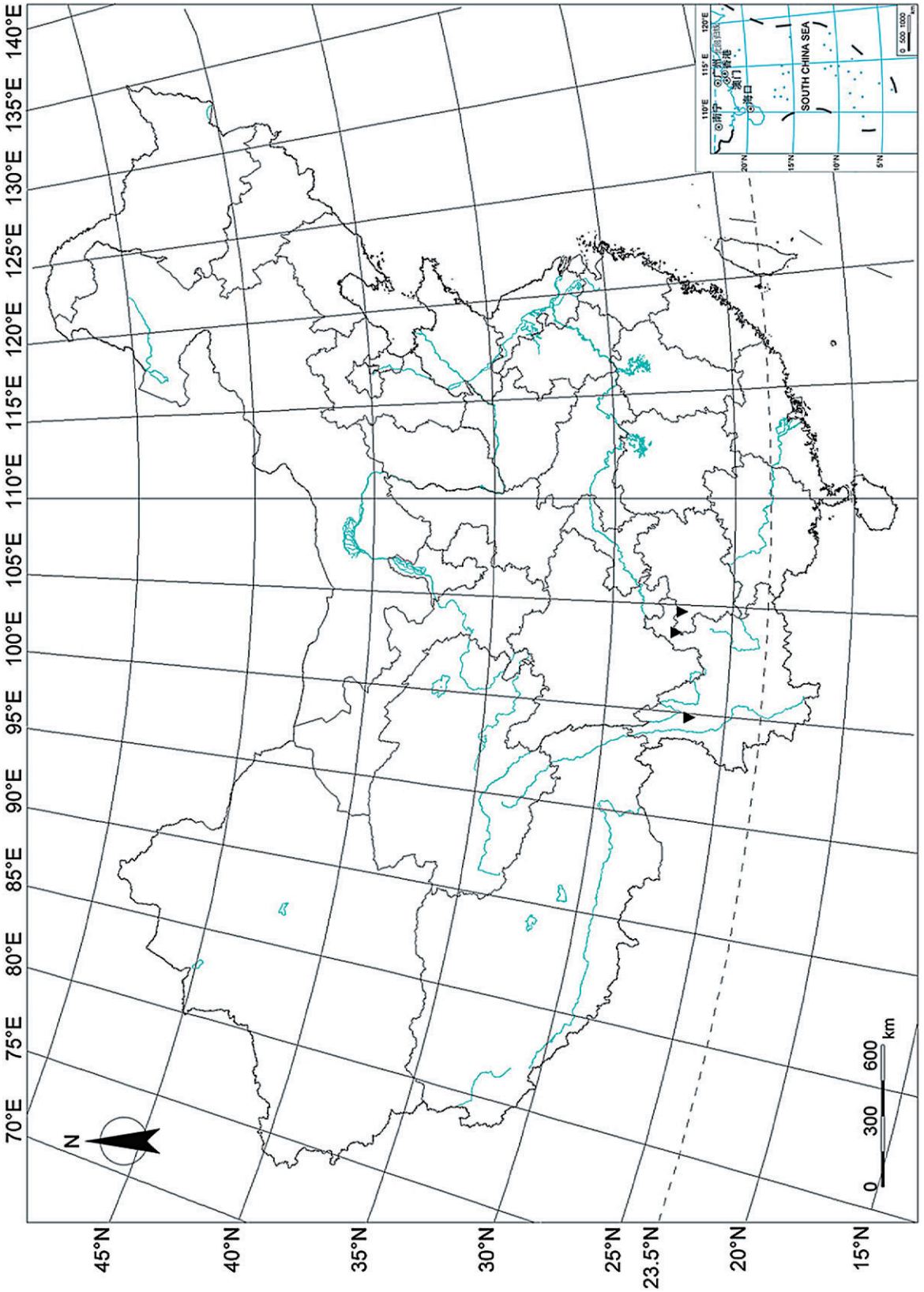

Figure 12. Checked localities of *Miscanthus paniculatus* collections.

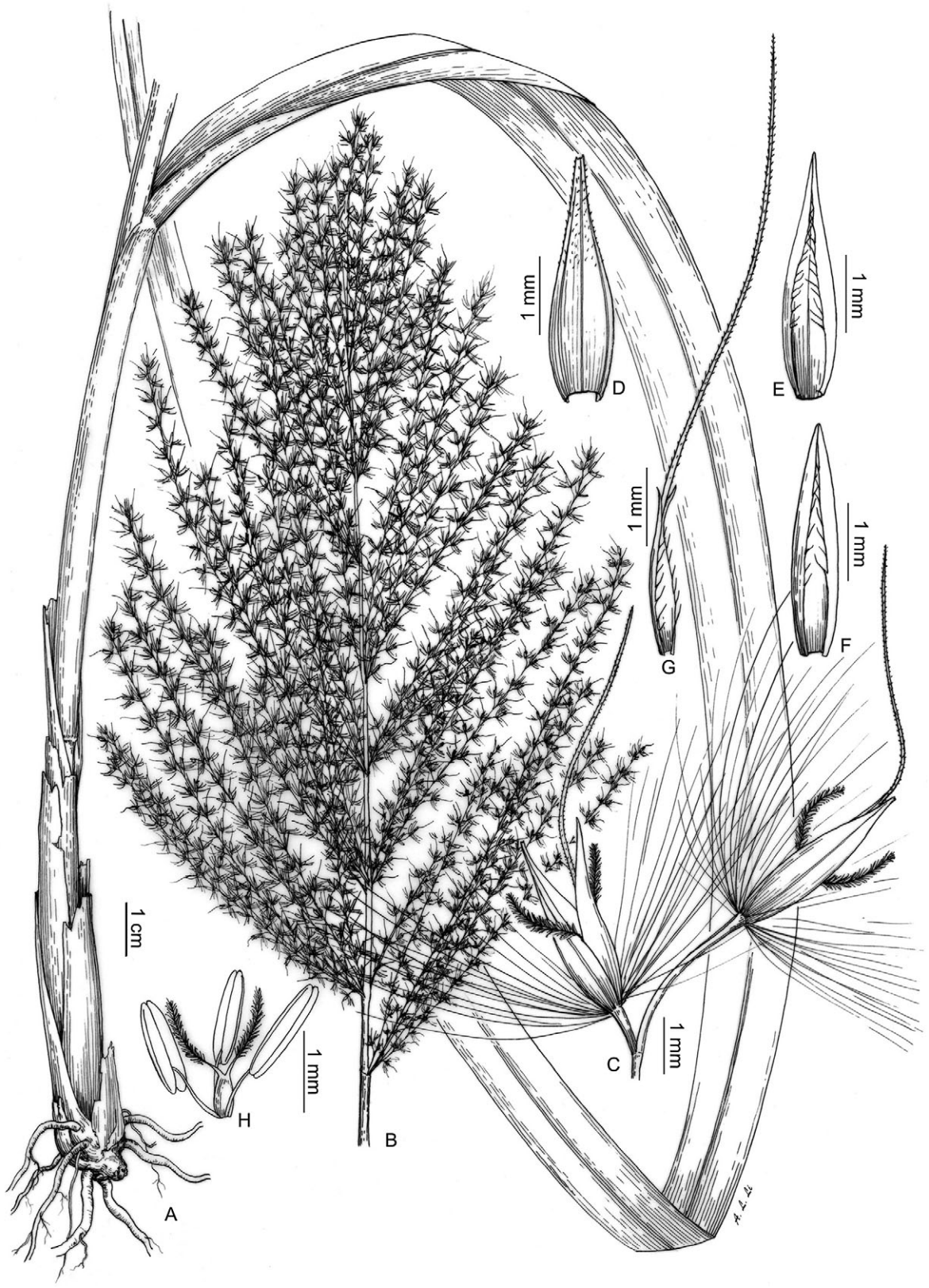

Figure 13. *Miscanthus floridulus*: A, culm and leaf; B, panicle; C, paired spikelets; D, back of lower glume; E, ventral side of upper glume; F, ventral side of lower lemma; G, ventral side of upper lemma with an awn; H, stamens and gynoecium. A–H, *Anonymous 553* (PE Bar Code No. 00573019).

Figure 14. *Miscanthus sinensis* var. *sinensis*: A, panicle and leaf; B, paired spikelets; C, back of lower glume; D, ventral side of upper glume; E, ventral side of upper lemma with an awn; F, lodicules, stamens and gynoecium. A–F, *T. Y. Cheo et al. 7230* (PE Bar Code No. 00573238).

Hunan, Jilin, Jiangsu, Jiangxi, Liaoning, Macao, Shaanxi, Shandong, Shanghai, Sichuan, Taiwan, Yunnan and Zhejiang (Fig. 7) [Japan and Korea], occurring on mountain slopes, highlands, open grassy places and wasteland at altitudes below 2500 m.

Phenology: Flowers and fruits from July to December.

Note: Molecular phylogenetic results (Hodkinson, Chase & Renvoize, 2002a) indicated that *M. transmorrisonensis* was distinguishable from *M. sinensis*, and that it should be accepted as a species. However, we cannot separate them on the basis of our examinations of herbarium specimens. Therefore, we retain the previous taxonomic treatment of *M. transmorrisonensis* as a synonym of *M. sinensis*. Moreover, we found that the specimens and wild plants once named as *M. jinxianensis* L.Liu (1997) (an invalidly published name) showed no consistent distinguishable features from *M. sinensis*. Therefore, we do not adopt this name here.

2B. VAR. *PURPURASCENS* (ANDERSSON) RENDLE (FIG. 15)

Miscanthus sinesis var. *purpurascens* (Andersson) Rendle in Journ. Linn. Soc., Bot. 36: 348 (1904). – *Miscanthus purpurascens* Andersson in Öfvers. Förh. Kongl. Sv. Vet.-Akad. Stockh. 12: 167 (1855). – *Miscanthus sinensis* ssp. *purpurascens* (Andersson) Tzvelev in Zlaki SSSR 693 (1976). – *Miscanthus sinensis* forma *purpurascens* (Andersson) T.Nakai in Bot. Mag., Tokyo 31: 16 (1917). *Type:* 'Patria ignota verosimiliter autem Japonia aut China, Anon. herb. Alstroemeri' (holotype: Museo Holmiensi).

Miscanthus flavidus Honda in Bot. Mag., Tokyo 37: 113 (1923), syn. nov. *Type*: CHINA. Taiwan: Tentyozan, in 1919, *E. Matsuda's Gram. 21* (holotype: TI).

Glumes pilose on abaxial surfaces.

Distribution and habitat: Anhui, Bejing, Fujian, Guangdong, Hainan, Hebei, Henan, Hong Kong, Hubei, Hunan, Jilin, Jiangsu, Jiangxi, Liaoning, Shaanxi, Shandong, Shanghai, Sichuan, Taiwan and Zhejiang (Fig. 8) [Japan, Korea and the Far East], occurring on mountain slopes, wood edges and roadside at altitudes below 3300 m.

Phenology: Flowers and fruits from August to October.

Notes: Chen & Renvoize (2006) treated *M. purpurascens* as a synonym of *M. sinensis*, but they pointed out that 'this is a widespread species with a broad range of variations. Although the variants may be locally distinct, there are too many intermediates to allow a more detailed taxonomy to be followed. The main variants are as follows: . . . *M. purpurascens*: glumes conspicuously pilose; throughout the range of *M. sinensis*; . . .' in the discussion of *M. sinensis*. The results of our PCAs showed that the two species cannot be separated, and they should therefore be treated as one species. However, there are distinct features between *M. sinensis* and *M. purpurascens*, including glumes either glabrous or pilose on the abaxial surface. The intermediate types of *M. purpurascens* and *M. sinensis* in east and central China have lower glumes pilose only on margins or sparsely pilose with several hairs on the abaxial surface. They are probably hybrids between the two taxa naturally occurring in the overlapping region. We agree with Rendle (1904) in recognizing *M. purpurascens* as a variety of *M. sinensis*, following the current usage of infraspecific ranks (Du Rietz, 1930). The protologue of *M. flavidus* stated that 'Species affinis *M. sinensis*, sed foliis vaginisque hirsutis, villis involu crantibus flavidis distincte differt', but we found that leaf sheaths with pilose and yellow callus hairs also appeared in *M. sinensis* in our examinations of a large number of *M. sinensis* collections. The characteristics of *M. flavidus* are still in the variation range of *M. sinensis*. Honda (1923) also reported that 'Gluma I^{ma} 5 mm. longa, dorso longe hirsute; II^{da} linearilanceolate, 5 mm. longa, margine ciliate, dorso pilosa; . . .'. That glumes are pilose on the abaxial surface is the same character as observed in *M. sinensis* var. *purpurascens*. The other characters of *M. flavidus* not described here are also in the variation range of *M. sinensis* var. *purpurascens*. Thus, *M. flavidus* is treated as a synonym of *M. sinensis* var. *purpurascens*.

SECTION II. *TRIARRHENA* (MAXIM.) HONDA

Section *Triarrhena* (Maxim.) Honda in Journ. Fac. Sci. Univ. Tokyo, Bot. 3: 391 (1930). – *Imperata* subg. *Triarrhena* Maximowicz, Prim. Fl. Amur. 331 (1859). *Triarrhena* (Maxim.) T.Nakai in Journ. Jap. Bot. 25(1–2): 7 (1950). *Type: Imperata sacchariflora* Maxim.

Herbs rhizomatous. Rhizome monopodial, Culms unbranched or branching; nodes often bearing buds, adventitious roots inserted at lower nodes. Leaf blades glabrous. Spikelets awnless or with a short arista.

3. *MISCANTHUS SACCHARIFLORUS* (MAXIM.) HACK.

Miscanthus sacchariflorus (Maxim.) Hack. in Journ. Linn. Soc. Bot. 19: 65 (1882). – *Imperata sacchariflora* Maxim. in Prim. Fl. Amur. 9: 331 (1859). – *Miscanthus sacchariflorus* (Maxim.) Hack. in Nat. Pflanzenfam. 2(2): 23 (1887). – *Miscanthus*

Figure 15. *Miscanthus sinensis* var. *purpurascens*: A, culm and leaf; B, panicle; C, paired spikelets; D, back of lower glume; E, ventral side of upper glume; F, back of lower lemma; G, ventral side of upper lemma with an awn; H, stamens and gynoecium. A–H, *Anonymous 3103* (PE Bar Code No. 00573075).

sacchariflorus (Maxim.) Bentham & Hook. ex Franchet in Pl. David. 1884: 327 (1884). – *Triarrhena sacchariflora* (Maxim.) T.Nakai, Journ. Jap. Bot. 25: 7 (1950). *Type:* Hab. *Am siidlichen Amur*, auf Prairieen häufig, z. B. zwei Tagereisen oberhalb der Ssungari–Mündung: 10 Aug. (flor.) (syntype: LE); bei Aicho, 31 Agu. 1856 (frf.) (syntype: LE). Am *Ussuri*, ebenso, z. B. der Por–Mündung gegenüber, auf feuchten Wiesen, recht häufig, 6 Aug. (flor.) (syntype: LE); unterhalb Nor, auf Prairieen recht häufig, 11 Aug. 1855 (flor.) (syntype: LE).

Herbs perennial, rhizomatous, growing in extensive colonies. Rhizome long-creeping, branched. Culms erect (50–)80–700 cm tall, 5–25 mm in diameter at base, 10–47 nodes, internodes of cane-like part hollow, unbranched or branching, glabrous; nodes glabrous, lower nodes often bearing adventitious roots; buds invested with pubescent or pilose scales. Leaves basal and cauline; leaf sheaths overlapping, striate, glabrous or hispid on lower ones, pilose at base with white or yellow hairs; leaf blades linear, flat, 20–100 cm long, 5–35 mm wide, glabrous, adaxial surface pilose at base, margins scabrid, base rounded or tapering to a pseudopetiole, apex finely acuminate; midrib white, convex on abaxial surface; ligule *c*. 0.5–1.0 mm long, margin ciliate, auricles *c*. 1 mm or absent, collar pilose. Panicle corymbose, 20–45 cm long, 8–15 cm wide; axis 5–25 cm long, glabrous, nodes pubescent or pilose. Racemes 4–70, 5–35 cm long; rachis glabrous, nodes glabrous or pilose; pedicels unequal, glabrous or scabrid, lower one 1–3.5 mm long, upper one 3–7 mm long. Spikelets lanceolate, 4.0–6.5 mm long, awnless; callus hairs 7–12 mm long, approximately 1.5–2.0 times as long as the spikelet; glumes membranous, yellow to brown, apex acuminate; lower glume lanceolate, as long as the spikelet, two-keeled, zero- to one-veined between the keels, sparingly pilose or glabrous on abaxial surface, scabrid or pubescent near apex, apex and margins pilose with *c*. 10-mm-long hairs; upper glume navicular, slightly shorter than the lower one, one-veined, back glabrous or sparsely pilose near apex, margins hyaline and ciliate; lemmas lanceolate, membranous, hyaline, apex acuminate, glabrous on abaxial surface; lower lemma 2.5–4.5 mm long, veinless, apex and margins ciliate; upper lemma 2–4 mm long, zero- to one-veined, occasionally with a short arista, apex and margins ciliate; upper palea ovate-lanceolate, 1–2.5 mm long, membranous, hyaline, apex and margins ciliolate. Stamens three, anthers 1.5–2.6 mm long. Style 0.5–1.0 mm long. Stigmas purple–black, 1.5–2.5 mm long, exserted laterally from the spikelet. Caryopsis long-ellipsoidal, 1.5–3.0(–4.0) mm long. $2n = 38–40$, 57, 74, 76, 95.

Distribution and habitat: Anhui, Beijing, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangxi, Jiangsu, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanghai, Shanxi, Shanghai and Zhejiang (Fig. 9) [Japan, Korea and Russia (Siberia and Far East)], occurring on mountain slopes, roadsides, plains, river banks and lakesides at altitudes of lower than 4100 m.

Phenology: Flowers and fruits from August to November.

3A. SSP. *SACCHARIFLORUS* (FIG. 16)

Culms (50–)80–250(–300) cm tall, 5–10 mm in diameter at base, over 10 nodes, unbranched or branching at lower nodes. Racemes 4–40, 5–30 cm long. Lower glume sparingly pilose or glabrous on abaxial surface.

Distribution and habitat: Anhui, Beijing, Gansu, Guizhou, Hebei, Heilongjiang, Henan, Hubei, Hunan, Jiangxi, Jiangsu, Jilin, Liaoning, Nei Mongol, Shaanxi, Shandong, Shanghai, Shanxi, Shanghai and Zhejiang [Japan, Korea and Russia (Siberia and Far East)], occurring on mountain slopes, roadsides, plains and river banks at altitudes of 15–4100 m.

Phenology: Flowers and fruits from August to November.

3B. **SSP. *LUTARIORIPARIUS*** (L.LIU EX S.L.CHEN & RENVOIZE) Q.SUN & Q.LIN, **STAT. NOV. & COMB. NOV.** (FIG. 17)

Miscanthus lutarioriparius L.Liu ex S.L.Chen & Renvoize, Kew Bull. 60: 605 (2006). *Type*: CHINA. Hunan: Hanshou, Lake Dongting, *L. Liu s. n.* (= PE Herb. no. 1559904) (holotype: PE!).

Culms 300–700 cm tall, 8–25 mm in diameter at base, 20–47 nodes, ascendingly branching at upper nodes. Racemes (16–)30–70. Lower glume glabrous on abaxial surface.

Distribution and habitat: Only known in China. Plains of Anhui, Hunan, Hubei, Jiangxi, Jiangsu and Shanghai in the south of the middle and lower reaches of the Yangtze River, occurring on lakesides and flooded river banks at altitudes below 50 m.

Phenology: Flowers and fruits from September to November.

Note: Based on our morphological observation and PCAs, no obvious taxonomic gaps between *M. lutarioriparius* and *M. sacchariflorus* were identified, except for a few distinct traits, such as the height and

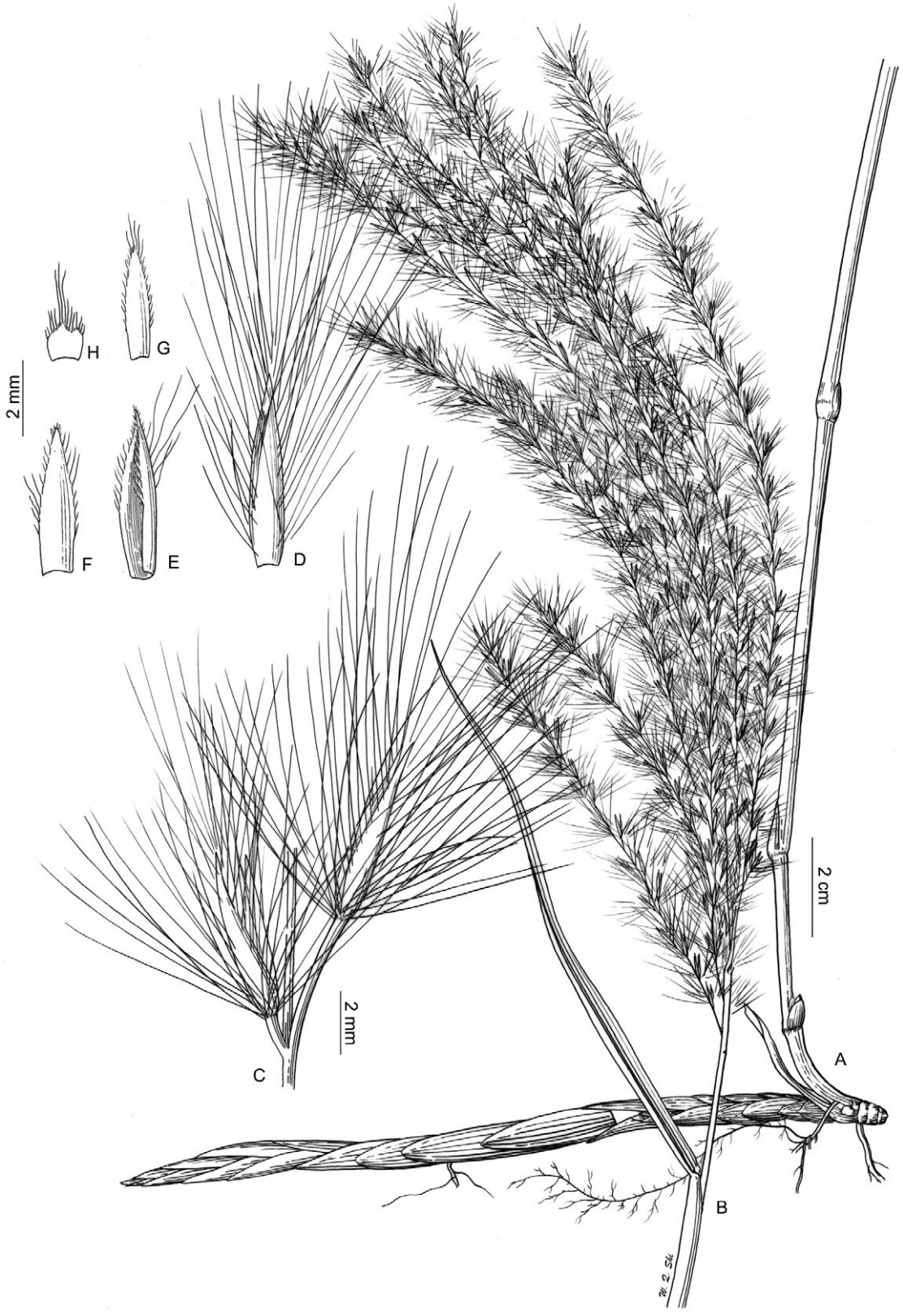

Figure 16. *Miscanthus sacchariflorus* ssp. *sacchariflorus*: A, rhizome and culm; B, panicle and leaf; C, paired spikelets; D, back and ventral side of lower glume; E, ventral side of upper glume; F, back of lower lemma; G, back of upper lemma without an awn; H, lodicule. A–H, *C. G. Yang 513* (PE).

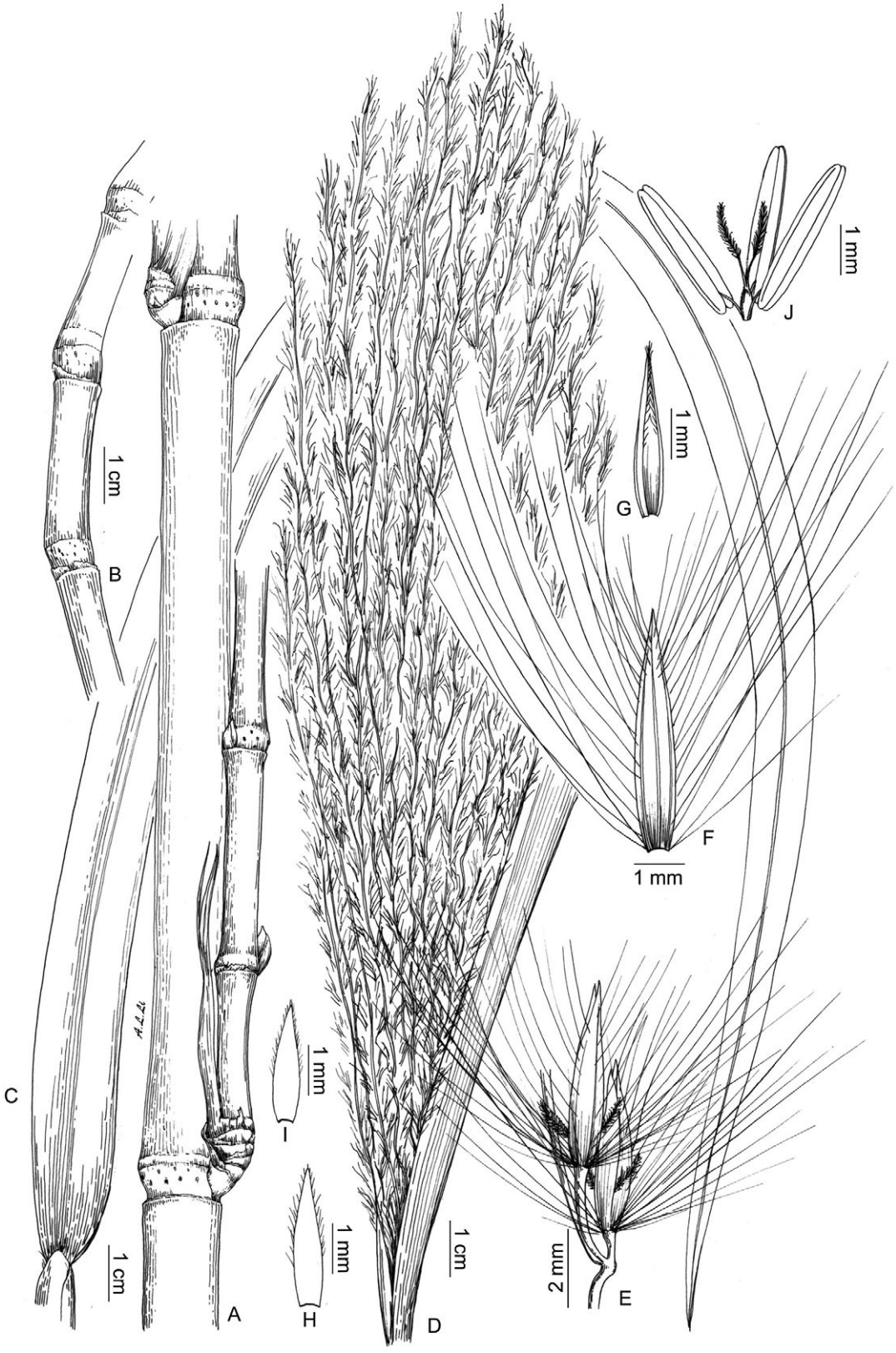

Figure 17. *Miscanthus sacchariflorus* ssp. *lutarioriparius*: A, culm with tough branch; B, upper part of culm; C, leaf; D, panicle; E, paired spikelets; F, back of lower glume; G, ventral side of upper glume; H, back of lower lemma; I, back of upper lemma without an awn; J, stamens and gynoecium. A–J, *L. Liu s. n.* (PE Bar Code No. 00573207).

diameter of the culm, unbranched or branching upper parts of the culms and the number of racemes. ITS sequence data (Chen *et al*., 2007) provided evidence in support of them not being treated as two species. Taking all this together and their distributions (Fig. 9), we tend to treat them as subspecies following the intraspecific ranks designated by Du Rietz (1930).

SUBGENUS II. ***DIANDRANTHUS*** (L.LIOU) Q.SUN & Q.LIN, **STAT. NOV. & COMB. NOV.**

Subgenus *Diandranthus* (L.Liou) Q.Sun & Q.Lin. – *Type: Miscanthus nudipes* (Grisebach) Hackel [= *Erianthus nudipes* Grisebach].

Diandranthus L.Liou, Fl. Xizang 5: 308 (1987) et Fl. Reipubl. Popularis Sin.10(2): 10 (1997). *Type*: *Diandranthus nudipes* (Grisebach) L.Liou [= *Erianthus nudipes* Grisebach].

Rubimons B.S.Sun, Acta Bot. Yunnan 19(3): 239 (1997). *Type*: *Rubimons paniculatus* B.S.Sun.

Herbs tufted. Panicle patent or contracted; axis tough or slender. Lower glume apex obtuse or truncate, shorter than or subequal to the upper one; midrib on upper lemma spreading to be an awn, straight or geniculate, upper part scabrid, base twisted. Stamens two or three. Style 1.0–2.5 mm long, subequal to stigmas. Stigmas exserted apically from the spikelet.

4. *MISCANTHUS NEPALENSIS* (TRINIUS) HACKEL (FIG. 18)

Miscanthus nepalensis (Trin.) Hack., Monogr. Phan. 6: 104 (1889). – *Eulalia nepalensis* Trin., Mém. Acad. Imp. Sci. St.-Pétersbourg, Sér. 6, Sci. Math. 2: 333 (1833). – *Diandranthus nepalensis* (Trin.) L.Liou, Fl. Xizangica 5: 313 (1987). *Type:* NEPAL. Others unknown (holotype: LE).

Herbs perennial, tufted. Culms erect (30–)70–200 cm tall, 2–7(–10) mm in diameter at base, usually unbranched, smooth or pubescent below the panicle, nodes glabrous. Leaves basal and cauline; leaf sheaths overlapping, striate, glabrous or pilose near leaf blades, pilose at throat; leaf blades linear, flat, 15–60 cm long, 3–25 mm wide, margins serrulate, base gradually tapering or rounded, apex acuminate, green, glabrous or pilose on abaxial surface, midrib white, prominent, convex on abaxial surface; ligule semicircular, membranous, 1–3 mm long, margin ciliolate; collar usually pilose. Panicle corymbose, 8–26 cm long, 6–10 cm wide; axis 1.5–16.0 cm long, usually glabrous or pubescent at lower part, axil pilose or pubescent. Racemes 5–45, 8–26 cm long, spreading; rachis slender, glabrous; pedicels unequal, glabrous or scabrous, lower one 1.0–2.5 mm long, upper one 2.0–5.5 mm long, recurved. Spikelets ovate-lanceolate, 2–3 mm long, 0.5 mm wide, awned; callus hairs 5–11 mm long, yellow, 3.0–4.5 times as long as the spikelet; glumes membranous, golden-brown; lower glume lanceolate to ovate-lanceolate, subequal to or slightly shorter than the upper one, apex obtuse or emarginate, two-keeled, faintly one- to three-veined between the keels, glabrous on abaxial surface, margins pilose with 4–6-mm-long hairs; upper glume navicular, as long as the spikelet, apex acuminate, one- to three-veined, apex and margins hyaline, glabrous or margins ciliate; lemmas lanceolate, membranous, hyaline, glabrous on abaxial, lower lemma (1.5–)2.0–2.5 mm long, veinless, occasionally one-veined, apex and margins usually ciliate; upper lemma 1.5–2.3 mm long, apex acuminate or deeply two-toothed, margins ciliolate on lower part; awn exserted between the teeth of the upper lemma, 10–17 mm long, brown, straight, lower part twisted, upper part scabrid; upper palea lanceolate, 0.5–1.0 mm long, membranous, hyaline. Stamens two, anthers 1.0–1.5 mm long. Style 1.0–1.5(–1.8) mm long. Stigmas purple–black, 1–1.5 mm long, exserted apically from the spikelet. Caryopsis long-ellipsoidal, 1.0–1.5 mm long. $2n = 40$.

Distribution and habitat: Chongqing, Gansu, Sichuan, Xizang and Yunnan (Fig. 10) [Bhutan, India, Myanmar and Nepal; introduced in Malaysia], occurring on mountain slopes, grassland in valley and roadsides at altitudes of 950–3000 m.

Phenology: Flowers and fruits from June to November.

Note: Miscanthus nepalensis was apparently distinguishable from other taxa in *Miscanthus.* It was often treated as section *Diandranthus* or genus *Diandranthus* because of characters such as unequal pedicels, paired and awned spikelets and two stamens. In this paper, it is classified as subgenus *Diandranthus* on the basis of our examinations of its morphological characters. More study is needed to clarify the taxonomic status of *M. nepalensis*, considering the result of our PCAs.

5. *MISCANTHUS NUDIPES* (GRISEBACH) HACKEL

Miscanthus nudipes (Griseb.) Hack. in A.DC., Monogr. Phan. 6: 109 (1889). – *Erianthus nudipes* Griseb. in Nachr. Königl. Ges. Wiss. Georg-Augusts-Univ. 3: 92 (1868). – *Diandranthus nudipes* (Griseb.) L.Liou in Fl. Xizangica 5: 312 (1987). *Type*: INDIA. Sikkim: 9000–13 000 ft, *J. D. Hooker 10* (holotype: GOET; isotype: K).

Miscanthus taylorii Bor in Kew Bull. 8: 273 (1953). – *Miscanthus nudipes* (Griseb.) Hack. ssp. *taylorii*

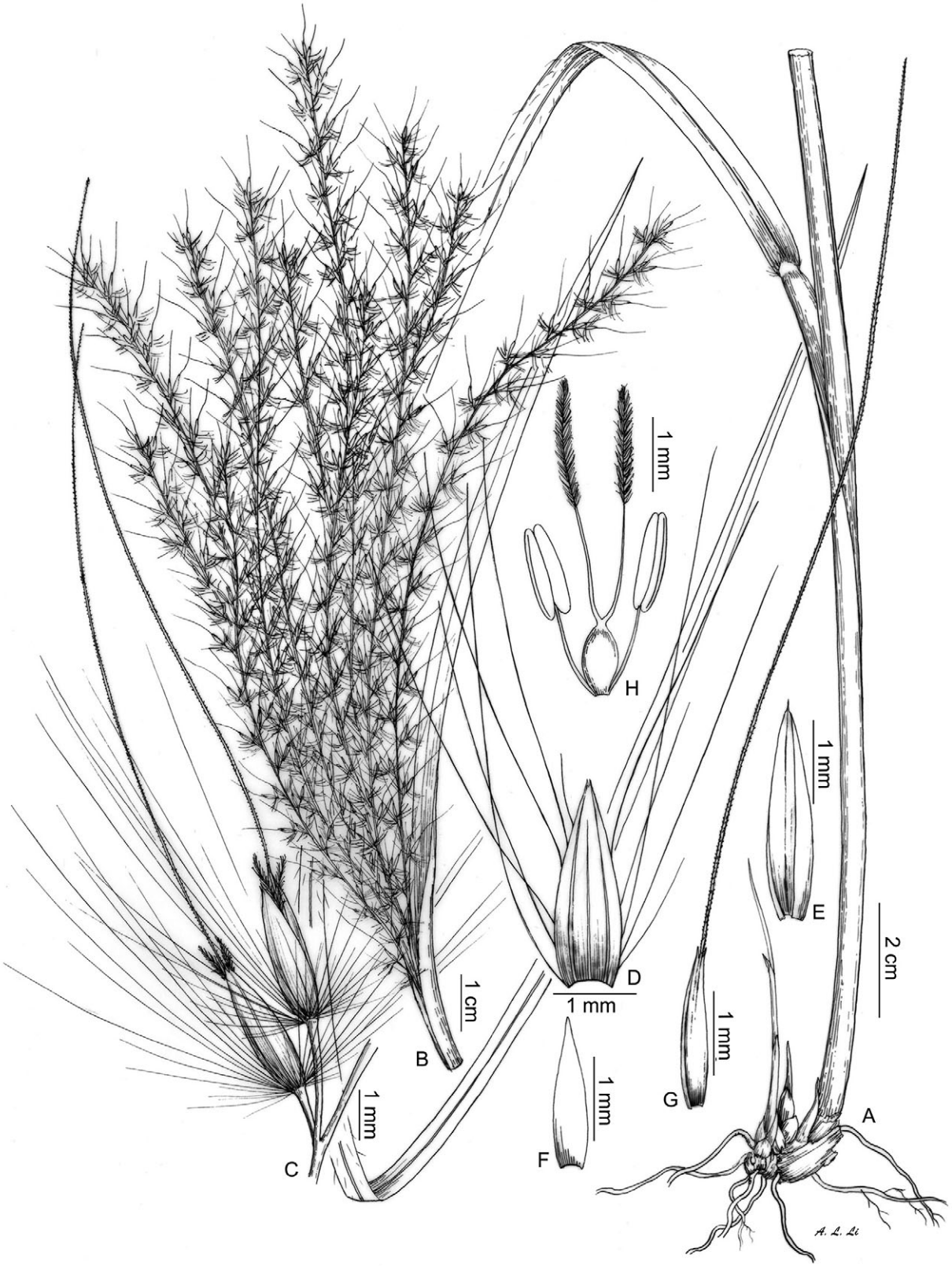

Figure 18. *Miscanthus nepalensis*: A, culm and leaf; B, panicle; C, paired spikelets; D, back of lower glume; E, ventral side of upper glume; F, back of lower lemma; G, ventral side of upper lemma with an awn; H, stamens and gynoecium. A–H, *Expediton of Qinghai & Xizang 9717* (PE Bar Code No. 00468389).

(Bor) Y.N.Lee in Korean Pl. Taxon 3: 18 (1971). – *Diandranthus taylorii* (Bor) L.Liou in Fl. Xizangica 5: 310 (1987). *Type*: CHINA. Xizang: Kongbo, Trim La, Mayër, 3500 m, 9.vii.1938, *Ludlow*, *Sherriff & Taylor 5799* (holotype: BM).

Miscanthus wardii Bor in Kew Bull. 8: 274 (1953). – *Miscanthus nudipes* (Griseb.) Hack. ssp. *wardii* (Bor) Y.N.Lee in Korean Pl. Taxon 3: 18 (1971). – *Diandranthus wardii* (Bor) L.Liou in Fl. Xizangica 5: 311 (1987). *Type*: INDIA. Assam: Di Chu Gorge, Lohit valley, 12.iv.1950, *F. Kingdon-Ward 19328* (holotype: K).

Diandranthus corymbosus L.Liou in Fl. Xizangica 5: 312 (1987). *Type*: CHINA. Xizang: Nyingchi, 3200 m, 20.v.1966, *G. W. Chang & J. T. Wang 87* (holotype: PE!).

Diandranthus ramosus L.Liou in Fl. Xizangica 5: 310 (1987). *Type*: CHINA. Xizang: Zayü, 1300 m, 10.vii.1973, *G. W. Chang 620* (holotype: PE!).

Diandranthus tibeticus L.Liou in Fl. Xizangica 5: 308 (1987). *Type*: CHINA. Xizang: 2080 m, 23.vii.1965, T. S. Ying & D. Y. Hong 650799 (lectotype: PE Bar Code No. 00038657!, designated here, PE; isolectotype, PE!).

Herbs perennial, tufted. Culms erect, 20–150 cm tall, 2–8 mm in diameter at base, usually unbranched, smooth or pilose below the panicle, nodes glabrous. Leaves basal and cauline; leaf sheaths overlapping, striate, glabrous or pilose; leaf blades linear, flat (6–)10–50 cm long, 2–15 mm wide, margins serrulate, base gradually tapering or rounded, apex acuminate, abaxial surface pilose, adaxial surface glabrous or sparingly pilose, midrib white, prominent, convex on abaxial surface; ligule semicircular, membranous, 0.5–1.8 mm long, margin ciliolate or dentate; collar usually pilose. Panicle corymbose, 5–26 cm long, 2–10 cm wide; axis 1.5–10.0 cm long, glabrous or pilose. Racemes 3–20(–30), 1.5–16.0 cm long, spreading; rachis glabrous or pilose; pedicels unequal, glabrous or scabrous, lower 0.5–2.5 mm long, upper 2–5 mm long. Spikelets lanceolate (3.2–)3.5–6.0 mm long, 0.8–1.2 mm wide, awned; callus hairs white or purple; glumes membranous, pale yellow to yellow–brown; lower glume lanceolate, shorter than the upper, apex truncate or slightly two-toothed, two-keeled, two- to five-veined between the keels, abaxial surface and margins pilose, apex ciliolate; upper glume navicular, as long as the spikelet, apex acuminate, 1–5(–6)-veined, apex and margins hyaline, abaxial surface glabrous or sparingly pilose, margins ciliate; lemmas lanceolate, membranous, hyaline, abaxial surface glabrous, lower lemma (2.5–)3.5–5.0 mm long, veinless to one-veined, margins ciliate near apex; upper lemma 2.5–4.5 mm long, apex acuminate or deeply two-toothed, margins ciliolate at lower part; awn exserted between the teeth of the upper lemma, 3–15 mm long, brownish, straight or geniculate, lower part twisted, upper part scabrid; upper palea lanceolate, 1.5–4.5 mm long, membranous, hyaline. Stamens two, anthers 1.5–2.8(–3.0) mm long. Style 1.5–2.5(–3.3) mm long. Stigmas purple–black, 1.5–3.0 mm long, exserted apically from the spikelet. Caryopsis long-ellipsoidal, 1.5–2.0 mm long. $2n = 40$.

Distribution and habitat: Chongqing, Guizhou, Sichuan, Xizang and Yunnan (Fig. 11) [Bhutan, India, Nepal], occurring on mountain slopes, wood edges, roadsides of river banks and sand of rivulets at altitudes of 640–3600 m.

5A. VAR. *NUDIPES* (FIG. 19)

Both surfaces of leaf blades sparingly pilose. Spikelets 4.0–5.5(–6.0) mm long; callus hairs 1–5 mm long, half to once as long as the spikelet; lower glume pilose with 1.0–3.5-mm-long hairs on abaxial surface and margins; upper glume glabrous or sparingly pilose on abaxial surface.

Distribution and habitat: Guizhou, Sichuan, Xizang and Yunnan [Bhutan, India, Nepal], occurring on mountain slopes, wood edges, roadsides of river banks and sand of rivulets at altitudes of 1000–3600 m.

Phenology: Flowers and fruits from June to November.

Note: We agree with Ibaragi (2003) that *M. taylorii* Bor, *M. wardii* Bor, *D. corymbosus* L. Liou, *D. ramosus* L.Liou and *D. tibeticus* L.Liou should be treated as synonyms of *D. nudipes* ssp. *nudipes* (= *M. nudipes* var. *nudipes*) based on our examinations. Liu (1994) designated *T. S. Ying et D. Y. Hong 799* as the type of *D. tibeticus* L. Liou. Three sheets of this collection were found in PE, and all are labelled in the handwriting of Liou as 'sp. nov.'. As there is no cross-labelling, they are syntypes according to Art. 9.4 and 37.2 of the Vienna Code (McNeill *et al*., 2006). We here designate the sheet PE Bar Code No. 00038657 to be the lectotype of *D. tibeticus* L.Liu under Art. 8.1 and 9.10 of the Vienna Code.

5B. **VAR. *YUNNANENSIS*** (A.CAMUS) Q.SUN & Q.LIN, **STAT. NOV.** (FIG. 20)

Miscanthus nudipes (Griseb.) Hack. ssp. *yunnanensis* A.Camus in Bull. Mus. Hist. Nat. Paris, 25: 670 (1919).–*Miscanthus yunnanensis* (A.Camus) Keng in Sinensia 10: 290, in obs., 338 (1939).–*Diandranthus yunnanensis* (A.Camus) L.Liu, Fl. Reipubl. Popularis

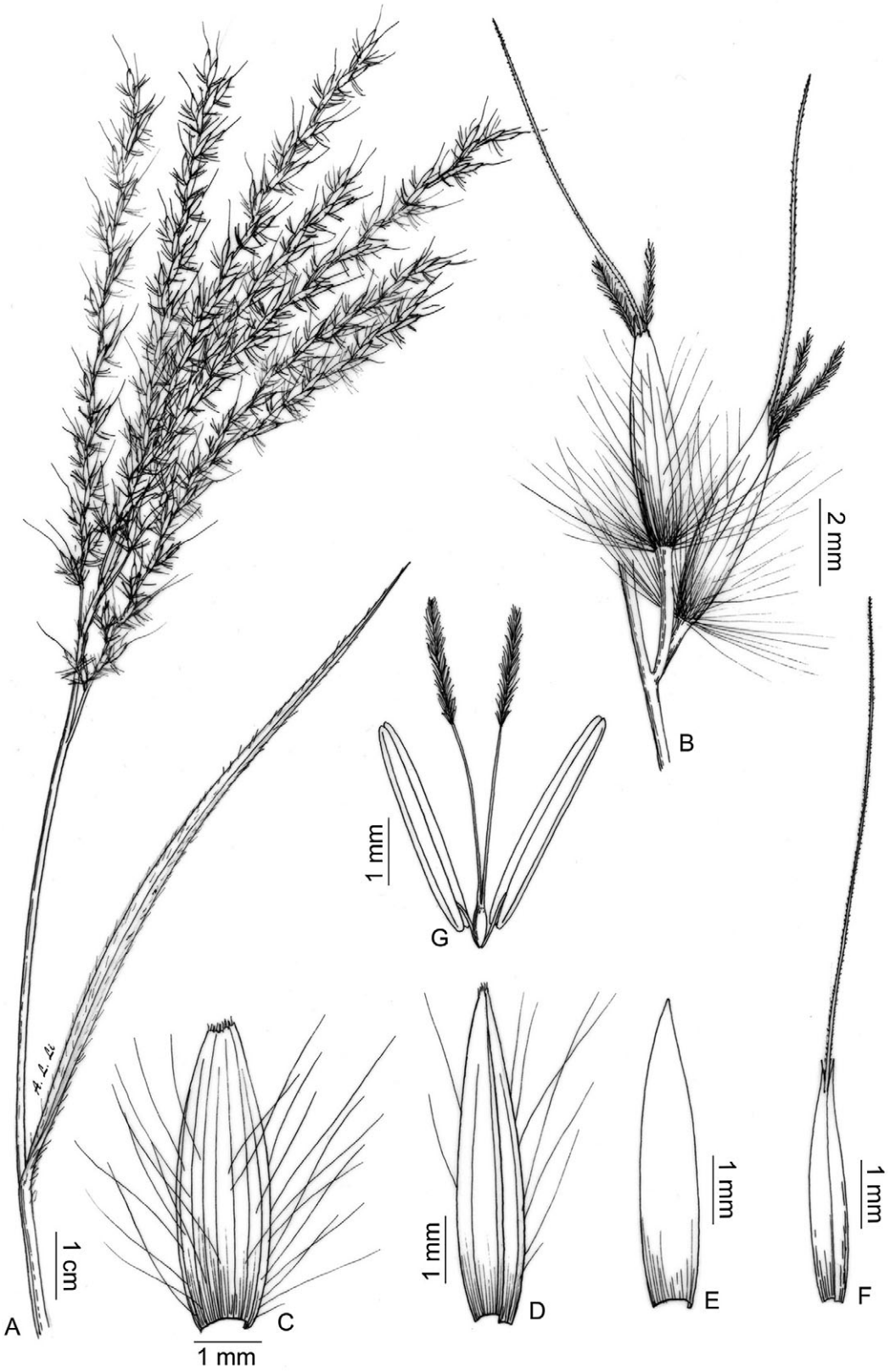

Figure 19. *Miscanthus nudipes* var. *nudipes*: A, panicle and leaf; B, paired spikelets; C, back of lower glume; D, ventral side of upper glume; E, back of lower lemma; F, ventral side of upper lemma with an awn; G, stamens, and gynoecium. A–G, *T. S. Ying & D. Y. Hong 650096* (PE Bar Code No. 00573070).

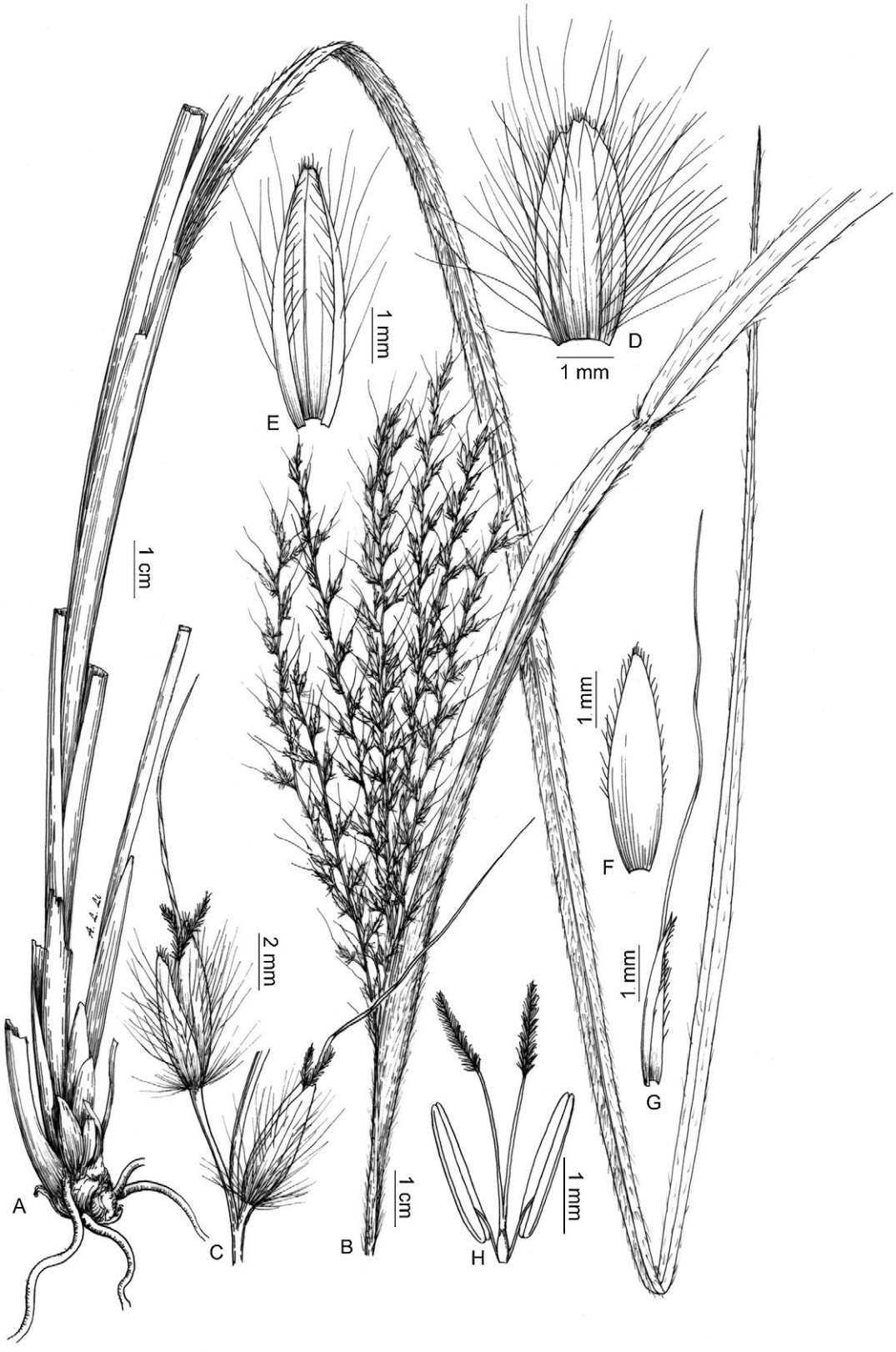

Figure 20. *Miscanthus nudipes* var. *yunnanensis*: A, culm and leaf; B, panicle; C, paired spikelets; D, back of lower glume; E, ventral side of upper glume; F, back of lower lemma; G, ventral side of upper lemma with an awn; H, stamens and gynoecium. A–H, *Z. X. Tang et al. 61* (PE Bar Code No. 00487423).

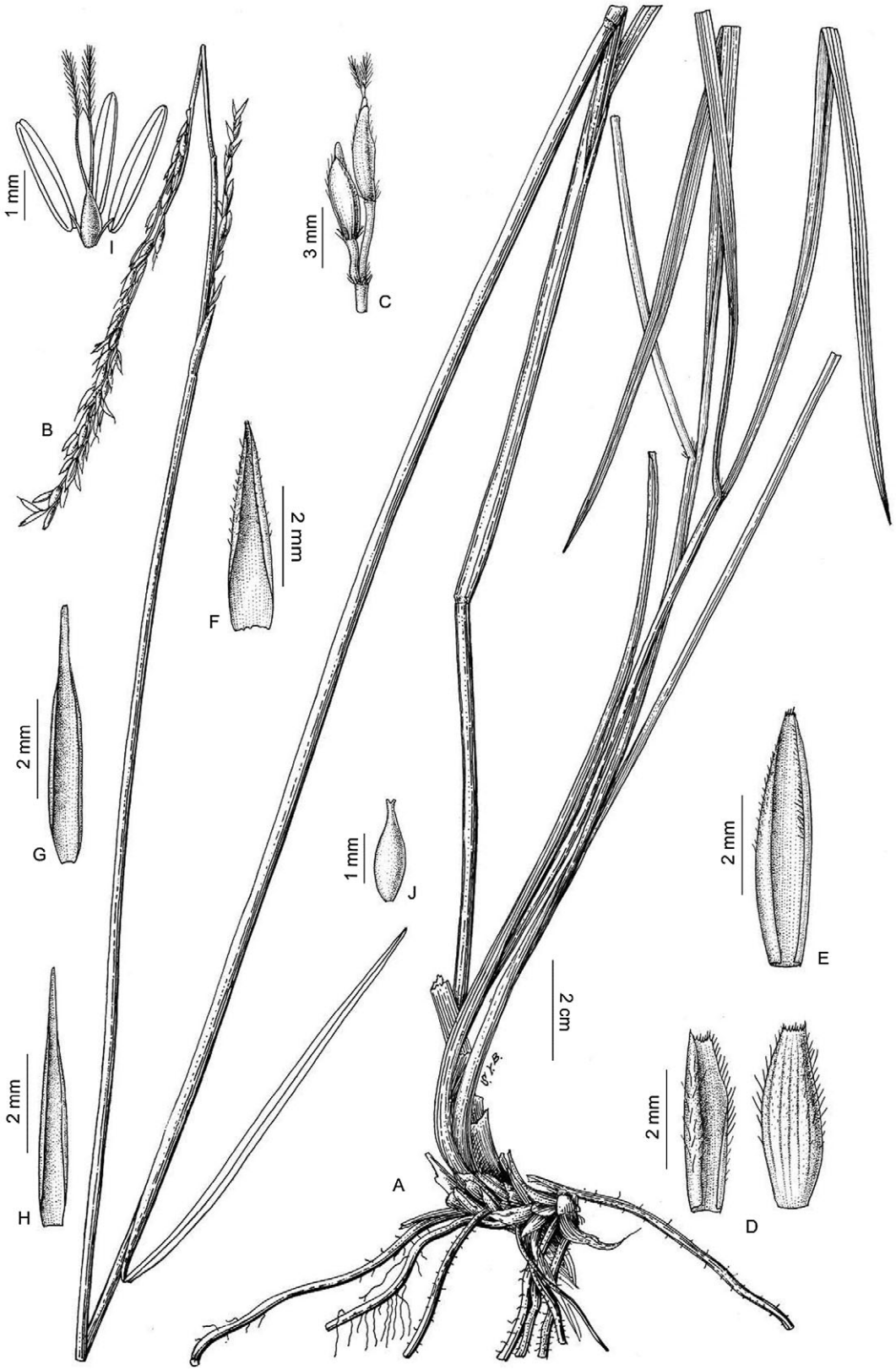

Figure 21. *Miscanthus paniculatus*: A, culms and leaves; B, panicle; C, paired spikelets; D, back and ventral side of lower glume; E, ventral side of upper glume; F, ventral side of lower lemma; G, ventral side of upper lemma; H, ventral side of upper lemma; I, stamens and gynoecium; J, ovary. A–J, *B. S. Sun 82042* (YUKU Bar Code No. 05030354).

Sin.10(2): 14 (1997). – *Diandranthus nudipes* (Griseb.) L.Liou ssp. *yunnanensis* (A.Camus) Ibaragi in Acta phytotax. Geobot. 54(2):118 (2003). *Type:* CHINA. Yunnan, collines arides à Tong-chouan, 2500–2600 m, année 1914, *E. E. Maire s. n.* (isotype: P).

Miscanthus brevipilus Hand.-Mazz., Symb. Sin. 7(5):1306 (1936). – *Diandranthus brevipilus* (Hand.-Mazz.) L. Liu, Fl. Reipubl. Popularis Sin. 10(2): 16 (1997). *Type*: CHINA. Northwestern Yunnan: Föhrenwälder der tp. St. am Hange des Waha bei Yungning, 3200 m, 19.vii.1915, H. F. vs. *Handel-Mazzetti 7073* (holotype: WU).

Miscanthus eulalioides Keng, Sinensia 10: 288 (1939).–*Diandranthus eulalioides* (Keng) L.Liu, Fl. Reipubl. Popularis Sin. 10(2): 15 (1997). *Type:* CHINA. Yunnan: eastern slopes of Likiang Snow Range, Yangtze watershed, *J. F. Rock 10832* (holotype: US!; isotype: PE!).

Miscanthus szechuanensis Keng ex S.L.Zhong, J. Southwest. Agric. Coll. 1982(4): 80 (1982). – *Diandranthus szechuanensis* (Keng ex S.L. Zhong) L. Liu, Vasc. Pl. Hengduan Mount. 2: 2297 (1994). *Type:* CHINA. Sichuan: Leibo, 1500 m, 22.xii.1934, *T. T. Yü 3507* (holotype: PE).

Leaf blades abaxial surface sparingly pilose, adaxial surface glabrous or occasionally sparingly pilose. Spikelets (3.2–)3.5–6.0 mm long; callus hairs 0.5–2.0(–2.5) mm long, one-quarter to one-half length of the spikelet; lower glume densely pilose with 2–5-mm-long hairs on abaxial surface and margins; upper glume sparingly pilose on abaxial surface.

Distribution and habitat: Chongqing, Guizhou, Sichuan and Yunnan, occurring in grassland on mountain slopes at altitudes of 640–3500 m.

Phenology: Flowers and fruits from June to October.

Note: Ibaragi (2003) treated *M. nudipes* and *M. yunanensis* as two subspecies because of the geographical isolation. However, we found that their distribution was overlapping on the basis of our examination of more specimens. Following the current usage of intraspecific ranks, it is more appropriate to accept them as two varieties. In our study of relevant references, descriptions and specimens, we found that it also happens in other taxa of *Miscanthus* that one spikelet has two awns and each lemma has an awn. Therefore, the invalidly published name *Diandranthus aristatus* L.Liu (1997) should not be used.

6. *MISCANTHUS PANICULATUS* (B.S.SUN) S.L.CHEN & RENVOIZE (FIG. 21)

Miscanthus paniculatus (B.S.Sun) S.L.Chen & Renvoize, Kew Bull. 60: 607 (2006). – *Rubimons paniculatus* B. S. Sun, Acta Bot. Yunnan. 19: 239 (1997). *Type*: CHINA. Yunnan: Zhaotong, Sujia, 2700 m, 10.viii.1982, *B. S. Sun 82042* (holotype: YUKU!; isotypes: YUKU [×4]!).

Herbs perennial, tufted. Culms erect, 30–100 cm tall, 3–4 mm in diameter at base, unbranched, smooth, nodes puberulous. Leaves basal and cauline; leaf sheaths striate, glabrous; leaf blades linear, flat, 10–40 cm long, 2–8 mm wide, margins serrulate, base gradually tapering, apex acuminate, abaxial surface sparingly pilose, midrib white, convex on abaxial surface; ligule semicircular, membranous, 0.5–1.5 mm long, margin ciliolate; collar usually pilose. Panicle erect, 5–16 cm long, 1.5–2.0 cm wide; axis 4.5–12.0 cm long, usually glabrous. Racemes 3–8, 2–6 cm long, appressed; rachis glabrous or scabrid; pedicels unequal, glabrous or scabrid, lower one 1–2 mm long, upper one 3–5 mm long. Spikelets lanceolate, 4–6 mm long, 1.0–1.3 mm wide, awned; callus hairs 0.5–2.0 mm, white, one-fifth of the length of the spikelet; glumes membranous, yellow–brown; lower glume lanceolate, shorter than the upper, apex obtuse or emarginate, two-keeled (0–)2–4(–5)-veined between the keels, back scabrous or densely pilose with short hairs, keels hispidulous, apex and margins ciliate; upper glume navicular, as long as the spikelet, apex acuminate (1–)3–5-veined, apex and margins hyaline, scabrous, margins ciliate; lemmas lanceolate, membranous, hyaline, dorsally glabrous; lower lemma 4–5 mm long, apex acuminate or obtuse, 0–5-veined, apex and margins usually ciliate; upper lemma 3.5–5.0 mm long, apex acuminate, margins ciliolate; awn (1–)2–4 mm long, yellow–brown, straight, scaberulous; upper palea lanceolate, 1–2 mm long, membranous, hyaline. Stamens three, anthers 2–3 mm long. Style 2.0–2.5 mm long. Stigmas purple–black, 2.5–3.5 mm long, exserted apically from the spikelet. Caryopsis long-ellipsoidal, 2.0–2.5(–3.0) mm long.

Distribution and habitat: Guizhou, Sichuan and Yunnan (Fig. 12), occurring on mountain slopes, highlands and roadsides at altitudes of 2500–3100 m.

Phenology: Flowers July to August.

ACKNOWLEDGEMENTS

This work was supported by Medel Biotechnology Inc., and Plant Specimen Digitization and Chinese Virtual Herbarium Establishment (grant no. 2005DKA21401). We are grateful to the herbarium keepers of CCNU, E, GH, HIB, HNNU, IFP, KUN, LBG, N, NAS, NAU, NY, PE, US, WH, YAU and YUKU for permission to examine specimens or for

the loan of material. We thank two referees for significant comments and Mrs Ai-Li Li for the drawings.

REFERENCES

Adati S, Shiotani I. 1962. The cytotaxonomy of the genus *Miscanthus* and its phylogenic status. *Bulletin of the Faculty of Agriculture, Mie University* **25:** 1–14.

Bentham G. 1882. Notes on Gramineae. *Journal of the Linnean Society, Botany* **19:** 14–134.

Bor NL. 1953. Notes on Asiatic grasses: XII, new species. *Kew Bulletin* **1953:** 269–276.

Camus A. 1919. Espèces et variétés nouvelles de Graminées de l'Asie orientale. *Bulletin de Museum National d'Histoire Naturelle* **25:** 669–672.

Camus A. 1924. Graminees nouvelles des Comores et de Formose. *Bulletin de Museum National d'Histoire Naturelle* **30:** 513–514.

Chen SF, Dong SS, Wu W, Shi SH, Zhou PH. 2007. Phylogenetics of *Triarrhena* and related genera based on ITS sequence data. *Journal of Wuhan Botanical Research* **25:** 239–244.

Chen SL, Renvoize SA. 2005. A new species and a new combination of *Miscanthus* (Poaceae) from China. *Kew Bulletin* **60:** 605–607.

Chen SL, Renvoize SA. 2006. *Miscanthus* Andersson. In: Wu ZY, Raven PH, eds. *Flora of China*, Vol. 22. Beijing: Science Press; St. Louis, MO: Missouri Botanical Garden Press, 581–583.

Du Rietz GE. 1930. The fundamental units of biological taxonomy. *Svensk Botanisk Tidskrift* **24:** 333–428.

Franchet MA. 1884. *Plantae Davidianae ex Sinarum Imperio*. Paris: G. Masson, Editeur, 327.

Hackel E. 1889. Andropogoneae. *Monographiae Phanerogamarum* **6:** 74–691.

Hackel E. 1904. Supplementa enumerationis graminum Japoniae, Formosae, Coreae. *Bulletin de l'Herbier Boissier* Series 2, **4:** 522–532.

Handel-Mazzetti H. 1936. *Anthophyta*. 7.Vienna: Verlag von Julius Springer, 1306–1307.

Hayata B. 1911. Materials for a flora of Formosa. *Journal of the College of Science, Imperial University of Tokyo* **30:** 1–471.

Heaton E, Voigt T, Long SP. 2004. A quantitative review comparing the yields of two candidate C-4 perennial biomass crops in relation to nitrogen, temperature and water. *Biomass Bioenergy* **27:** 21–30.

Hodkinson TR, Chase MW, Lledó MD, Salamin N, Renvoize SA. 2002b. Phylogenetics of *Miscanthus, Saccharum*, and related genera (Saccharinae, Andropogoneae, Poaceae) based on DNA sequences from ITS nuclear ribosomal DNA and plastid *trnL* intron and *trnL–F* intergenic spacers. *Journal of Plant Research* **115:** 381–392.

Hodkinson TR, Chase MW, Renvoize SA. 2002a. Characterization of a genetic resource collection for *Miscanthus* (Saccharinae, Andropogoneae, Poaceae) using AFLP and ISSR PCR. *Annals of Botany* **89:** 627–636.

Hodkinson TR, Chase MW, Takahashi C, Leitch IJ, Bennett MD, Renvoize SA. 2002c. The use of DNA sequencing (ITS and *trnL-F*), AFLP, and fluorescent in situ hybridization to study allopolyploid *Miscanthus* (Poaceae). *American Journal of Botany* **89:** 279–286.

Hodkinson TR, Renvoize SA. 2001. Nomenclature of *Miscanthus* × *giganteus* (Poaceae). *Kew Bulletin* **56:** 759–760.

Honda M. 1923. Revisio graminum Japoniae III. *The Botanical Magazine* **37:** 113–124.

Honda M. 1930. Monographia Poacearum Japonicarum, bambusoideis exclusis. *Journal of the Faculty of Science, Imperial University of Tokyo, Section III, Botany* **3:** 1–432.

Ibaragi Y. 2003. The taxonomy of Diandranthus (Poaceae). *Acta Phytotaxonomica Geobotanica* **54:** 109–125.

Keng YL. 1939. The gross morphology of Andropogoneae (from the standpoint of taxonomy). *Sinenesia* **10:** 273–343.

Keng YL. 1959. *Flora illustralis plantarum primarum sinicarum–Gramineae*. Beijing: Science Press, 748–755.

Koyama T. 1987. *Grasses of Japan and its neighboring regions, an identification manual*. Tokyo: Kodansha Ltd., 395–404, 517–518.

Lee YN. 1964a. Taxonomic studies on the genus *Miscanthus* (1), new species and varieties. *The Journal of Japanese Botany* **39:** 115–123.

Lee YN. 1964b. Taxonomic studies on the genus *Miscanthus* (II), anatomical patterns of leaves. *The Botanical Magazine* **77:** 122–130.

Lee YN. 1964c. Taxonomic studies on the genus *Miscanthus* (3), relationships among the section, subsection and species, part 1. *The Journal of Japanese Botany* **39:** 196–204.

Lee YN. 1964d. Taxonomic studies on the genus *Miscanthus* (4), relationships among the section, subsection and species, part 2, enumeration of species and varieties. *The Journal of Japanese Botany* **39:** 257–265.

Lee YN. 1964e. Taxonomic studies on the genus *Miscanthus* (5), relationships among the section, subsection and species, part 3, enumeration of species and varieties. *The Journal of Japanese Botany* **39:** 289–298.

Lee YN. 1971. Notes on type specimens of *Miscanthus* in Kew Herbarium. *Korean Journal of Plant Taxonomy* **3:** 17–18.

Liou L. 1987. *Diandranthus*. In: Wu CY, ed. *Flora xizangica*, Vol. V. Beijing: Science Press, 308–315.

Liou L. 1989. Plant resources of Gramineae. 2: 1–67. Unpublished manuscript.

Liu L. 1994. *Diandranthus*. In: The Comprehensive Scientific Expedition to the Qinghai-Xizang Plateau, Chinese Academy of Sciences, eds. *Vascular plants of the Henduan Mountains*, Vol. II. Beijing: Science Press, 2296–2298.

Liu L. 1997. *Miscanthus, Diandranthus, Triarrhena*. In: Chen SL, ed. *Flora reipublicae popularis sinicae*. Vol. 10. Bejing: Science Press, 4–26.

McNeill J, Barrie FR, Burdet HM, Demoulin V, Hawksworth DL, Marhold K, Nicolson DH, Prado J, Silva PC, Skog JE, Wiersema JH, Turland NJ, eds. 2006. *International code of botanical nomenclature (Vienna Code) adopted by the Seventeenth International Botanical Congress Vienna, Austria, July 2005*. Liechtenstein: A. R. G. Gantner Verlag, Ruggell.

Merrill ED. 1910. New or noteworthy Philippine plants, VIII. *The Philippine Journal of Science* **5:** 167–257.

Nakai T. 1917. Notulae ad plantas Japoniae et Coreae XIII. *The Botanical Magazine* **31:** 3–30.

Nakai T. 1950. Classes, ordines, familiae, subfamiliae, tribus, genera nova quae attinent ad plantas Koreanas. (Supplementum). *The Journal of Japanese Botany* **25:** 5–7.

Pilger R. 1940. *Die natürlichen Pflanzenfamilien*, 14e. Leipzig: Verlag von Wilhelm Engelmann, 111–113.

Rendle AB. 1904. Bambuseae. In: Forbes FB, Hemsley WB, eds. An enumeration of all the plants known from China proper, Formosa, Hainan, Corea, the Luchu Archipelago, and the Island of Hong Kong, together with their distribution and synonymy. *Journal of the Linnean Society, Botany* **36:** 448–449.

Renvoize SA. 2003. The genus *Miscanthus*. *The Plantsman* New Series **2:** 207–211.

StatSoft, Inc. 2008. http://www.statsoft.com.cn/index.htm

Sun BX, Wang S. 1997. A new genus in the subtribe Saccharinae (Gramineae). *Acta Botanica Yunnanica* **19:** 239–240.

Xie CZ, Chen DC, Zhang YD, He FC. 1989b. The inflorescence development of *Miscanthus sacchariflorus*. *Journal of Huazhong Agricultural University, Supplement* **1989:** 40–43.

Xie CZ, Zhang YD, Wang ZQ, He FC. 1989a. The species, forma and distribution of *Miscanthus* and *Phragmites* in Hubei Province. *Journal of Huazhong Agricultural University, Supplement* **1989:** 1–7.

Zhong SL. 1982. Five new grass species in Sichuan. *Journal of Southwestern Agricultural College* **1982:** 75–85.

APPENDIX

Collections examined during this revision are listed below in alphabetical order of species.

MISCANTHUS FLORIDULUS

CHINA. Anhui: Anqing, *H. Migô. s. n.* (NAS [×4]); Chaohu, *H. Migo s. n.*(PE); Chizhou, *R. C. Ching 8401* (GH), Gui 7040 (NAS); Guangde, *Anonymous 3307* (NAS [×2]); Guzhen, *P. C. Tsoong 3620* (NAS); Hexian, *K. C. Kuan 75203* (PE [×2]); Huangshan, *T. N. Liou et al. 2148* (PE); Ningguo, *Anonymous 9945* (NAS); Qiangyang, *R. C. Ching 4001* (N), *8401* (US); Qianshan, *C. S. Fan & Y. Y. Li 250* (GH, N); Tongling, *J. S. Yue 3109* (NAS); Wuhu, *H. Migô. s. n.* (NAS [×2]); Xiuning, *Anomymous 2050* (KUN), *28019* (NAS), *29199* (N). **Fujian:** Precise locality not known, *G. Hoo 2291* (PE), *Y. Ling 2405* (PE); Changle, *P. E. Chen 2458* (US); Fuzhou, *H. C. Chen 1017* (US), *H. H. Chung 6481* (NY, WH [×2]), *7470* (NY, WH, US), *J. B. Norton 1165* (US); Jiangle, *Longxishan Exped. 1176* (PE); Jinmen, *T. I. Chuang 4276* (GH); Minhou, *H. H. Chung 2740* (E, N); Nan'an, *Fujian Exped. 2440* (NAS), *2636* (NAS); Nanping, *Anonymous s. n.* (NAS), *G. S. He 902* (N [×2], PE), *L. G. Fu 1201* (NAS); Wuyishan, *H. C. Chow 4163* (WH), *M. Suzuki et al. 98540* (PE); Xiamen, *A. N. Steward 3120* (N, NAS, PE), *H. H. Chung 1702* (E); Yong'an, *Y. Lin s. n.* (PE). **Guangdong:** Precise locality not known, *Levine 1523* (PE), *S. K. Lau 27520* (IBSC, NAS), *W. Y. Chun 6676* (IBSC, NAS); Chonghua, *W. T. Tsang 20593* (IBSC, NAS, NY, PE [×2], US); Dapu, *Anonymous 5203* (NAS [×2]); Gaoyao, *C. Huang 162447* (KUN); Gaozhou, *Y. Tsiang 2439B* (IBSC, N, NAS, NY), *2839A* (NY); Guangzhou, *A. S. Hitchcock 18674* (US [×2]), *19081* (US), *C. O. Levine 954* (US [×3]), *G. P. Du et al. 12306* (NAS, NY, PE, US [×2]), *12450* (US [×2]), *M. Y. Wang 84037* (YUKU [×3]), *Z. N. Feng 885* (N); Heping, *C. F. Wei 120487* (IBSC, KUN, NAS, PE); Heyuan, *W. T. Tsang 28945* (GH); Lechang, *C. L. Tso 20975* (IBSC, NAS, NY); Lianshan, *P. C. Tam 58245* (IBSC, IFP, KUN, NAS, PE); Meixian, *J. L. Gressitt 1337* (E, GH); Nanxiong, *L. Deng 6220* (IBSC, NAS, PE); Xingning, *X. G. Li 201811* (IBSC, PE); Ruyuan, *Guangdong 73 Exped. 304* (IBSC, PE), *Y. G. Liu 589* (PE [×2]); Yangshan, *Fengyan Zeng et al. 997* (IBSC, PE); Yingde, *A. S. Hitchcock 18750* (US), *18766* (US [×2]), *18807* (US [×2]), *18820* (US [×2]), *18846* (US), *18889* (US [×2]), *H. Y. Liang 60957* (US [×2]); Zhaoqing, *G. L. Shi 15482* (GH, IBSC); **Guangxi:** Huangjiang, *Guangxi–Guizhou–Yunnan Exped. 70398* (KUN), *70404* (KUN); Lingui, *Y. B. Xu 10331* (KUN, NAS); Nandan, *X. W. Tian et al. 155* (PE [×2]); Rongshui, *S. H. Chun 16651* (IBSC, KUN [×2], NAS, PE); Tianlin, *X. W. Tian et al. 85* (PE × 2); Rongxian, *A. N. Steward & H. C. Cheo 1108* (GH [×2], NY); Xing'an, *G. Z. Li 15915* (PE); Yangshuo, *M. Y. Wang 84069* (YUKU [×2]). **Guizhou:** Precise locality not known, *Y. Tsiang 6529* (IBSC, NAS, NY), *SW Guizhou Exped. Q7* (PE); Kaili, *S Guizhou Exped. 3468* (KUN, NAS); Libo, *X. Y. Hou 3843* (N); Songtao, *H. Mo 6182* (PE); Tongren, *A. N. Steward et al. 836* (GH [×2], N, PE [×2], US); Wangmo, *Z. H. Hu 78059* (NAS, YUKU); Xishui, *A. N. Steward et al. 796* (GH, N, NY, PE, US); Yinjiang, *Z. P. Jian et al. 30880* (PE [×2]), *31247* (PE), *31248* (PE); Zhenfeng, *Y. Tsiang 4710* (NAS, PE). **Hainan:** Precise locality not known, *F. A. McClure 7807* (US), *S. L. Liou 56* (NAS [×2]), *73* (NAS [×3]); Baoting, *Diaoluoshan Exped. 2396* (IBSC, PE); Chengmai, *C. I. Lei 263* (GH, NAS [×3], NY, PE [×2], US); Dongfang, *X. R. Liang 63613* (NY, PE); Qiongzhong, *Q. Liang 68245* (NAS). **Henan:** Shangcheng, *Pucha Exped. 10212* (PE). **Hong Kong:** *A. S. Hitchcock 18590* (US), *19118* (US [×2]), *Hu & But 20870* (GH), *Paul But 147* (GH), *278* (US), *S.Y. Hu 10063* (GH, PE), *5542* (US), *5543* (GH, US), *7693* (GH, PE), *9301* (PE, US). **Hubei:** Precise locality not known, *Anonymous Sep-82* (CCNU), *Gao 50068* (CCNU), *P. Y. Li 9214*

(KUN), Lichuan, *L. Y. Dai & C. H. Qian 23* (PE); Wuchang, *S. C. Sun 1912* (US, WH); Badong, *Z. W. Wen s. n.* (NAS [×2]); Wuchang, *H. Migô. s. n.* (NAS); Yingshan, *Anonymous s. n.* (NAS); **Hunan:** Changsha, *L. G. Lei 779102* (HNNU); Yuanling, *Wuling Exped. 718* (PE); Jianghua, *B. G. Li & S. B. Wan 870693* (KUN); Lengshuijang, *B. S. Sun et al. 78667* (YUKU [×2]); Ningxiang, *B. M. Yang N-11* (HNNU); Sangzhi, *Beijing Exped. 2939* (PE); Taoyuan, *Y. L. Peng 871107* (HNNU). **Jiangshu:** Changshu, *T. Y. Cheo & T. S. Ching 129* (N); Changzhou, *Anonymous 1499* (NAS), *1499D* (NAS), *1499F* (NAS), *527* (NAS); Dongtai, *F. X. Liu 7377* (NAS); Nanjing, *A. S. Hitchcock 18494* (US), *18459* (US [×2]), *L. Keng 1560* (NAS, PE, US), *T. N. Liou 9150* (PE [×2]); Qidong, *Nanjing University Jia-63* (N); Rudong, *Anonymous 15417* (NAS); Suqian, *T. N. Liou 531* (PE); Suzhou, *H. Migô. s. n.* (NAS); Wuxi, *W. X. Wu 4251* (NAS); Yixing , *D. Y. Xue 1203* (NAU), *F. X. Liu et al. 2251* (PE), *K. Ling 2333* (N), *S. H. Mao 189* (KUN, NAS, PE); Zhenjiang, *Anonymous 33180* (NAS). **Jiangxi:** Chongyi, *M. X. Nie et al. 8584* (KUN), *8906* (KUN); Dayu, *J. S. Yue et al. 1423* (NAS [×2]), *1569* (KUN, NAS [×2], PE); Gaoan, *Y. Tsiang 10458* (NAS [×3]), *10511* (NAS [×3], NY), Jinggangshan, *Nancaochang Exped. 190* (PE); Jiujiang, *A. N. Steward & H. C. Cheo 163* (GH, N), *C. M. Tan 94483* (PE), *X. Z. Sun 661* (NY, WH); Lichuan, *M. X. Nie 2628* (KUN, PE); Nanchang, *H. Migô. s. n.* (NAS); Taihe, *Nancaochang Exped. 146* (PE [×2]. **Shanghai:** *H. Migô. s. n.* (NAS [×6]), *Hance 485* (NY). **Sichuan:** Baxian, *Y. L. Keng 3675* (N); Emeishan, *C. Y. Chiao & C. S. Fan 573* (GH, N), *H. C. Chow 8657* (GH, WH), *X. Y. He 6568* (NAS [×2]); Hongya, *W. P. Fang 8387* (NAS [×2]), *X. Y. He 7008* (NAS [×4]); Kangding, *C.Y. Chiao 2092* (GH, N ×2]); Tianquan, *K. C. Kuan et al. 2307* (PE [×2]), Hanyuan, *T. P. Wang 8705* (PE). **Taiwan:** Precise locality not known, *A. Henry 1173* (NY [×3]), *1689* (US), *1690* (NY), *1691*(NY), *1823* (NY), *1823A* (US), *A. S. Hitchcock 18197* (US [×2]), *K. Odashima 13456* (PE, WH); Nantou, *Robert Ream 535* (US); Xinzhu, *S. Sasaki s. n.* (GH); Taibei, *C. C. Hsu & Kao 168* (GH), *K. Odashima s. n.* (GH, N, NAS [×2], NY, US), *S. Sasaki s. n.* (NAS [×2]). **Yunnan:** Gejiu, *Cao 48* (YUKU); Jinping, *Q. Huang 478* (N); Guangnan, *YNU Wenshan Exped. 1983-83225* (YUKU); Hekou, *Y. X. Feng & Y. Dong 9130* (YUKU [×2]), *K. M. Feng 5321* (NAS [×3], KUN [×3]); Honghe, *B. S. Sun & S. Wang 88121* (YUKU [×3]); Kunming, *F. T. Wang 1261* (N); Lüchun, *Y. M. Shui & W. H. Chen* 13193 (KUN); Menghai, *Anomymous s. n.* (YUKU); Mengla, *C. W. Wang 79962* (GH, PE [×2]), *80538* (GH, KUN); Pingbian, *H. T. Tsai 61973* (GH, KUN, PE), *C. W. Wang 82635* (KUN [×2], PE), *82830* (KUN, PE); Qiubei, *H. Sun 8093* (KUN); Shiping, *Anonymous 330* (YAU), *391* (YAU); Wenshan, *L. Z. Luo s. n.* (YUKU); Xichou, *H. Sun 8095* (KUN), *8096* (KUN), *8103* (KUN). **Zhejiang:** Hangzhou, *A. N. Steward 2543* (US), *512* (N), *E. D. Merrill 1346* (N), *11292* (GH, US), *Oliver 447* (NAS [×2]), *S.Y. Zhang 1109* (PE), *1453* (PE [×2]); Huangyan, *D. X. Zuo 340* (NAS [×2]); Leqing, *D. X. Zuo 644* (NAS [×2]), *850* (NAS [×2]); Lin'an, *X. Y. He 26068* (NAS), *X. Y. He 22369* (NAS, PE), *23563* (NAS [×2]), *23828* (NAS, PE); Longyou, *K. Ling 2808* (N); Ningbo, *Zhejiang Pl. Exped. 28793* (PE); Pingyang, *R. C. Ching 1963* (GH, N, NAS, US); Tiantai, *C. Y. Chiao 1265* (N), *Zhejing Pl. Exped. 28369* (PE); Xiangshan, *C. Y. Chiao 842* (E, N).

Cultivation: CHINA. Hunan: Changsha, *Q. Sun, Y. F. Lu & N. D. Deng 5* (PE), *10* (PE), *13* (PE), *16* (PE), *17* (PE), *24*(PE), *28* (PE), *29* (PE), *32* (PE), *36* (PE), *40* (PE), *42* (PE), *43* (PE), *47* (PE), *48* (PE), *50* (PE), *54* (PE), *91* (PE), *99* (PE), *100* (PE), *106* (PE), *112* (PE), *113* (PE), *114* (PE), *116* (PE), *117* (PE).

Miscanthus nepalensis

CHINA. Chongqing: Nanchuan, *Y. L. Keng & P. C. Keng 3874* (N), *J. H. Xiong & Z. L. Zhou 93057* (HIB, PE). **Gansu:** Wenxian, *Z. Y. Zhang 13942* (PE). **Sichuan:** Baoxing, *K. J. Guan et al. 2585* (PE [×2]), *2998* (PE [×2]), *K. L. Chu 3866* (PE [×3]); Dujiangyan, *D. E. Boufford et al. 24719* (NY); Emeishan, *C. Y. Chiao & C. S. Fan 285* (GH), *H. C. Chow 8202* (GH, US, WH), *K. C. Kuan et al. 1896* (PE [×2]), *W. P. Fang 3192* (E, GH, NY, PE, US); Jinyang, *Anonymous 13476* (PE); Puge, *Sichuan Economic Plant Exped. 5548* (PE [×2]); Songpan, *W. P. Fang 4185* (E, PE). **Xizang:** Cona, *Qinghai-Xizang Vegetation Exped. 2534* (PE); Tingri, *X. X. Wang 783* (N); Nyingchi, *B. S. Li & S. Z. Cheng 1914* (PE [×2]); Mêdog, *H. Sun et al. 932* (KUN), *936* (KUN), *B. S. Li & S. Z. Cheng 1000* (PE [×2]). **Yunnan:** Daguan, *N E Yunnan Exped. 478* (PE, YUKU), Dali, *Anonymous 1134* (PE), *H. C. Wang 1255* (PE), *1449* (PE [×2]); Fugong, *H. T. Tsai 54447* (GH, PE), *56565* (GH, PE, NAS), *58990* (GH, PE [×2]), *P. M. Peterson & Sun Hang 5239* (KUN); Gejiu, *X. L. Wei 25* (YUKU); Gongshan, *Dulongjiang Exped. 1502* (KUN [×2]), *2197* (KUN [×2]), *J. F. Rock 11511* (GH, N, US), *Qinghai-Xizang Exped. 9717* (KUN, PE); Jianchuan, *Jianchuan Exped. 492* (YUKU); Jingdong, *B. Y. Qiu 53425* (PE), *53751* (PE); Kunming, *B. S. Sun et al. 82328* (YUKU [×3]), *M. J. Yang 185* (YUKU [×3]); Lanping, *B. S. Sun 84129* (YUKU [×2]), *84132* (YUKU [×2]), *84137* (YUKU [×3]); Longling, *B. S. Sun & S. Wang 91166* (YUKU [×2]); Lushui, *Nujiang Exped. 1878* (KUN [×2]); Malipo, *Y. Z. Wang et al. 4005* (PE); Tengchong, *B. S. Sun & S. Wang 91057* (YUKU); Weixi, *H. T. Tsai 57963* (GH); Yangbi, *Anomymous 2101* (YUKU); Yongde, *B. S. Sun & Y. C.*

Wang 87307 (YUKU [×2]); Zhenkang, *B. S. Sun & Y. C. Wang 87338* (YUKU [×2]); Zhongdian, *Edinburgh Exped. 451* (KUN, E).

Miscanthus nudipes var. *nudipes*

CHINA. Guizhou: Weining, Y. Z. Liao *et al.* 75441 (NAS). **Sichuan:** Precise locality not known, *Anonymous 4585* (NAS [×2]). **Xizang:** Bomi, *J. S. Ying & D. Y. Hong 650096* (PE [×3]), *650101* (PE [×2]), *650163* (PE [×3]), *650710* (PE [×2]), *P. C. Tsoong 6572* (PE), *T. Naito et al. 1012* (PE [×2]), *Y. T. Zhang & K. Y. Lang 808* (PE [×2]); Zayü, *F. Kingdon-Ward 19328* (GH), *P. C. Tsoong 7043* (PE), *Qinghai Exped. 660* (PE), *664* (PE), *Q. H. Yang 90-2* (YUKU), *Z. C. Ni et al. 283* (PE [×2]); Dinggyê, *Anonymous 3817* (PE [×2]); Nyingchi, *Xizang Plant Exped. 3299* (PE); Mainlin, *P. C. Tsoong 7143* (PE); Mêdog, *H. Sun et al. 332* (KUN), *963* (KUN), *3356* (KUN [×3]), *3497* (KUN), *3498* (KUN), *3880* (KUN), *3889* (KUN), *3890* (KUN [×2]), *3899* (KUN), *3926* (KUN), *3959* (KUN), *3961* (KUN), *3971* (KUN), *3977* (KUN), *4071* (KUN), *4081* (KUN [×2]), *5093* (KUN [×2]), *5115* (KUN [×2]), *5119* (KUN [×2]), *5122* (KUN), *W. L. Chen 10621* (PE [×3]), *14489* (PE); Yadon, *Anonymous 75-970* (PE [×3]), *P. C. Tsoong 6032* (PE [×2]), *7385* (PE), *R. E. Cooper 252* (GH). **Yunnan:** Gongshan, *H. Li 11935* (GH), *Nujiang Exped. 801-0044* (YUKU [×2]), *801-0144* (YUKU); Kunming, *Q. H. Yang 1* (YUKU); Yongsheng, *Y. F. Hang et al. 81-936* (PE).

Miscanthus nudipes var. *yunnanensis*

CHINA. Chongqing: Fengjie, *T. K. Wang & T. S. Wen 66* (GH). **Guizhou:** Guiyang, *Z. Y. Cao 174* (PE [×2]); Panxian, *Nanjing University Exped. 230* (N); Pingba, *Nanjing University Exped s. n.* (N); Xiuwen, *M. T. An 302* (PE); Zunyi, *A. N. Steward et al. 209* (NY, PE), *Sichuan–Guizhou Exped. 980* (PE), *1108* (PE [×2]). **Sichuan:** Baoxing, *K. L. Chu 3069* (NAS, PE [×3]), *S. Y. Hu 1040* (GH); Daofu, *T. S. Ying 9517* (PE [×2]), *S. Jiang & T. S. Ying 2327* (PE); Heishui, *X. Li 73189* (PE); Jinchuan, *X. Li 77901* (PE); Jiulong, *T. S. Ying 4879* (PE); Lixian, *C. He & Z. L. Zhou 14188* (PE), *Z. L. Wu 33505* (N, PE), *33693* (PE); Luding, *K. C. Kuan & W. C. Wang 1769* (PE [×2]; Barkam, *Anonymous 9572* (PE); Maoxian, *C. He & Z. L. Zhou 14188* (N); Muli, *X. W. Tang et al. 61* (PE [×2]), *T. S. Ying 4231* (PE); Puge, *Anonymous 14196* (PE); Tianquan, *S. Y. Hu 975* (GH); Xiangcheng, *D. E. Boufford et al. 28952* (GH, NY), Zhaojue, *Anonymous 12753* (PE). **Yunnan:** Chuxiong, *B. S. Sun et al. 82354* (YUKU [×2]); Funing, *S. Z. Wang 1015* (KUN), *X. G. Zhang 83107* (YUKU [×2]); Guangnan, *Wenshan Exped. 83-220* (YUKU [×2]), *83234* (YUKU [×2]), *83238* (YUKU [×2]), *83239* (YUKU [×2]); Kunming, *B. S. Sun & Y. Dong 90308* (YUKU [×4]; Lijiang, *Hengduanshan Exped. 2686* (PE [×4]), *Jinshajiang Exped. 4575* (N, PE); Luoping, *L. H. Zhou &C. R. Li 87315* (YUKU [×2]); Ninglang, *S. Jiang et al. 6132* (PE [×4]); Weixi, *Hengduanshan Exped. 1375* (PE [×3]), Xichou, *Wenshan Exped. 83-329* (YUKU); Yanshan, *Wenshan Exped. 83-208* (YUKU [×5]); Yiliang, *B. S. Sun 82250* (YUKU [×2]); Yimen, *B. S. Sun & M. Y. Wang 82096* (YUKU [×2]); Zhongdian, *NW Yunnan Exped. 84-184* (YUKU [×2]), *84-649* (YUKU [×2]), *84-656* (YUKU [×2]), *84-727* (YUKU [×2]), *84-791* (YUKU [×2]), *84-798* (YUKU).

Miscanthus paniculatus

CHINA. Guizhou: Hezhang, *Zhao P. et al. 91028* (YUKU). **Yunnan:** Jianchuan, *Forage grass Exped 429* (YUKU [×3]); Zhaotong, *B. S. Sun 82040* (YUNU [×2]), *82042* (YUKU [×4]), *82048* (YUKU [×4]), *82064* (YUKU [×12]), *Forage grass Exped 112* (YUKU [×2]).

Miscanthus sacchariflorus ssp. *sacchariflorus*

CHINA. Provincial locality not known: *U. H. Cowary 225* (US Herb. No. 1061293). **Anhui:** Huangshan, *Y. Zou 01678* (PE), *01683* (PE [×2]), *01684* (PE), *01698* (PE). **Beijing**: *S. S. Chien 9* (PE [×2]), *S. T. Wang 278* (PE, US), *T. N. Liou 966* (N, PE, US), *W. C. Wang et al. 2515* (PE). **Gansu:** Huachi, *C. Hou & P. L. Yang 187* (PE); Tianshui, *Q. X. Li* 1491 (PE); Xifeng, *T. P. Wang* 17562 (PE). **Guizhou:** Liupanshui, *Y. Tsiang 9476* (NAS, NY, PE), Pingba, *Anshun Exped. 1797* (PE). **Hebei:** Neiqiu, *X. Y. Liu 1163* (KUN, HIB, NAS, PE); Tangshan, *P. H. Dorsett & W. J. Morse 7174* (NAS [×2], US), *Y. Liu & G. F. Zhu 40* (PE); Xinglong, *T. N. Liou 4940* (IFP [×3], PE); Yuxian, *H. Smith 1140* (PE); Zanhuang, *X. Y. Liu 922* (PE); Zhuolu, *Anonymous 7145* (PE [×2]), *Y. Liu* 11435 (PE). **Heilongjiang:** Precise locality not known, *Heilongjiang Wild Plant Exped. 1084* (PE); Boli, *Y. L. Chang et al. 2134* (IFP [×7]); Hulin, *G. Z. Wang et al. 465* (IFP [×3], PE); Luobei, *C. S. Wang 47* (IFP), *56* (IFP [×3]), *Y. L. Chang 2091* (IFP [×3]); Mishan, *C. S. Wang s. n.* (IFP [×3]), *G. Z. Wang & Z. H. Zhang 4044* (IFP [×5]), *Z. H. Zhang 3042* (IFP [×5]); Ning'an, *G. S. Zhou et al. 31* (PE [×2]); Raohe, *G. Z. Wang 681* (IFP [×2], PE); Shangzhi, *G. Z. Wang et al. 1656* (IFP [×2]); Sunwu, *A. L. Cui & Z. Q. Lin* 1504 (IFP). **Henan:** Fengqiu, *N Henan Exped. 120* (NAS); Lushi, *J. Q. Fu 861* (IFP, KUN, NAS); Luoning, *Y. B. Gao & C. C. Li* 2 (PE [×3]); Nanzhao, *Henan Provincial Forestry Departmen*t *676* (PE [×2]); Ruyang, *Z. W. Wen 51216* (NAS); Xichuan, *Henan Provincial Forestry Department 1475* (PE [×2]). **Hubei:** Precise locality not known, *A. Henry 7507* (GH), *H. C. Chow 392* (WH), *L.*

Y. Dai 51 (WH), *57* (WH [×2]); Badong, *Q. L. Chen et al. 1867* (PE [×2], WH); Gucheng, *H. C. Chow 3704* (US); Shennongjia, *Shennongjia Exped. 22138* (PE [×2]); Wuchang, *C. Persson 183* (NY), *S. C. Sun 889* (NY, WH, US). **Hunan:** Xinhua, *Handel-Mazzetti 2706* (US); Yongshun, *C. S. Yang 44* (KUN). **Jiangsu:** Baoying, *S.L. Liou s. n.* (NAS [×3]); Danyang, *Y. Ling s. n.* (PE); Jurong, *F. X. Liu 1788* (NAS); Nanjing, *Anonymous 1361* (US), *R. C. Ching 3951* (NAS, PE, US [×2]), *Y. Y. Li 24* (GH, N), *1258* (PE, US), *1978* (US); Sheyang, *Z. R. Yu et al. 5803* (NAS); Suzhou, *H. T. Chang 596* (PE), *1250* (N); Wuxi, *W. X. Wu 9135* (NAS); Yixing, *W. C. Zhou 2826* (US). **Jiangxi:** Xiushui, *C. M. Tan 951203* (E, HIB). **Jilin:** Precise locality not known, *F. H. Chen 451* (GH, NY, PE), *605* (PE); *Antu*, *Yanbian No.1 Exped. 539* (IFP, PE [×2]), *Yanbian No.2 Exped. 217* (IFP, PE), J.Y. Li *415* (IFP), *P. Y. Fu et al. 1043* (IFP [×2]), *1397* (PE [×2]), *T. N. Liou 3779* (IFP [×3], PE); Changbai, *C. F. Fang et al. 3571* (IFP); Helong, *Yanbian No.2 Exped. 1026* (IFP, PE); Huichun, *C. S. Wang et al. 2387* (IFP [×3]); Jilin, *Y. L. Chang & S. X. Li 921* (IFP [×3], PE); Jiaohe, *Y. L. Chou & P. Y. Fu 2305* (IFP [×2]); Tongyu, *Baicheng Exped. 265* (IFP, PE). **Liaoning:** Anshan, *C. Q. Lin & Y. H. Chang 577* (PE); Benxi, *Z. S. Qin 1066* (IFP [×2]); Dalian, *Q. Sun 140* (PE [×2]); Jinzhou, *G. Z. Wang 16* (IFP [×3], PE); Lingyuan, *C. S. Wang et al. 3072* (IFP [×3]); Panjin, *L. Liu 11* (PE [×2]). Pulandian, *Xinjin Exped. 132* (IFP [×2]); Shenyang, *X. D. Cui 760* (IFP), *Y. L. Chang 2631* (IFP); Xifeng, *C. X. Sun et al. 124* (IFP [×3]), *X. C. Jiang et al. 407* (IFP), *429* (IFP [×2]); Zhangwu, *C. C. Chung 55294* (N), *55338* (N). Zhuanghe, *Anonymous 133* (IFP). **Nei Mengol:** Ar Horgin Qi, *P. Y. Fu 4241* (IFP); Horqin Zuoyi Hou Qi, *P. Y. Fu & Y. L. Chou 3205* (IFP); Tongliao, *J. S. Wu 1138* (NAS); Tuquan, *Hulunbeiermeng No. 5 Exped. 370* (IFP); Ongniud Qi, *P. Y. Fu 4265* (IFP), *G. Z. Wang 265* (PE). **Shaanxi:** Hancheng, *K. T. Fu 7940* (PE); Lüeyang, *K. T. Fu 5698* (PE); Pingli, *C. L. Tang 1356* (IFP [×2], KUN); Taibai, *K. S. Hao 4440* (PE [×2]); Xi'an, *F. T. Wang et al. 442* (PE). **Shandong:** Changqing, *C. Y. Guo 055314-6*; Qufu, *B. S. Sun & H. M. Yuan 810528* (YUKU [×2]); Tai'an, *T. Y. Cheo et al. 7048* (PE). **Shanxi:** Huozhou, T. P. Wang 3887 (NAS, PE); Lanxian, *T. Tang 1476* (NAS [×2], PE, US); Pingding, *K. M. Liou 3928* (N, PE, US); Puxian, *T. P. Wang 3783* (PE); Ruicheng, *S. Y. Bao & S. J. Yan 853* (PE [×2]); Tuter, *E. Licent 12833* (GH); Xixian, *T. P. Wang 3598* (PE); Yuanqu, *S. Y. Bao & S. J. Yan 706* (PE [×2]), *2278* (PE [×2]). **Shanghai:** Fengxian, *H. Migô. s. n.* (NAS); Minxing, *H. Migô. s. n.* (NAS). **Zhejiang:** Shipu, *C. Y. Chiao 14142* (PE); Tiantai, *Anonymous 359* (CCNU).

Cultivation: CHINA. Hunan: Changsha, *Q. Sun, Y. F. Lu & N. D. Deng 51* (PE), *52* (PE), *53* (PE), *55* (PE), *57* (PE), *60* (PE), *61* (PE), *62* (PE), *63* (PE), *64* (PE), *65* (PE), *68* (PE), *69* (PE), *70* (PE), *71* (PE), *72* (PE), *73* (PE), *74* (PE), *75* (PE), *76* (PE), *79* (PE).

MISCANTHUS SACCHARIFLORUS SSP. *LUTARIORIPARIUS*

CHINA. **Anhui:** Dangtu, *S. L. Liou et al. 1021* (NAS). **Hubei**: Precise locality not known, *Anonymous* (WH [×2]), *Anonymous* 3704 (WH), *Anonymous* 3961 (WH), *Anonymous* 3975 (WH), *Anonymous* 86125004 (CCNU). **Hunan**: Precise locality not known, PE Herb. Bar Code No. 00718240 (PE), 00718241 (PE), 00718242 (PE), 00718243 (PE), 00718244 (PE), 00718245 (PE), 00718246 (PE), 00718247 (PE), 00718248 (PE), 00718249 (PE), 00718250 (PE), 00718251 (PE), 00718252 (PE), 00718255 (PE), 00718256 (PE), 00718257 (PE); Hanshou, Lake Dongting, in xi.1982, *L. Liu & al. s. n.* (PE Herb. Bar Code No. 00573208); Hanshou, Lake Dongting, alt. 30 m, 15.ix.1989, *L. Liu s. n.* [PE Herb. Bar Code No. 00718205 (PE), 00718206 (PE), 00718207 (PE), 00718208 (PE), 00718209 (PE), 00718210 (PE), 00718211 (PE), 00718212 (PE), 00718213 (PE), 00718214 (PE), 00718215 (PE), 00718216 (PE), 00718217 (PE), 00718218 (PE), 00718219 (PE), 00718220 (PE), 00718221 (PE), 00718222 (PE), 00718223 (PE), 00718224 (PE), 00718225 (PE), 00718226 (PE), 00718228 (PE), 00718229 (PE), 00718230 (PE), 00718231 (PE), 00718232 (PE), 00718233 (PE), 00718234 (PE), 00718235 (PE), 00718236 (PE), 00718237 (PE), 00718238 (PE), 00718239 (PE), 00718258 (PE), 00718259 (PE), 00718260 (PE), 00718261 (PE), 00718262 (PE), 00718263 (PE), 00718265 (PE), 00718266 (PE), 00718267 (PE), 00718268 (PE), 00718269 (PE), 00718270 (PE), 00718271 (PE), 00718272 (PE), 00718274 (PE), 00718275 (PE)]; Changsha, *Handel-Mazzetti 2733* (US); Hanshou, Lake Dongting, 8.x.2007, *Q. Sun & Q. Lin 101* (PE [×3]), *102* (PE [×2]), *103* (PE [×2]), *104* (PE [×2]), *105* (PE [×2]). **Jiangsu:** Baoying, *S. L. Liou et al. 240* (NAS). Wuxi, *Anonymous 22365* (NAS). **Shanghai:** *H. Migô. s. n.* (NAS [×4]).

MISCANTHUS SINENSIS VAR. *PURPURASCENS*

CHINA. Anhui: Huangshan, *M. J. Wang 3523* (NAS, PE [×2]), *W. P. Fang 160* (NAS); Ningguo, *Anonymous 10284* (NAS), *12413* (NAS); Shouxian, *Anonymous 160* (NAS); Xiuning, *Anonymous 26992* (NAS); Xuancheng, *Anonymous 211* (NAS); JinZhai, *Plant Resource Exped. Dao 283* (PE); Qingyang, *S.L. Liou s. n.* (NAS). **Beijing:** Fangshan, *W. Y. Hsia 330* (PE). **Fujian:** Precise locality not known, *Anonymous 282* (PE [×2]); Jianyang, *Wuyishan Exped. 1323* (N); Wuy-

ishan, *M. K. Wang et al. 1719* (NAS [×4]), *Wuyishan Exped. 902* (N); Jiangle, *Longxishan Exped. 2008* (PE). **Guangdong:** Boluo, *C. O. Levine s. n.* (GH); Huiyang, *W. T. Tsang 25621* (GH, N). **Hainan:** Baoting, *Diaoluoshan Exped. 2345* (PE). **Hebei:** Precise locality not known, *Yu 337* (PE); Yuxian, *Anonymous 3103* (PE). **Henan:** Weishi, *J. Q. Fu 619* (NAS); Xinyang, *Carl Persson 3* (NY). **Hong Kong**: *S. Y. Hu 6052* (GH, PE, US), *8161* (GH, PE, US), *A. S. Hitchcock 19698* (US). **Hubei:** Xingshan, *Q. L. Chen et al. 2116* (PE [×2]). **Hunan:** Yongshun, *C. S. Yang 46* (KUN), *H. Li et al. 1454* (KUN [×2]). **Jilin:** Huadian, *Y. Q. Ma 40* (PE); Jiaohe, *Y. L. Chang et al. 974* (IFP [×4], PE); Jiutai, *Y. L. Chou & P. Y. Fu 2014* (IFP [×3]); Linjiang, *S. X. Li et al. 1107* (PE). **Jiangsu:** Lianyungang, *K. Yao 8355* (NAS, NY); Nanjing, *J. J. Gong 215* (NAS); Ganyu, *Anonymous 37351* (NAS), *37547* (NAS), *38108* (NAS), *40041* (NAS), *40613* (NAS), *Anonymous 40659* (NAS). **Jiangxi:** Precise locality not known, *Y. K. Hsiung 5930* (LBG [×2]); Jiujiang, *M. K. Wang 1007* (LBG, NAS [×2]), *Science Exped. Y0064* (PE [×2]); Fu'an, *Jiangxi Exped. 1502* (PE [×2]); Pingxiang, *Jiangxi Exped. 2430* (PE); Suichuan, *J. S. Yue et al. 4173* (NAS [×2], PE); **Liaoning:** Anshan, *Q. Sun 120* (PE), *121* (PE), *123* (PE), *125* (PE), *126* (PE); Benxi, *C. Q. Lin 1201* (PE), *Q. J. Wang 496* (IFP [×2]); Dalian, *Q. Sun 138* (PE), *141* (PE), *143* (PE), *144* (PE), *145* (PE [×3]); Huanren, *C. S. Wang et al. 3865* (IFP [×2], PE), *4040* (IFP), *4042* (NAS, PE), *4048* (IFP), *S. C. Cui et al. 230* (IFP [×2]); Kuandian, *W. Cao et al. 735* (PE); Xifeng, *Y. C. Deng 580* (IFP [×2]), *Y. M. Lin 350* (IFP); Yingkou, *Q. Sun 131* (PE), *134* (PE), *135* (PE), *136* (PE). **Shaanxi :** Huayin, *K. S. Hao 4112* (PE); Lantian, *G. X. Su 550* (PE); Taibai, *T. P. Wang 1642* (PE, US); Yangxian, *K. T. Fu 5241* (PE); Ziyang, *P. Y. Li 6371* (PE). Shanghai, *Anonymous 9536* (NAS). **Shandong:** Qingdao, *H. B. Chen & Y. T. Liang 83* (NAS [×2]); Mouping, *T. N. Liou & K. M. Liou 1483* (NAS, US), *1537* (US); Qixia, *Anonymous 211* (PE); Taian, *Y. C. Wang 464* (PE [×2]); Yantai, *H. B. Chen & Y. T. Liang 145* (NAS). **Shanghai:** *Anonymous 9536* (NAS). Sichuan: Wenchuan, *R. J. Soreng 5339* (KUN). **Taiwan:** Jiayi, *Robert Ream 586* (US); Yilan, M. Tamura, *T. Shimizu & M. T. Kao 20853* (KUN). **Zhejiang**: Linan, *H. Q. Zhu 425* (NAS).

Cultivation: CHINA. Hunan: Changsha, *Q. Sun et al. 9* (PE), *98* (PE).

MISCANTHUS SINENSIS VAR. *SINENSIS*

CHINA. Anhui: Anqing, *H. Migô. s. n.* (NAS); Chouzhou, *G. N. Song 226* (N [×3]); Dongzhi, *C. M. Tan 971208* (PE); Fanchang, *Anonymous 16451* (NAS); Huangshan, *M. J. Wang 3819* (NAS, PE), *S. L. Lu 1* (NAS [×2]), *71* (NAS), *78* (NAS), *W. C. Cheng 4040* (NAS [×2], PE), *Y. Zhou 1551* (PE); Jingde, *Anonymous 12612* (NAS), *13304* (NAS); Ningguo, *Anonymous 12380* (NAS), *12381* (NAS); Qianshan, *B. A. Shen 122* (PE [×2]); Jingxian, *Anonymous 763* (NAS), *801* (NAS); Xiuning, *Anonymous 2050* (NAS [×2], PE); Yuexi, *Plant. Resource Exped. Da-0601* (PE). **Chongqing:** Chengkou, *T. L. Dai 102715* (NAS[×5]), *104333* (NAS[×3]), *104489* (NAS, PE [×2]); Nanchuan, *F. T. Wang 10406* (PE), *Y. L. Keng & B. J. Keng 3895* (N [×2]); Wuxi, *Y. D. Chen et al. 2092* (PE [×2]), *2367* (PE [×2]), *Y. H. Liu 53* (PE); Yongchuan, *Anonymous 217* (PE). **Fujian:** Dehua, *P. C. Tsoong 374* (PE); Fuzhou, *S. G. Tang 5688* (US), *5858* (US), *6599* (N), *7014* (N); Jiangle, *Longxishan Exped. 2153* (PE), *2196* (PE [×2]), *2254* (PE), *2867* (PE [×3]); Jianyang, *Wu 8082403* (N); Liancheng, *Y. Ling 3335* (PE), *3860* (PE), *3989* (PE); Nanjing, *Xiamen University Exped. 1469* (PE); Nanping, *G. S. He 1591* (N [×2]), *9980* (PE); Shaxian, *P. C. Tsoong 558* (PE); Shanghang, *L. K. Ling 7350* (PE), *Y. T. Zhang 82047* (N); Shaowu, *H. C. Chow 4759* (WH), *6494* (WH); Wuyishan, *M. J. Wang et al. 1869* (NAS [×3]), *Wuyishan Exped. 380* (PE), *1050* (PE), *1735* (N); Xiamen, *G. D. Ye 1772* (N, PE), *Zhou & Huang 43* (N). **Gansu:** Huixian, *Z. X. Peng 5010* (PE), *5114* (PE), *Z. Y. Zhang 598* (IFP, KUN, NAS); Kangxian, *Y. S. Lian et al. 96461* (PE), *Z. Y. Zhang 16614* (PE), *16988* (PE); Liangdan, *Z. X. Peng 5911* (PE), *5943* (PE); Wenxian, *Q. X. Li & X. C. Zhao 2286* (PE), *2463* (PE), *Y. C. Hou 1205* (PE); Tianshui, *Q. X. Li 1283* (PE [×2]). **Guangdong:** Boluo, *A. S. Hitchcock 18954* (US [×3]), *C. O. Levine 1432* (GH, US [×2]), *10181* (US), *E. D. Merrill 10777* (GH, US), *10987* (GH, NY), *Levine*, *McClure*, *Ah To 6894* (NAS, US [×2]), *N. K. Chun 41572* (KUN, NAS, PE, US [×2], WH); Guangzhou, *A. S. Hitchcock 18190* (US), *18911* (US), *18916* (US [×2]), *19093* (US [×2]); Huaiji, *W. T. Tsang 22796* (GH); Huiyang, *W. T. Tsang 25989* (E, GH); Lechang, *W. T. Tsang 20750* (GH, NAS [×2], NY, PE [×2], US), *N. K. Chun4 1951* (NAS); Liannan, *P. C. Tam 59550* (IFP, KUN, NAS, PE); Qingyuan, *Y. K. Wang 30084* (US), *30085* (US); Renhua, *L. Deng 7187* (KUN, NAS, PE); Ruyuan, *Guangdong 73 Exped. 485* (PE), *L. Deng 5840* (PE [×2]); Shantou, *J. M. Dalziel s. n.* (E); Shenzhen, *Shenzhen Exped. 462* (PE), *1610* (PE); Xuwen, *Xuwen Exped. 731* (PE), *839* (PE); Yangjiang, *Anonymous 1523* (NAS); Yangshan, *P. C. Tam 60501* (KUN, NAS, PE); Yingde, *Y. K. Wang 30013* (US); Zhaoqing, *K. C. Ting & G. L. Shi 1097* (YUKU), *K. S. Chow et al. 78079* (GH, NY, US). **Guangxi:** Baise, *Baise Exped. 1454* (KUN, NAS, PE); Guilin, *Y. B. Xu 10621* (HIB [×2], KUN [×2], NAS); Lingui, *Guangxi Exped. 3875* (PE [×2]), *3905* (PE), *4072* (PE [×2]), *G. Z. Li 16226* (PE), *16261* (PE); Nanning, *Guangxi Exped. 187* (PE), *R. C. Ching 8204* (NAS [×3], NY, PE); Pingguo, *X. W. Tian et al. 153* (PE [×2]); Longsheng, *R. R. Yang 84317* (PE), *X. W. Tian et al. 188* (PE); Xing'an, *Xing'an*

Exped. 292 (KUN, PE); Yangshuo, *R. H. Shan 498* (PE); Sanjiang, *A. N. Steward & H. C. Cheo 951* (GH [×2], N, [×4], NY); Rongshui, *S. H. Chun 16749* (KUN [×2], NAS, PE); Rongxian, *A. N. Steward & H. C. Cheo 1107* (GH [×2], N, NY), *Z. Y. Wei 40045* (KUN), *41045* (KUN). **Guizhou:** Dejiang, *M. T. An 3894* (PE); Duyun, *X. Y. Hou 1511* (N); Guiyang, *M. T. An 5278* (PE); Jiangkou, *Sino-American Guizhou Exped. 1235* (GH, NY, PE), *C. P. Tsien et al. 32303* (PE [×2]); Kaili, *S. Guizhou Exped. 3468* (PE [×2]); Pu'an, *Anshui Exped. 1629* (KUN, PE [×3]); Qingzhen, *Sichuan–Guizhou Exped. 1643* (PE [×2]); Xingyi, *L. H. Zhou & R. C. Li 87461* (YUKU [×2]); Xishui, *Bijie Exped. 1519* (PE [×3]), 1556 (PE [×2]); Yinjiang, *Sino-American Guizhou Exped. 1698* (GH [×2], PE); Zhenfeng, *S. X. Tan 12* (PE). **Hainan:** Baoting, *Diaoluoshan Exped. 2636* (PE), *F. C. How 73986* (GH, NAS); Danzhou, *F. A. McClure 8119* (US); Ding'an, *Anonymous 68162* (NAS); Qiongzhong, *Hainan Exped. 502* (PE). **Hebei:** Precise locality not known, *P. Licent S. J. 2429* (PE). **Heilongjiang:** Hailin, *X. Y. Hou 11658* (PE), *11658a* (PE); Qiqihar, *X. Y. Hou 10695* (PE). **Henan:** Dengfeng, *Z. W. Wen 51169* (N, NAS); Lingbao, *J. Q. Fu 65* (IFP, KUN, NAS), *174* (KUN, NAS); Lushi, *J. Q. Fu 619* (IFP, KUN), *1021* (IFP, KUN), *1190* (IFP, KUN, NAS), *1515* (KUN), *K. M. Liou 939* (PE); Nanzhao, *Henan Forestry Department Exped. 707* (PE [×2]); Rurang, *Pucha Exped. 22514* (PE), *22700* (PE), *23189* (PE); Shangcheng, *Pucha Exped. 10832* (PE [×2]); Songxian, *K. C. Kuan & T. L. Dai 1917* (PE [×2]), *1937* (KUN, PE [×2]), *Henna Forestry Department Exped. 782* (PE [×2]); Tongbai, *Plant Resource Exped. T0637* (PE [×2]); Xinyang, *A. R. Li et al. 38* (PE); Xinxian, *Plant Resource Exped. D0997* (PE [×4]), *D1187* (PE [×3]), *68* (PE); Yuzhou, *Anonymous 1502* (PE). **Hong Kong:** *A. S. Hitchcock 19119* (US [×2]), *J. P. W. Woo & T. K. Woo 733* (GH), *888* (GH), *Paul But 160* (GH), *S. Y. Hu 6045* (GH, PE), *6088* (GH), *6403* (GH, PE, US), *8394* (GH, US), *8395* (GH, PE, US), *8396* (GH, PE), *8451* (GH), *8900* (GH, PE), *8966* (GH, US), *9301* (GH), *11195* (GH, PE), *11196* (GH, PE), *Y. P. Cheung 1011* (GH). **Hubei:** Badong, *M. Z. Qian 1616* (PE [×2]), *Z. W. Wen 54007* (NAS); Danjiangkou, *J. Q. Xing 16479* (KUN); Gucheng, *H. C. Chow 3339* (US [×2]), *3685* (US); Fangxian, *K. M. Liou 9064* (PE [×2]), *9175* (PE); Hefeng, *Y. M. Wang 6069* (PE); Hong'an, *Anonymous 536* (CCNU); Lichuan, *G. X. Fu & Z. S. Zhang 1834* (KUN, NAS [×2], PE [×3]), *J. Linsley Gressitt 2555* (GH); Shennongjia, *Shennongjia Exped. 11566* (PE [×2]), *21659* (PE [×2]), *22811* (PE [×2]), *24960* (PE), *25325* (PE), *32721* (PE); Wuhan, *S. X. Liu 57* (CCNU), *Z. C. Zhao 62* (WH), *85* (WH), *W. X. Wang 177* (WH); Xianfeng, *Y. M. Wang 6490* (PE); Xingshan, *Q. L. Chen et al. 2116* (N, WH), *S. S. Chien 5509* (N, NAS), *T. P. Wang 11899* (KUN), *11917* (KUN, PE); Xuan'en, *WH Vegetation Exped. 630* (HIB); Zhuxi, *P. Y. Li 9416* (KUN), *11195* (KUN), *Y. Zhen 91-26* (KUN), *91-401* (KUN). Enshi, *D. M. Chen Tian-013* (CCNU). **Hunan:** Baojing, *G. J. Chang 8043* (HNNU), *L. H. Liu 9833* (HNNU, KUN); Changsha, *B. M. Yang 590* (HNNU), *598* (HNNU), *641* (N), *Handel-Mazzetti 2258* (US); Chengbu, *R. R. Yang 84125* (PE [×2]); Cili, *W Hunan Exped. 917* (PE); Guzhang, *Anonymous 821* (HNNU [×2]); Hengyang, *R. H. Shan 498* (NAS); Huaihua, *H. Li & H. Y. Yu 1395* (KUN); Huayuan, *Q. S. Wang 3505* (HIB); Jianghua, *B.G. Li & S. B. Wan 5334* (HNNU, KUN, PE); Jishou, *Q. S. Wang 3861* (HIB); Luxi, *Q. S. Wang 3713* (HIB [×2]); Sangzhi, *H. R. Chen 821* (N); Shaoyang, *L. D. Duan 20020654* (PE); Taoyuan, *Grass Team 25* (PE); Xinning, *L. B. Luo 358* (PE), *L. H. Liu & G. Z. He 15127* (HNNU, KUN, PE), *15532* (KUN, N., NAS, PE); Xupu, *W Hunan Exped. 1* (PE); Yizhang, *L. H. Liu 1043* (HNNU, N, PE); Zhijiang, *Wuling Exped. 1532* (PE), *2071* (PE). **Jilin:** Precise locality not known, *H.W. Kung 2137* (PE); Jiling, *Y. Yabe s. n.* (NAS). **Jiangshu:** Baoying, *S. L. Liou et al. 230* (NAS); Jurong, *M. B. Deng & C. T. Yuan 3534* (NAS); Lianyungang, *C. D. Chen et al. 20828* (PE), *21101* (PE); Liyang, *F. X. Liu et al. 2793* (NAS, PE); Nanjing, *L. Y. Qian 79* (NAU), *P. Z. Ye 653* (NAS), *Y. L. Keng 1927* (NAS, US), *2789* (US); Suzhou, *S. W. Kang 116* (NAS), *17* (NAS); Wuxi, *D. Y. Xue 1158* (NAU), *W. X. Wu 8040* (NAS); Yixing, *W. C. Zhou 2817* (US). **Jiangxi:** Anfu, *Y. K. Hsiung 9032* (LBG); Chongyi, *Science Exped. B135* (PE [×2]); Dexing, *M. X. Nie 5623* (PE); Fenyi, *K. Yao 9491* (NY); Guangchang, *J. S. Yue et al. 2677* (NAS [×2], PE), *C. M. Hu 5414* (KUN, PE); Guangfeng, *M. X. Nie & S. S. Lai 5866* (KUN); Jinggangshan, *J. Xiong 2428* (PE), *S. S. Lai et al. 4687* (KUN, LBG [×2]); Jiujiang, *A. N. Steward 699* (N), *2562* (US [×2]), *A. R. Schindles 317* (E), *H. C. Cheo 388* (N [×3], NAS), *Y. Zou 859* (LBG, NAS [×2]), *1206* (LBG, NAS); Lichuan, *J. M. Wang et al. 2036* (NAS, PE); Longnan, *Anomymous 12192* (HIB); Ningdu, *C. M. Hu 5738* (KUN); Ninggang, *S. S. Lai et al. 5291* (KUN); Pingxiang, *Jiangxi Exped. 2409* (PE); Yanshan, *F. Konta 3111* (GH), *M. X. Nie & S. S. Lai 4214* (KUN); Shangrao, *M. X. Nie & S. S. Lai 4788* (KUN); Shangyou, *Jiangxi Exped. 836* (PE [×2]); Wuning, *C. M. Tan 941157* (PE), *951235* (NAS [×2]); Wuyuan, *R. C. Ching 4488* (N), *8867* (US); Xiushui, *M. X. Nie et al. 140293* (LBG); Yichun, *J. S. Yue 3423* (KUN, NAS [×2], PE); Yongxiu, *Y. K. Hsiung 7408* (LBG); Yushan, *M. X. Nie 6093* (KUN, PE), *6163* (LBG, PE). **Liaoning:** Anshan, *Q. Sun 122* (PE), *127* (PE); Dalian, Jinzhou, *C. Wang et al. 1074* (IFP [×3], KUN [×2], NAS, PE); Huanren, *C. S. Wang et al. 4108* (PE), *4309* (IFP [×3]); Qingyuan, *S. Z. Liu et al. 807* (IFP); Shenyang, *X. Y. Hou 12234* (PE); Xinbin, *X. A. Tian 64* (IFP); Yingkou, *Q. Sun 132* (PE). **Macao:** *A. S. Hitchcock 19685* (US [×2]). **Shaanxi:** Chenggu, *K. T. Fu 5417* (KUN [×3], PE); Fengxian, *Z. Y. Zhang 10*

(KUN, NAS), *88* (IFP [×2], KUN, NAS); Hanzhong, *Y. L. Qiao 280* (PE); Huaxian, *Z. X. Hu & G. X. Su 741* (KUN [×2], PE); Lueyang, *C. L. Tang 1070* (IFP), *J. Q. Fu 1190* (IFP); Meixian, *X. M. Zhang 827* (IFP, KUN, NAS); Mianxian, *K. T. Fu 3867* (PE); Ningshan, *Z. W. Zhang 908* (PE), 989 (PE); Nanzheng, *J. W. Wang & Z. C. Shi 226* (PE); Pingli, *P. Y. Li 9682* (KUN); Shangxian, *B. Z. Guo 4023* (IFP); Taibai, *F. T. Wang et al. 314* (PE), *S. H. Luo 16* (IFP), *T. N. Liou et al. 42* (NAS [×2], PE); Xixiang, *T. N. Liou et al. 4015* (PE), *4025* (PE [×2]); Xunyang, *P. Y. Li 8927* (KUN); Yangxian, *T. N. Liou et al. 3877* (NAS, PE), *3879* (PE [×2]); Zhouzhi, *X. M. Zhang 75* (IFP, KUN); Ziyang, *P. Y. Li 6298* (PE). **Shandong:** Feixian, *T. Y. Cheo & L. Yen 39* (N); Linyi, *T. Y. Cheo et al. 1183* (NAS); Qingdao, *Y. C. Wang 746* (NAS [×2]); Taian, *T. Y. Cheo et al. 7230* (NAS, PE), *7372* (NAS); Yantai, *K. M. Liou 1824* (NAS). **Shanghai:** *D. Argy s. n.* (NY). **Sichuan:** Dujiangyan, *C. L. Wu 33936* (N); Ebian, *T. N. Liou 12630* (PE); Emeishan, *T. N. Liou & C. Wang 829* (PE [×3]), *C. L. Chow 4811* (US), *4911* (GH), *7169* (E); Guangyuan, *P. Y. Li 982* (PE); Jian'ge, *Z. R. Xu 1* (PE [×2]); Kaixian, *T. L. Dai 101778* (PE); Nanping, *C. Y. Wu, 9-806* (KUN [×2]); Wenchuan, *C. H. Chow 1083* (WH), *R. J. Soreng et al. 5339* (PE); Wushan, *E Sichuan Exped. 110263* (NAS, PE). **Taiwan:** Precise locality not known, *K. Odashima 13457* (PE, WH), *R. Kanehira & S. Sasaki 21722* (US); Taibei, *M. Mizushima 7941* (KUN), *N. Fukuyama 4881* (NAS), *S. Saito 7940* (KUN); Xinzhu, *S. Sasaki s. n.* (E). **Yunnan:** Eshan, *Eshan Exped. 499* (KUN); Jianshui, *Lijang 79-Exped. 82919* (YUKU [×2]); Funing, *Wenshan 83-Exped. 83097* (YUKU [×2]); Hekou, *H. Peng & Z. W. Gao 81* (YUKU); Kaiyuan, *S. H. Huang & H. M. Yuan 193* (YUKU [×2]); Luoping, *L. H. Zhou & R. C. Li 87308* (YUKU [×2]), *87310* (YUKU [×2]), *87311* (YUKU [×2]), *87348* (YUKU [×2]), *87353* (YUKU [×2]), *87362* (YUKU [×2]), *87450* (YUKU); Menghai, *C. W. Wang 83228* (KUN, N, PE); Mengla, *C. W. Wang 80104* (NAS); Qiubei, *W. X. Tang s. n.* (YUKU); Shizong, *B. D. Yu et al. 115* (KUN [×2]), *H. Sun et al. 171* (KUN [×2]); Xichou, *H. Sun 8099* (KUN); Yanjin, *NE Yunnan Exped. 1028* (KUN [×2]), *1122* (KUN [×2]); Zhenxiong, *P. H. Yu 1054* (KUN, PE). **Zhejiang:** Cangnan, *Anonymous 24860* (NAS [×2]); Deqing, *T. N. Liou 1985b* (NAS); Hangzhou, *T. N. Liou 2021a* (NAS); Jiangshan, *Y. D. Chen & P. C. Wu 48* (PE); Lin'an, *H. Q. Zhu 887* (NAS [×2]), *X. Y. He 426* (NAS), *26514* (NAS, PE); Linhai, *H. Migô. s. n.* (NAS); Longquan, *D. X. Zuo et al. 22212* (NAS [×2]), *23503* (NAS), *X. Y. He 3170* (NAS [×3]); Taishun, *D. X. Zuo et al. 23685* (NAS [×2]), *23825* (NAS); Tiantai, *C. Y. Chiao 14564* (US), *M. J. Wang et al. 1153* (NAS [×4]).

Cultivation: CHINA. Hunan: Changsha, *Q. Sun, Y. F. Lu & N. D. Deng 1* (PE), *2* (PE), *3* (PE), *4* (PE), *6* (PE), *7*(PE), *8* (PE), *11* (PE), *12* (PE), *14* (PE), *15* (PE), *18* (PE), *19* (PE), *20* (PE), *21* (PE), *22* (PE), *23* (PE), *25* (PE), *26* (PE), *27* (PE), *30* (PE), *31* (PE), *33* (PE), *34* (PE), *35* (PE), *38* (PE), *39* (PE), *41* (PE), *45* (PE), *49* (PE), *77* (PE), *78* (PE), *80* (PE), *81* (PE), *82* (PE), *83* (PE), *84* (PE), *85* (PE), *86* (PE), *87* (PE), *88* (PE), *89* (PE), *90* (PE), *92* (PE), *93* (PE), *94* (PE), *95* (PE), *96* (PE), *97* (PE), *107* (PE), *108* (PE), *109* (PE), *110* (PE), *115* (PE).