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A REVISION OF *PANICUM*
SUBG. *DICHANTHELIUM*
SECT. *DICHANTHELIUM*
(POACEAE: PANICOIDEAE:
PANICEAE) IN
MESOAMERICA, THE
WEST INDIES, AND
SOUTH AMERICA¹

Fernando O. Zuloaga,² Roger P. Ellis,³
and Osvaldo Morrone²

ABSTRACT

A revision of *Panicum* subg. *Dichantherium* sect. *Dichantherium* (Poaceae: Panicoideae: Paniceae) for Mesoamerica, the West Indies, and South America is presented, considering exomorphological, anatomical data and caryological characters. Thirty-seven species and seven varieties of section *Dichantherium* of *Panicum* are recognized from this area. *Panicum caparaoense* is described as a new species, and *Panicum dichotomum* var. *tenuis* as a new combination. An anatomical description of section *Dichantherium*, with photomicrographs of representative species, is given, together with a key, morphological descriptions, and distribution maps. It is concluded that section *Dichantherium* is not sufficiently distinct to be regarded as a separate genus. The taxonomic position of *Dichantherium* within *Panicum* is discussed.

Dichantherium was established by Hitchcock & Chase (1910) as a subgenus of *Panicum* in their treatment of North American species of the genus. *Dichantherium* was delimited due to the presence of an overwintering rosette of short, broad leaves, which produce simple culms with terminal, chasmogamous inflorescences in the spring. Later in the season, branch culms arise at the nodes of the vernal culms, forming loose to rather dense fascicles of reduced leaves and branches together with cleistogamous inflorescences.

Hitchcock & Chase (1910) recognized 17 informal groups in *Dichantherium*, 110 species and 5 subspecies. The taxa were distinguished principally by characters of the spikelet and leaf blade. Gould (1974) raised *Dichantherium* to generic rank. This decision was followed by Clark & Gould (1975), Brown & Smith (1975), Gould & Clark (1978), Clark (1977), Gould (1980), Freckmann (1981a, b), and Hansen & Wunderlin (1988) based on the foliar and floral dimorphism, ploidy level, Kranz syndrome, and ornamentation of the upper antheridium as diagnostic characters for the genus. Pohl

(1980), Lelong (1984), Zuloaga (1987), Webster (1988), and Morrone & Zuloaga (1991), however, retained *Dichantherium* as a subgenus of *Panicum*, due to a lack of adequate characters to support the segregation of these two taxa. Variation in several characters, such as the presence or absence of the basal rosette, and foliar and floral dimorphism in tropical species were not considered by Hitchcock & Chase (1910), Gould (1974), and subsequent authors in their decision to separate *Dichantherium* from *Panicum*.

The present treatment includes a comprehensive taxonomic and anatomical analysis of the 37 species of section *Dichantherium* occurring in Mesoamerica, the West Indies, and South America, which comprise all tropical species of the section.

MATERIALS AND METHODS

Scanning electron micrographs (SEMs) were prepared of the upper antheridia of most of the species, utilizing the procedures described by Soderstrom & Zuloaga (1989). The vouchers for this

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study are marked with an asterisk in the specimens examined section of the taxonomic treatment. Field procedures included collection and drying of herbarium specimens, and immediately fixing leaves, spikelets, and other structures in FAA (formalin-ethanol-acetic acid) (Johansen, 1940) and thereafter transferring this material to 70% ethanol in the laboratory for storage. Transverse sections of leaf blade material 10 μm thick were prepared after desiccation in 30% hydrofluoric acid (Breakwell, 1914), dehydration in a methyl cellosolve series (Feder & O'Brien, 1968), and embedding in Tissue Prep (Fisher Scientific); the sections were stained in safranin and fast green.

Abaxial epidermal scrapes of leaf blades were prepared by removing the mesophyll and vascular tissue with a scalpel and camel hair brush following the method of Metcalfe (1960). The epidermis was stained in safranin.

The standardized terminology of Ellis (1976, 1979) was used to describe the anatomical structure of the leaf blades. The following abbreviations are used in the anatomical description:

- vb/s—vascular bundle/s
- 1'vb/s—first-order vascular bundle/s
- 2'vb/s—second-order vascular bundle/s
- 3'vb/s—third-order vascular bundle/s
- ibs—inner bundle sheath; i.e., mestome sheath
- obs—outer bundle sheath; i.e., parenchyma sheath

MORPHOLOGY

Basal rosette. The rosette is typical of North American species of section *Dichantherium* and is also sometimes present in some West Indian species, *P. scoparium* Lam., *P. aciculare* Desv., and *P. acuminatum* Sw. However, this feature is absent from species from Mesoamerica and South America, as well as from some species that are widespread in both North and South America, such as *P. aciculare*, *P. acuminatum*, and *P. sphaerocarpon* Elliott.

Foliar dimorphism. Leaf size is variable in representatives of section *Dichantherium*. Leaf blades are usually broad and long on the main culms and smaller on the axillary culms in species from North America. However, this dimorphism is absent in species from Mesoamerica and South America. Main and axillary culms are persistent in Mesoamerican and South American species (Morrone & Zuloaga, 1991), while in North American species only the rosette usually persists.

Inflorescences. The inflorescence in section *Dichantherium* is typically a lax, diffuse panicle

borne on the uppermost node of the culm; it is short-exserted to exserted. The axes of the branches are pilose or glabrous; when glabrous they usually have multicellular glands. Each axis ends in a developed spikelet; these spikelets are solitary on the branches, or occasionally geminate in specimens of *P. heboties* Trin. The panicle, although usually open, is contracted in *P. superatum* Hackel and *P. aciculare*.

Glands. Multicellular glands are a characteristic feature of several species of section *Dichantherium*. These glands are present in *P. acuminatum*, *P. sabulorum* var. *polycladum* (E. Ekman) Palacios, *P. sabulorum* var. *cordatum* Zuloaga & Morrone, *P. stigmosum* Trin., *P. adenorachis* Zuloaga & Morrone, *P. sphaerocarpon*, *P. strigosum* Muhlenb., *P. surrectum* Chase ex Zuloaga & Morrone, *P. ensifolium* Elliott, *P. scoparium*, *P. cucaense* Zuloaga & Morrone, *P. divergens* HBK, and *P. laxiflorum* Lam. These glands occur on the axes of the inflorescence branches, peduncles, pedicels, culms, sheaths, and blades.

Spikelets. The spikelets are ellipsoid to obovoid, with two glumes, two florets, and two flowers. They disarticulate at the base of the lower glume. Lower glume length varies from $\frac{1}{4}$ to $\frac{1}{2}$ the length of the spikelet. The upper glume and lower lemma are isomorphic and 7–11(–15)-nerved, or occasionally 5-nerved in *P. sciurotis* Trin. and *P. ensifolium*. The lower floret is either staminate or neuter; the lower palea may be as long as the lemma or reduced to absent in *P. aciculare* and *P. penicillatum* Nees ex Trin. The upper antheridium is almost as long as the spikelet; the upper lemma and palea are indurate, smooth and shining, and pale (but dark in *P. heboties*) with simple papillae regularly distributed over the surface. The upper lemma is shortly apiculate or crested and pilose or glabrous, with the margins involute and covering $\frac{2}{3}$ of the upper palea. The upper palea is 2-nerved. The upper floret is bisexual, with two conduplicate truncate lodicules that embrace the lower margins of the palea, three stamens, and a gynoeceium with two free styles and a plumose stigma.

Floral dimorphism. Hitchcock & Chase (1910) and Gould & Clark (1978) described the presence of both chasmogamous and cleistogamous flowers in the species of *Dichantherium* from North America. Study of herbarium specimens and native and cultivated Mesoamerican and South American plants, including widespread species from both North America and South America, demonstrated that the production of chasmogamous and cleistogamous flowers is extremely variable. Climatic fac-

tors, such as humidity and temperature, appear to determine the proportion of cleistogamous flowers produced.

Cleistogamous flowers also occasionally occur on species of section *Dichantherium* from Mesoamerica and South America.

CHROMOSOME NUMBERS

Section *Dichantherium* is characterized by a basic chromosome number of $x = 9$. Gould & Soderstrom (1967) mentioned one deviation in this character, a count of $2n = 20$, $x = 10$ for *P. missionum* Mez, non Ekman (= *Panicum surrectum* Chase ex Zuloaga & Morrone).

Most of the species are diploid, with $2n = 18$. In addition, six tetraploid counts, one hexaploid count, and one octoploid count are also known.

The following list summarizes chromosome counts determined for species of section *Dichantherium* treated in the present contribution:

- Panicum aciculare* Desv. var. *aciculare*: $2n = 18$ (Brown, 1948; Dubcovsky & Zuloaga, 1992).
- P. aciculare* Desv. var. *arenicoloides* (Ashe) Beetle: $2n = 18$ (Brown, 1948; Gould, 1958; Burton, 1942, as *P. arenicoloides* Ashe; Brown, 1948, as *P. angustifolium* Elliot).
- P. acuminatum* Sw. var. *acuminatum*: $n = 9$ (Davidse & Pohl, 1972a, 1978, as *P. olivaceum* A. Hitchc. & Chase; Spellenberg, 1970, as *P. olivaceum*); $2n = 18$ (Dubcovsky & Zuloaga, 1992).
- P. acuminatum* Sw. var. *longiligulatum* (Nash) Lelong: $2n = 18$ (Brown, 1948, as *P. longiligulatum* Nash and *P. wrightianum* Scribner).
- P. aequivaginatum* Swallen: $2n = 18$ (Dubcovsky & Zuloaga, 1992).
- P. davidsei* Zuloaga & Morrone: $2n = 72$ (Dubcovsky & Zuloaga, 1992).
- P. dichotomum* L.: $2n = 18$ (Brown, 1948; Clark, 1977; Sherif et al., 1983; Brown, 1948, as *P. barbulatum* Michaux, *P. yadkinense* Ashe, and *P. caerulescens* Hackel ex A. Hitchc.).
- P. dichotomum* L. var. *unciphyllum* (Trin.) Zuloaga & Morrone: $2n = 18$ (Brown, 1948, as *P. albomarginatum* Nash).
- P. divergens* HBK.: $2n = 18$ (Burton, 1942; Brown, 1948; Sherif et al., 1983, as *P. commutatum* Schult.).
- P. ensifolium* Baldwin ex Elliott: $2n = 18$ (Brown, 1948; Brown, 1948, as *P. chamaelonche* Trin.).
- P. laxiflorum* Lam.: $2n = 18$ (Brown, 1948; Gould,

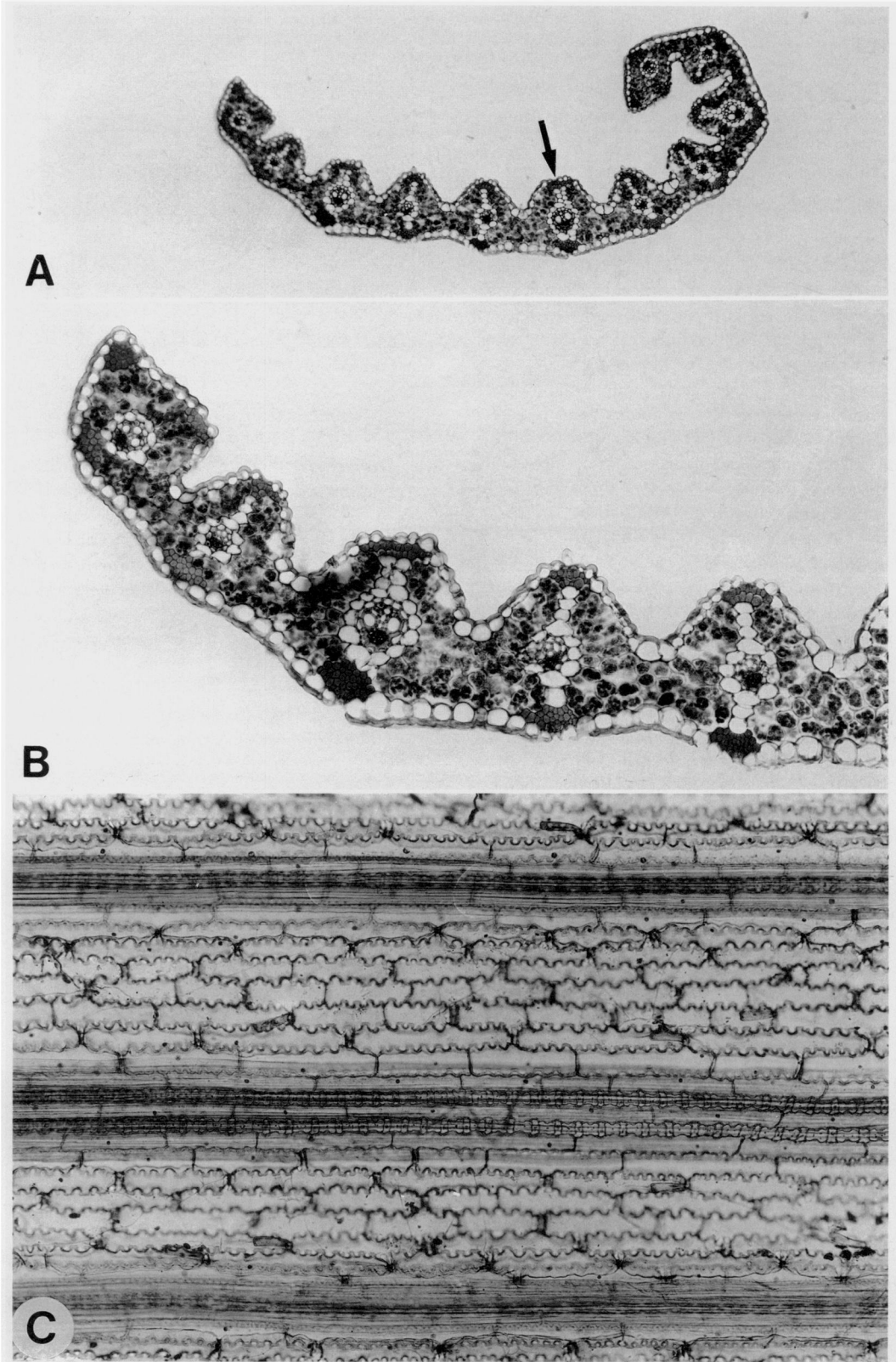
1958; Pohl & Davidse, 1971; Bowden, 1960, as *P. xalapense* Kunth).

- P. portoricense* Desv. ex Ham.: $2n = 18$ (Brown, 1946; Brown, 1948, as *P. lancearium* Trin.).
- P. pycnocladus* Tutin: $2n = 18$ (Dubcovsky & Zuloaga, 1992).
- P. sabulorum* Lam. var. *polycladum* (E. Ekman) Palacios: $2n = 36$ (Parodi, 1946; Núñez, 1952, as *P. sabulorum*; Dubcovsky & Zuloaga, 1992).
- P. sabulorum* Lam. var. *sabulorum*: $2n = 54$ (Dubcovsky & Zuloaga, 1992; Parodi, 1946; Núñez, 1952, as *P. fultum* Hackel).
- P. sciurotoides* Zuloaga & Morrone: $2n = 18$ (Dubcovsky & Zuloaga, 1992).
- P. scoparium* Lam.: $n = 9$ (Davidse & Pohl, 1972b); $2n = 18$ (Brown, 1948).
- P. sphaerocarpon* Elliott: $n = 9$ (Spellenberg, 1970; Davidse & Pohl, 1972a, 1978; Reveal & Spellenberg, 1976); $2n = 18$ (Church, 1929; Brown, 1948; Gould, 1958; Pohl & Davidse, 1971; Reveal & Spellenberg, 1976; Dubcovsky & Zuloaga, 1992; Brown, 1948, as *P. sphaerocarpon* Elliott var. *inflatum* (Scribner & Smith) A. Hitchc.).
- P. strigosum* Muhlenb.: $2n = 18$ (Brown, 1946; Brown, 1948, as *P. ciliatum* Elliott).
- P. viscidellum* Scribner: $n = 18$ (Davidse & Pohl, 1972a, 1974); $2n = 36$ (Pohl & Davidse, 1971; Dubcovsky & Zuloaga, 1992).

LEAF ANATOMY

Anatomical data for 14 species of section *Dichantherium* are presented by means of photomicrographs (Figs. 1–23). The following species were studied: *P. aciculare*, *P. acuminatum*, *P. aequivaginatum*, *P. cumbucana* Renvoize, *P. davidsei*, *P. hebetes*, *P. peristypum* Zuloaga & Morrone, *P. pycnocladus*, *P. sabulorum*, *P. sciurotoides*, *P. sphaerocarpon*, *P. stigmosum*, *P. superatum*, and *P. viscidellum*. For comparative purposes the North American species *P. boscii* Poir., *P. clandestinum* L., and *P. oligoanthos* Schultes are also included in this study. *Panicum acuminatum* is the only species studied anatomically with specimen samples from both American continents. For this species a comparison between the leaf anatomy of the basal rosette leaves and the cauline leaves is also made.

The leaf anatomy of section *Dichantherium* is variable, with few unifying or diagnostic characters being evident; the vascular bundle sheaths and their extensions are the most consistent and valuable anatomical character for distinguishing the section



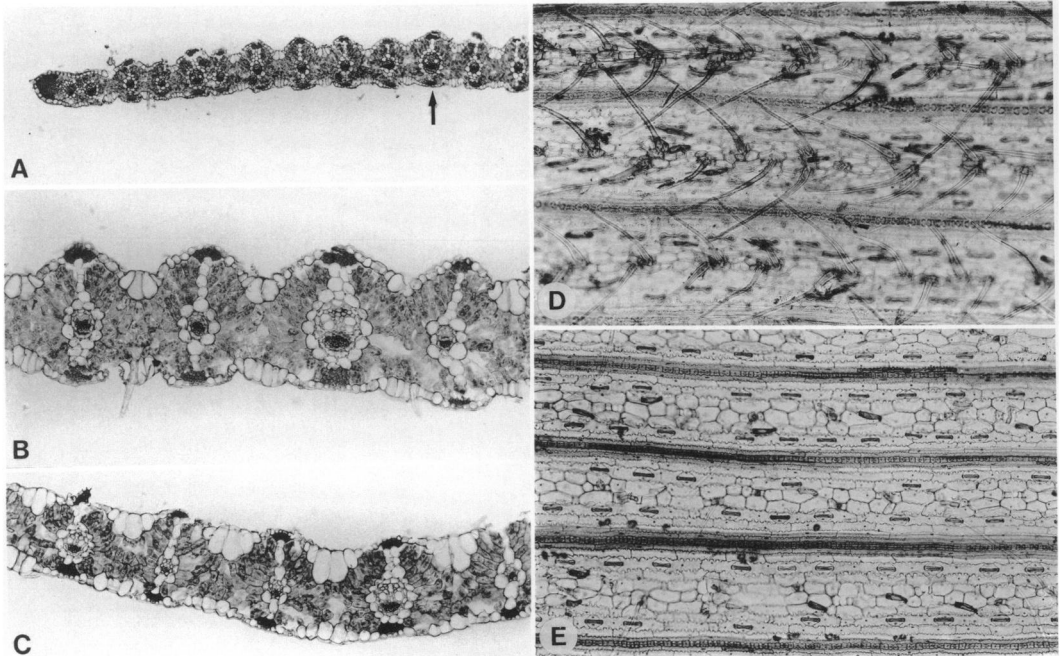


FIGURE 2. Leaf blade anatomy of South American specimens of *Panicum acuminatum*. A–C. Transectional anatomy.—A. Outline of half of lamina showing rounded margin with well-developed sclerenchyma cap and undifferentiated median vascular bundles (arrowed).—B. Detail of semiradiate chlorenchyma, colorless outer bundle sheath and extension cells, uniseriate adaxial and abaxial bundle sheath extensions, and small sclerenchyma strands associated with the third-order vascular bundles and slight adaxial ribs and furrows; note the raised cushion cells associated with the macrohairs, which are very common in the abaxial intercostal zones.—C. Specimen with thinner leaf without ribs and furrows. D, E. Abaxial epidermal structure.—D. Specimen with numerous recurved macrohairs located along the intercostal zones; microhairs also relatively common.—E. Specimen with few macrohairs, these associated with two inflated epidermal cells; the central files of the intercostal zones with bulliformlike long cells (based on Zuloaga 4202; A $\times 100$; B–E $\times 250$).

and subgenus *Dichantherium* from most of the other C_3 subgenera of *Panicum*. A detailed description of section *Dichantherium* based on the studied species is presented below.

LEAF BLADE IN TRANSVERSE SECTION

Outline: expanded, either flat or very broadly V-shaped; arms of lamina either straight or outwardly bowed; two halves of lamina symmetrical about the median vascular bundle; leaf width variable and leaf blade section includes between 17

and 117 vbs; *P. aciculare* (Fig. 1) is an exception with narrow (only 11 vbs), inrolled leaf blades. **Ribs and furrows:** variable, from flat adaxial surfaces without ribs or furrows to medium furrows (about a quarter of the leaf thickness); furrows wide and open, occurring between all vbs; adaxial ribs, when present, located over the vbs, with rounded apices, and all are structurally uniform; abaxial ribs usually absent but slight ribbing may be developed; in *P. aciculare* abaxial ribs are clearly present (Fig. 1B). **Midrib:** variable, from undifferentiated median vb to definite keel; median vbs, structurally indistin-

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FIGURE 1. Leaf blade anatomy of *Panicum aciculare*.—A. Blade outline showing atypical, narrow, slightly inrolled blade containing only three first-order bundles with the central median bundle (arrowed) structurally identical to the lateral first-order bundles.—B. Detail of unusually prominent adaxial ribs and furrows, small, bulliform cells, and thick abaxial cuticle without stomata; translucent parenchymatous sheath and extension cells are present as are adaxial and abaxial sclerenchyma strands; the rather dense mesophyll tissue exhibits no pattern of cellular arrangement.—C. Abaxial epidermis without stomata, the costal zones are five cells wide with cross-shaped silica bodies separated by tall and narrow cork cells, the intercostal long cells are elongated-rectangular with very sinuous walls, and small, narrow microhairs occur in the intercostal zones; macrohairs are absent (based on Zuloaga & Londoño 4201; A $\times 100$; B, C $\times 250$).

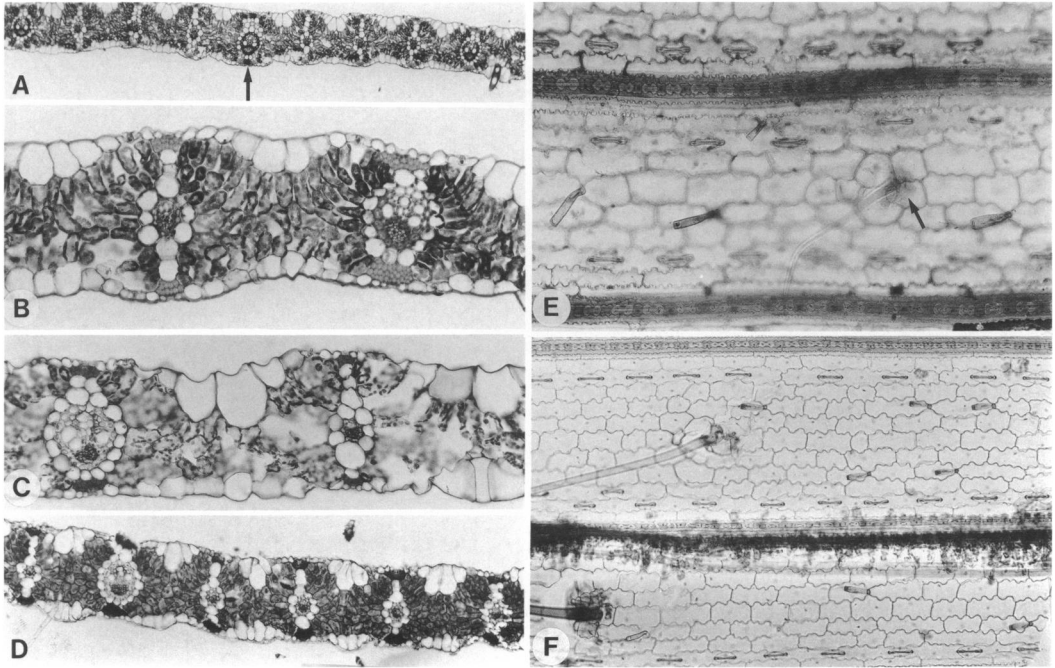


FIGURE 3. Leaf blade anatomy of *Panicum acuminatum* specimens from North America. A–D. Transverse leaf blade sections.—A. Median part of blade with midrib (arrowed) structurally barely distinct from lateral first-order bundles; note cushion-based macrohair; adaxial ribs and furrows not present.—B. Semiradiate chlorenchyma tissue with a tendency to adaxial palisade and abaxial spongy mesophyll tissue; note adaxial and abaxial uniseriate bundle sheath extensions associated with the third-order bundle, the extensions linked to small sclerenchyma strands.—C. Specimen with diffuse chlorenchyma tissue with very large intercellular air spaces and very thin cuticle.—D. Specimen with compact mesophyll tissue; no adaxial ribs or furrows developed. E, F. Abaxial epidermis.—E. Detail of small macrohair with associated cushion base cells (arrowed), elongated fingerlike microhairs (at least twice the length of the stomata), intercostal long cells and numerous stomata in files adjacent to the narrow costal zones.—F. Epidermis of specimen with thin cuticle and diffuse mesophyll; note macrohairs, sinuous walls of long cells, microhairs, stomata, and narrow costal zones, only three cells wide (A, B, E, based on *Davidse & Ellis 30825*; C, F, based on *Davidse & Ellis 30807*; D, based on *Zuloaga 2492*; A $\times 100$; D, F $\times 250$; B, C, E $\times 400$).

guishable from other 1'vbs, most common (Figs. 2A, 5A, 12B, 15C, 16A, 17A, 18A, C, 23A); midribs (Figs. 3A, 11A, 14A, 21A) and keels (Figs. 8A, C, 10A, 22A) much less common; keels include either 1 or 3 abaxially positioned vbs and adaxially located parenchyma ground tissue; no lacunae present.

Vascular bundle arrangement: number of vbs very variable with 3, 5, 7, 9, 11, 13, or 15 1'vbs in entire blade; *P. aciculare*, with 3 (Fig. 1), and *P. sabulorum*, which may have only 5, also have the narrowest leaf blades; 2 (*P. aciculare* and *P. sabulorum*, Fig. 12D), 3, 4, 5, 6, 7, and rarely 8, 3'vbs are located between consecutive lateral 1'vbs; the wider the leaf the more 1'vbs and the more minor bundles are present between the 1'vbs; 2'vbs absent. Vbs usually displaced slightly toward the abaxial side of the blade thickness although they may be centrally situated; all vbs positioned

at the same level. *Vascular bundle description:* 3'vbs angular with phloem distinguishable. 1'vbs elliptical in outline; phloem adjoins ribs; lysigenous cavities and protoxylem present; circular metaxylem vessels narrow with diameters less than half those of the obs cells. *Vascular bundle sheaths:* obs of 1' and 3'vbs conspicuous, entire, round to elliptical, consisting of 5–8 (3'vbs) or 12–18 (1'vbs) inflated, rounded cells; chloroplasts absent except in a few specimens (e.g., *P. sphaerocarpon*, Fig. 15A–D, as well as specimens of *P. viscidellum* with silicified macrohair bases, Fig. 20). Adaxial and abaxial bundle sheath extensions in all species; adaxial 3'vb extensions usually uniseriate (but may be biseriate) and consisting of 1–5 cells, whereas abaxial extensions are shorter (usually only 1 cell deep) and wider; the extensions consist of conspicuous, thin-walled, colorless cells very similar to the obs cells; the extensions extend and join small

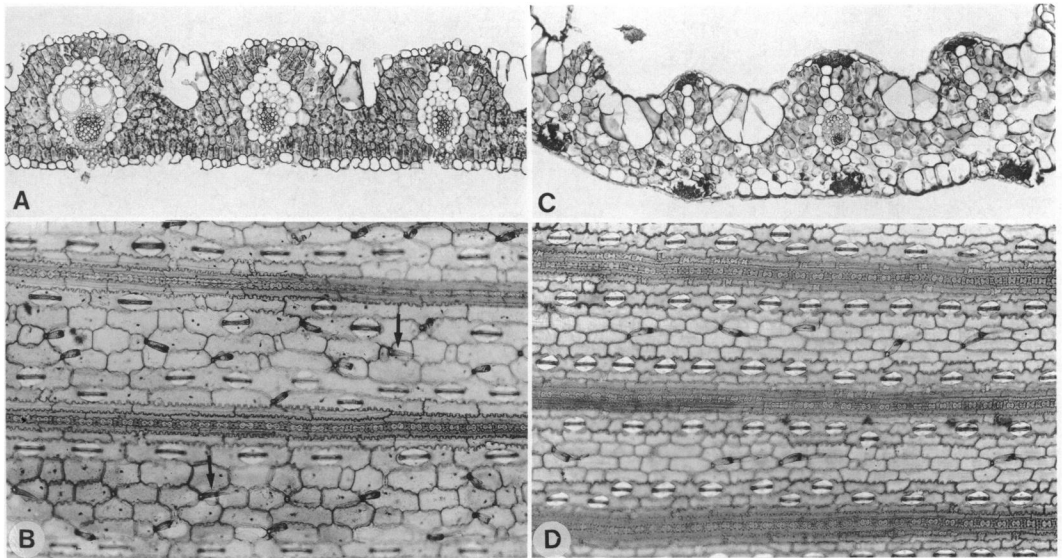


FIGURE 4. A comparison of the leaf blade anatomy of the upper culm leaves and the basal rosette leaves of *Panicum acuminatum*. A, B. Upper culm leaves.—A. Transverse section showing slight adaxial ribs and furrows, distinct bulliform cell groups, and very short bundle sheath extensions; the mesophyll is unusual in that the abaxially located cells are also palisadelike in their arrangement, and the mesophyll tissue is dense, without large intercellular air spaces.—B. Abaxial epidermis with short long cells, short microhairs (less than twice the length of the stomatal complexes) and dumbbell-shaped silica bodies alternating with cross-shaped cork cells on the central files of the costal zones; note the very short macrohairs (arrowed), these barely distinct from hooks except that they are associated with a single inflated epidermal cell. C, D. Basal rosette leaves.—C. Transverse section showing distinct adaxial ribs and furrows, well-developed uniseriate extensions to four cells long and diffuse mesophyll tissue with the abaxial cells resembling spongy mesophyll.—D. Abaxial epidermis with short long cells, microhairs at least twice the length of the stomata, no macrohairs, and with costal zones to five cells wide; the silica bodies are irregular in shape, often resembling the dumbbell type (A–D, based on Zuloaga 2490; A–D $\times 250$).

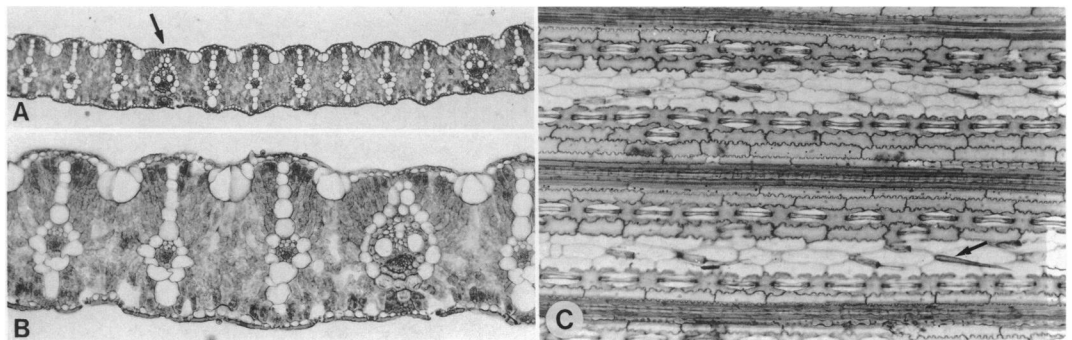


FIGURE 5. Leaf blade anatomy of *Panicum aequivaginum*. A, B. Transectional anatomy.—A. Center of lamina showing median vascular bundle (arrowed) undifferentiated from other first-order vascular bundles.—B. Detail of conspicuous outer bundle sheath and uniseriate extension cells without chloroplasts; the mesophyll separable into spongy and palisade chlorenchyma tissue and the cells are densely arranged; bulliform cells are small and sclerenchyma strands minute.—C. Abaxial epidermis showing clear differentiation between the narrow costal zones with dumbbell-shaped silica bodies and much wider intercostal zones; the latter are differentially stained, the cell files adjacent to the costal zones as well as the interstomatal files staining darkly, the central files staining only slightly; microhairs and few short macrohairs (arrowed) are located along these central interstomatal files; specimens with thicker cuticles (e.g., B) lack these central intercostal files with microhairs and macrohairs (A, B, based on Zuloaga et al. 4470; C, based on Zuloaga et al. 2469; A $\times 100$; B $\times 250$; C $\times 400$).

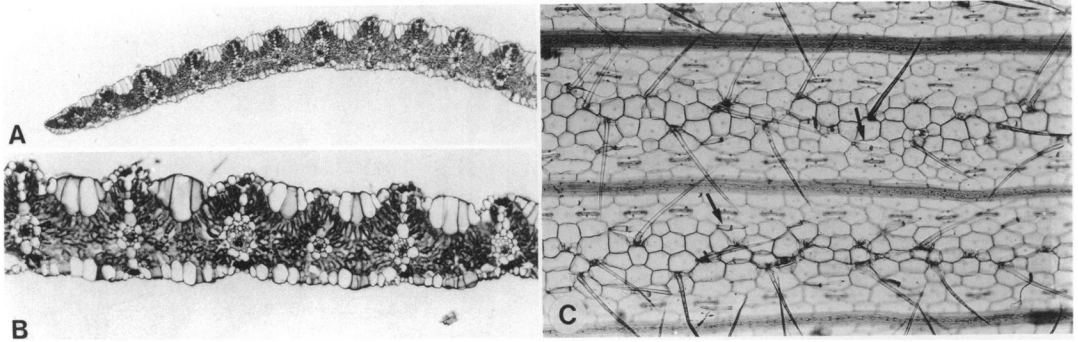


FIGURE 6. Leaf blade anatomy of *Panicum cubucana*. A, B. Transverse leaf sections.—A. Gently tapering margin with evenly spaced vascular bundles.—B. Detail showing bundle sheath extensions, small adaxial and abaxial sclerenchyma strands and rather dense chlorenchyma tissue with a tendency toward the radiate type of cellular arrangement.—C. Abaxial epidermis structure with narrow costal zones only three to five cells wide; silica bodies are dumbbell-shaped to nodular and very narrow; the wide intercostal zones composed of short, hexagonal long cells and microhairs (arrowed) and macrohairs (pointed) are common, the latter being rather short and pointed and inserted between only a few (two to three) specialized epidermal cells, one of which appears to be inflated (A–C, based on Calderón 2425; A $\times 100$; B, C $\times 250$).

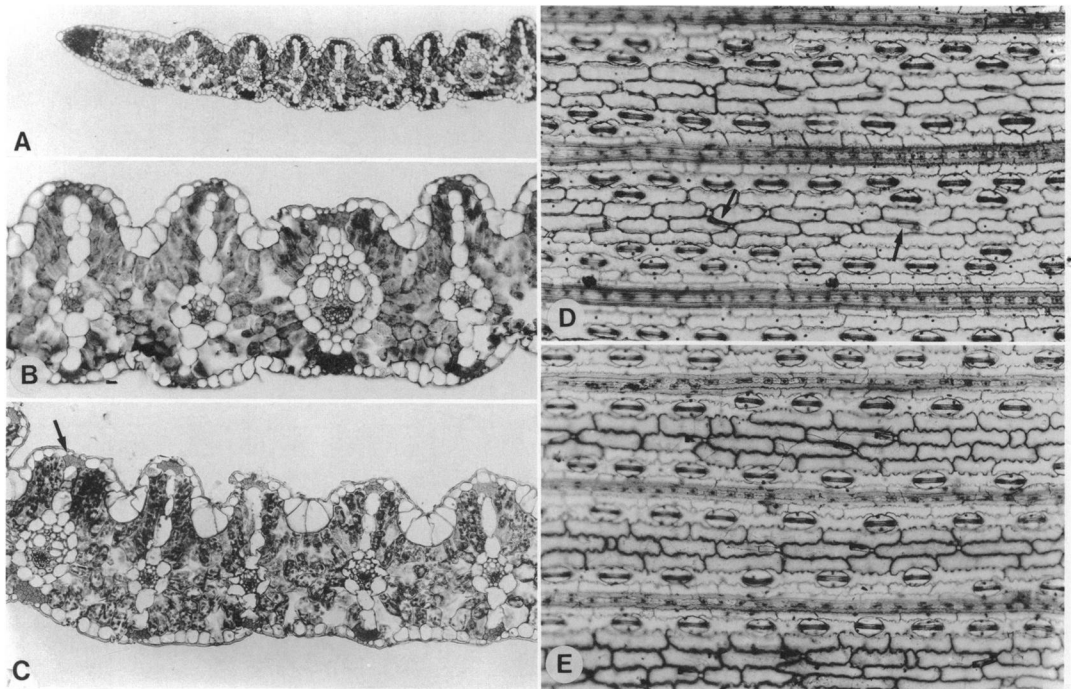


FIGURE 7. Leaf blade anatomy of *Panicum davidsei*. A–C. Transectional anatomy.—A. Gently tapering margin with sclerenchyma cap; adaxial ribs and furrows well developed, slight abaxial furrows present.—B. Long (four or more cells), uniseriate bundle sheath extensions associated with third-order bundles only—first-order bundles with wider extensions (triseriate) but much shorter, consisting of only one cell row; parenchyma sheath and extension cells conspicuous, translucent; the mesophyll approaches the radiate type, particularly the adaxial palisadelike tissue; bulliform cells small; small sclerenchyma strands associated with all bundles, both adaxially and abaxially.—C. Very similar anatomical structure except first-order adaxial bundle sheath extension uniseriate and three cells long (arrowed).—D, E. Abaxial epidermal structure.—D. Interstomatal cells, stomata, and microhairs (arrowed) common but no other epidermal appendages present.—E. No appendages except for microhairs; two stomatal files in each intercostal zone each separated by a short interstomatal cell; costal files of three cell files, the central with alternating dumbbell-like silica bodies and cork cells (A, B, D, based on Zuloaga et al. 4427; C, E, based on Zuloaga et al. 4406; A $\times 100$; B–E $\times 250$).

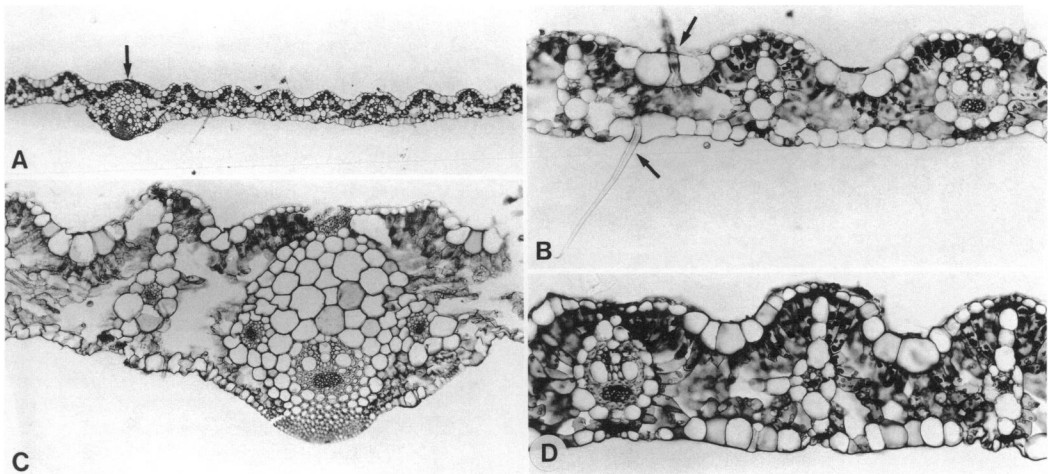


FIGURE 8. Leaf blade anatomy of *Panicum hebotos* as seen in transverse section.—A. Expanded leaf blade with keel (arrowed) incorporating three vascular bundles and adaxial parenchyma.—B. Detail of very short bundle sheath extensions, adaxial ribs, and furrows, and diffuse mesophyll tissue with large intercellular air spaces; note adaxially located chlorenchyma cells with semiradial arrangement; adaxial and abaxial macrohairs (arrowed) present, these without raised cushion cells but inserted between unmodified epidermal cells.—C. Greater detail of keel structure showing one first-order and two third-order vascular bundles embedded in parenchymatous ground tissue.—D. Thicker leaf with longer adaxial bundle sheath extension; these cells clearly evident in the chlorenchyma cells; abaxial epidermal cells large and inflated (A, B, based on Zuloaga et al. 2373; C, based on Zuloaga et al. 4534; D, based on Zuloaga et al. 2390; A $\times 100$; C $\times 250$; B, D $\times 400$).

sclerenchyma strands on both adaxial and abaxial surfaces. Ibs entire, of small cells with uniformly thickened walls.

Sclerenchyma: small, inconspicuous sclerenchyma strands associated with all vbs, both adaxially and abaxially; these strands linked to bundle sheath extensions; fibers lignified; small, rounded sclerenchyma caps located in leaf margins (Figs. 2A, 7A, 15A, 18D).

Mesophyll: chlorenchyma semiradial with adaxial cells tending to a palisade-type of arrangement; abaxially located chlorenchyma cells irregular in shape, diffusely arranged with large intercellular air spaces, resembling spongy mesophyll; walls not invaginated; mesophyll varies from dense to very diffuse, irregular tissue; always more than 5 chlorenchyma cells between consecutive vbs. No colorless tissue apart from the bundle sheath extensions.

Adaxial epidermal cells: bulliform cells present in adaxial furrows between all vbs; usually in restricted groups with larger, fan-shaped central cells; size of bulliform cells very variable. Epidermal cells small, regular in size; no papillae or prickles, but macrohairs may be present.

Abaxial epidermis cells: very narrow costal zones; wide intercostal zones, often with larger, inflated, bulliformlike cells in the central files (e.g., *P. hebotos*, Fig. 8B, D); cuticle often very thin;

no papillae or prickles, but macrohairs either common or absent, either with raised cushion-bases or inserted between unmodified epidermal cells as seen in section.

ABAXIAL EPIDERMIS AS SEEN IN SURFACE VIEW

Intercostal long cells: variable, short-rectangular (Figs. 13F, 16E) to hexagonal, resembling bulliform cells (Fig. 10C, D); side walls parallel or angled outward, end walls vertical, and anticlinal walls either unthickened or slightly thickened; rectangular cells with moderately undulating anticlinal walls but hexagonal cells usually with straight walls; intercostal cell shape variable across intercostal zones, with lateral cells being elongate and rectangular and central files being hexagonal and bulliformlike; no short cells between successive long cells except in *P. aciculare* (Fig. 1C). **Stomata:** absent in *P. aciculare* (Fig. 1C) but otherwise always present; low-triangular to low dome-shaped; two rows of stomata in each intercostal zone, these restricted to the edges adjacent to the costal zones; a single short interstomatal cell present between successive stomata in a file.

Intercostal short cells: absent except in *P. aciculare* (Fig. 1C), where they are tall and narrow. **Papillae:** absent. **Prickles:** absent throughout sam-

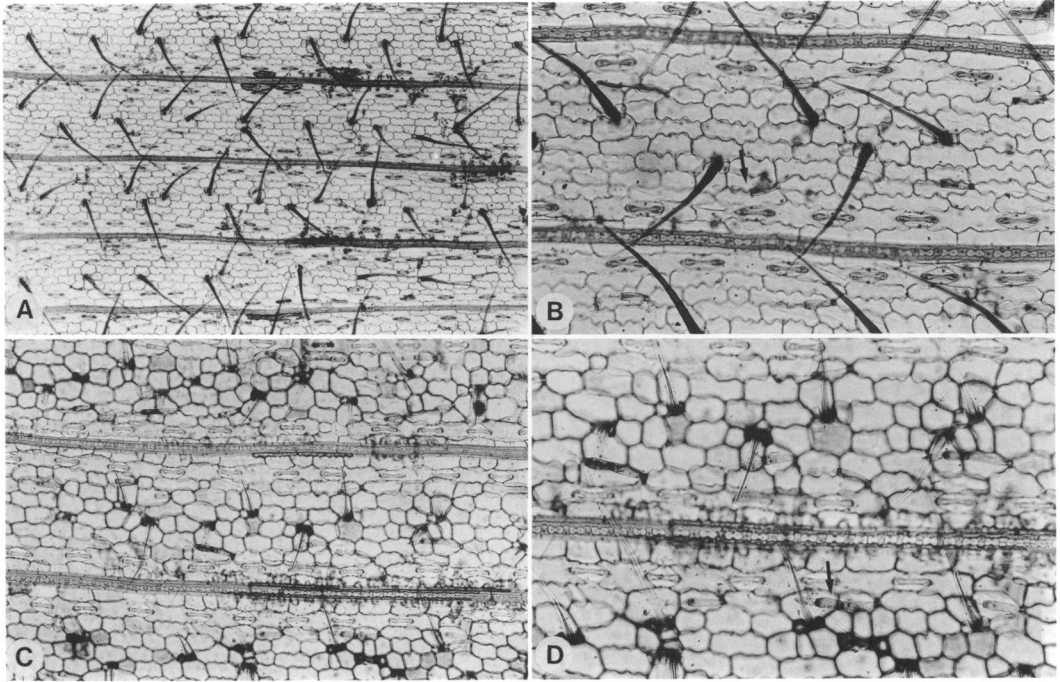


FIGURE 9. Abaxial leaf blade epidermis of *Panicum hebotos*.—A. Epidermal pattern showing marked zonation with very narrow costal zones and wide intercostal zones with numerous macrohairs.—B. Detail of irregular dumbbell-shaped costal silica bodies alternating with short, rectangular cork cells; intercostal long cells short with sinuous walls; macrohair bases associated with two specialized epidermal cells, one of which appears inflated; note that all the microhairs are three-celled (arrowed)—a very unusual configuration.—C. Typical epidermal cellular arrangement of this species; cells associated with the macrohair bases stain darkly.—D. Short intercostal long cells, macrohairs, and stomata; the microhairs (arrowed) all consist of three cells (A, B, based on Zuloaga *et al.* 2373; C, D, based on Zuloaga *et al.* 2390; A $\times 160$; C $\times 250$; B, D $\times 400$).

ple. *Microhairs*: bicellular, fingerlike, with basal cell slightly shorter than distal cell; elongate, equal in length to the stomatal complexes to more than twice their length; distal cell deciduous with very thin walls; common in the central files of the intercostal zones; very rarely absent as in *P. sphaerocarpon* (Fig. 15E, F); *Panicum hebotos* always with unique tricellular microhairs (Fig. 9B, D). *Macrohairs*: either absent or present, variable in structure; two types can be recognized: long, thick hairs inserted into raised cushion-bases (Figs. 11C, 19A–D), and thin, needlelike hairs with only two specialized epidermal cells associated with the base (Figs. 6C, 9A–D, 10C, D); all intermediates occur between these extremes; recurved hairs may occur (Figs. 2D, 14D, E); macrohairs always restricted to intercostal zones; size and frequency very variable. *Silica bodies*: costal bodies irregular in shape, cross-shaped to equidimensional dumbbell-shaped to elongate dumbbell-shaped or even nodular (the latter type only overlying 3'vbs); confined to costal zones where they alternate regularly with similar-shaped or shorter cork cells; only 3 (rarely 5) files

of cells per costal zone, with 1 file with silica bodies. No intercostal silica bodies.

DISCUSSION OF LEAF ANATOMY OF SECTION *DICHANTHELIUM*

Leaf blades in section *Dichantherium* are typically flat, open, expanded, and symmetrical about the midrib. Leaf width is variable, including between 11 and 117 vascular bundles. *Panicum aciculare* differs from all other representatives of the section in having narrow, inrolled blades with only 11 bundles (Fig. 1A, B). This species also differs in several other respects, which may be linked to these narrow leaf blades.

The degree of development of adaxial ribs and furrows varies in section *Dichantherium*, from complete absence to well-developed medium ribs and furrows. The full range of variation found in the section can occur in a single species, as is seen in *P. acuminatum* (Fig. 2B, C). Midrib structure is also variable, ranging from median vascular bundles structurally indistinguishable from the lateral

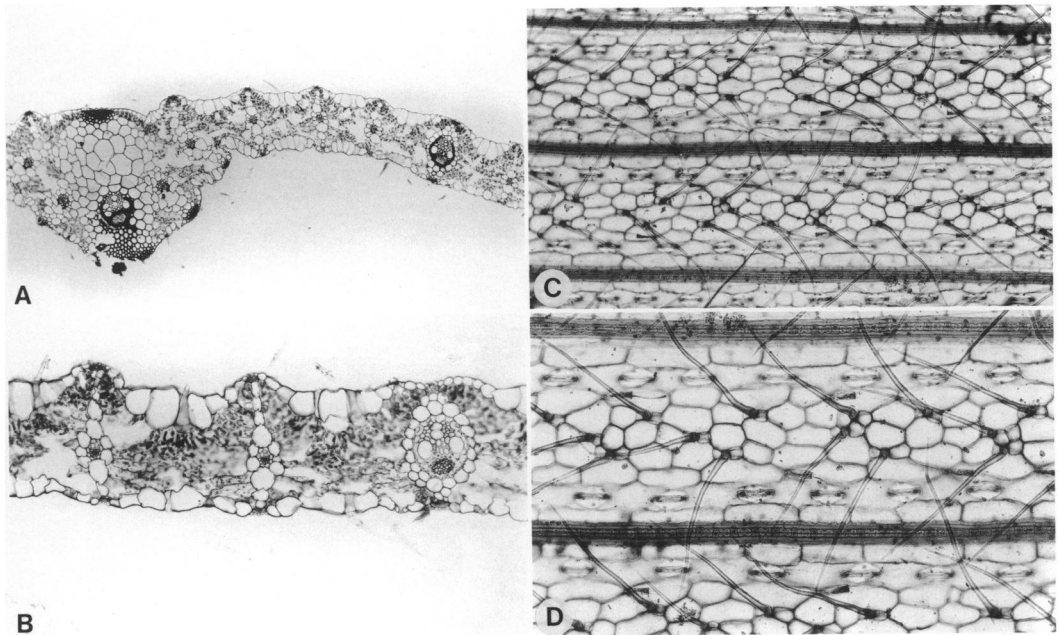


FIGURE 10. Leaf blade anatomy of *Panicum peristypum*. A, B. Anatomy as seen in transverse section.—A. Well-developed keel containing three vascular bundles and adaxial parenchyma ground tissue.—B. Detail of diffuse mesophyll and bundle sheaths and their extensions. C, D. Abaxial epidermis.—C. Epidermal pattern with very narrow costal zones and wide intercostal zones containing numerous macrohairs.—D. Detail of inflated basal cells associated with the macrohairs, bicellular microhairs, stomata, and short, irregularly shaped long cells (A–D, based on Zuloaga et al. 2398; A $\times 100$; B, C $\times 250$; D $\times 400$).

first-order bundles to well-developed keels including up to three vascular bundles and extensive parenchyma ground tissue. Generally, each species is consistent in midrib structure, having either a median bundle, a midrib, or a keel. This is not always consistent, however; for example, all midrib types

were apparent on different leaves of the same plant of *P. peristypum*.

The vascular bundle sheaths and their extensions are the most consistent and valuable anatomical character distinguishing *Dichantherium* from the other C_3 taxa in *Panicum*. Colorless parenchyma

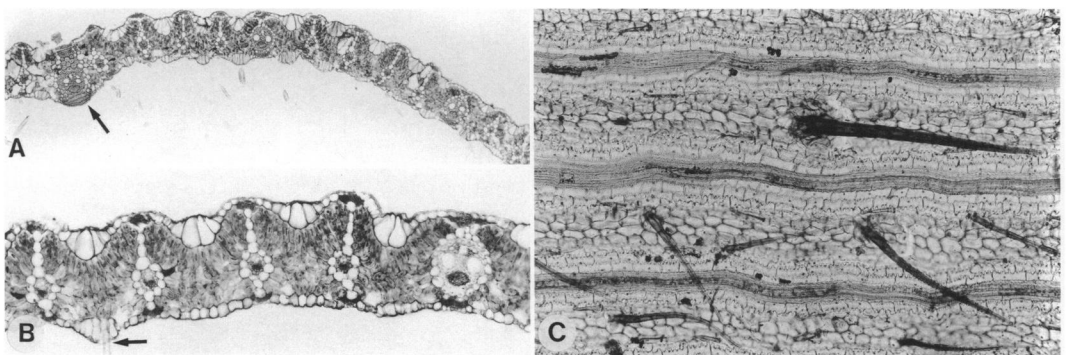


FIGURE 11. Anatomy of *Panicum pycnocladus*. A, B. Transectional anatomy.—A. Midrib (arrowed) comprising a single vascular bundle distinguishable from other first-order bundles by the large adaxial and abaxial sclerenchyma girders.—B. Rather compact mesophyll of the intermediate type with palisade and spongy tissue differentiated; third-order bundles with long uniseriate extensions; note macrohair with base inserted between raised cushion cells (arrowed).—C. Abaxial epidermis with thick macrohairs associated with cushion bases (A–C, based on Zuloaga et al. 4404; A $\times 100$; B, C $\times 250$).

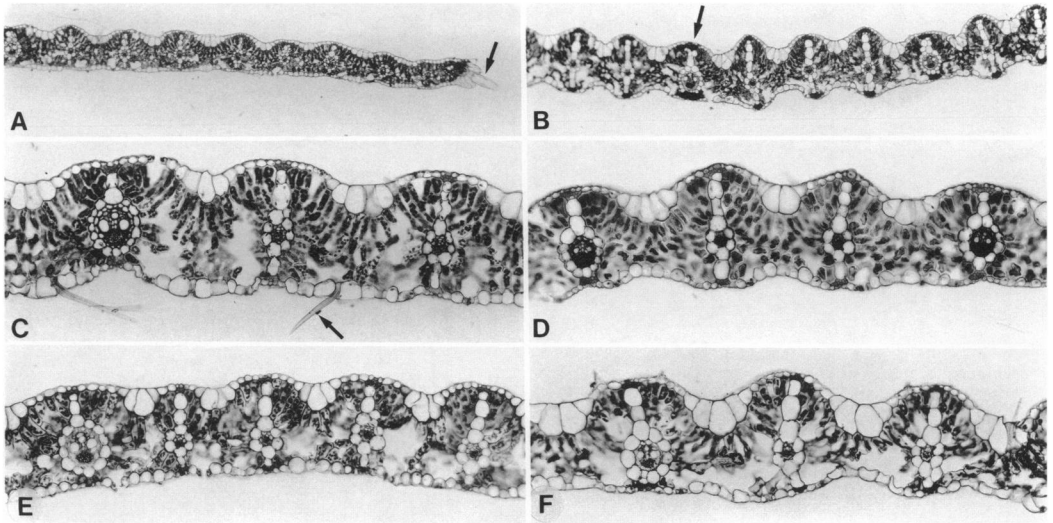


FIGURE 12. Leaf blade anatomy of *Panicum sabulorum* in transverse section.—A. Expanded blade showing margin with base of thick, cushion-based macrohair (arrowed).—B. Center of lamina with median vascular bundle (arrowed) indistinguishable from lateral first-order bundles.—C. Detail of diffuse mesophyll tending to the radiate type of arrangement; note short bundle sheath extensions and macrohairs without cushion bases (arrowed).—D. Denser mesophyll tissue with conspicuous outer bundle sheath and extension cells and small but discrete bulliform fans located in the troughs of the shallow adaxial furrows.—E. Typical anatomy of this species except that no macrohairs are present.—F. Well-developed bundle sheath extensions and very diffuse mesophyll (A, C, based on Zuloaga 2060; B, based on Zuloaga 1972; D, based on Zuloaga 2128; E, based on Zuloaga 2380; F, based on Zuloaga 2352; A, B $\times 100$; C–F $\times 250$).

sheath and extension cells are present in all taxa studied. *Panicum sphaerocarpon* (Fig. 15A–D) is an exception, as unspecialized chloroplasts appear to occur in the outer sheath and extension cells. In a few specimens of *P. viscidellum* (Fig. 20A–D), plastidlike structures are also evident in these tissues, but these appear to be found primarily in older, senescing leaves. Nevertheless, all specimens of section *Dichantherium* examined had bundle sheath extensions, the length correlated with the thickness of the leaf blade. Section *Cordovensia* of subgenus *Dichantherium* also has prominent adaxial bundle sheath extensions. Extensions are thus diagnostic for subgenus *Dichantherium*, but occur sporadically in the other C_3 subgenus of *Panicum*, *Phanopyrum* (Raf.) Pilger, where they are found in section *Lorea* Zuloaga (*P. chnoodes* Trin. and *P. trinii* Kunth), and often in species of sections *Parvifolia* (A. Hitchc. & Chase) Pilger, *Stolonifera* (A. Hitchc. & Chase) Pilger, and *Megista* Pilger. Sections *Laxa* (A. Hitchc. & Chase) Pilger, *Parviglumia* (A. Hitchc. & Chase) Pilger, and *Phanopyrum* of subgenus *Phanopyrum* are without bundle sheath extensions, as is the intermediate C_3/C_4 subgenus *Steinchisma* (Raf.) Zuloaga.

The mesophyll tissue, together with the absence

of specialized chloroplasts in the bundle sheath cells, indicates that section *Dichantherium* is non-Kranz throughout. More than five chlorenchymatous mesophyll cells are always found between successive vascular bundles, implying that many chlorenchyma cells are more than two cells removed from the nearest bundle sheath cell. These parameters have been shown to predict reliably the photosynthetic pathway in grasses (Hattersley & Watson, 1975), and section *Dichantherium* is consequently considered to be entirely C_3 . This has been confirmed by Brown (1977) for 73 species of *Dichantherium*.

The mesophyll tissue of section *Dichantherium* is also of interest in that the chlorenchyma tissue does not display the irregular pattern of cellular arrangement that is normally associated with non-Kranz leaf anatomy. Instead, it is semiradiate, with the adaxially located cells palisadelike and the abaxial cells resembling spongy mesophyll tissue. This anatomy is clearly distinguishable from that of the pooid C_3 grasses, but most C_3 panicoids also have mesophyll of this type. *Panicum sphaerocarpon* (Fig. 15B) is unusual in that the adaxial chlorenchyma cells are also interspaced with intercellular air spaces, although a semiradiate arrangement is still evident.

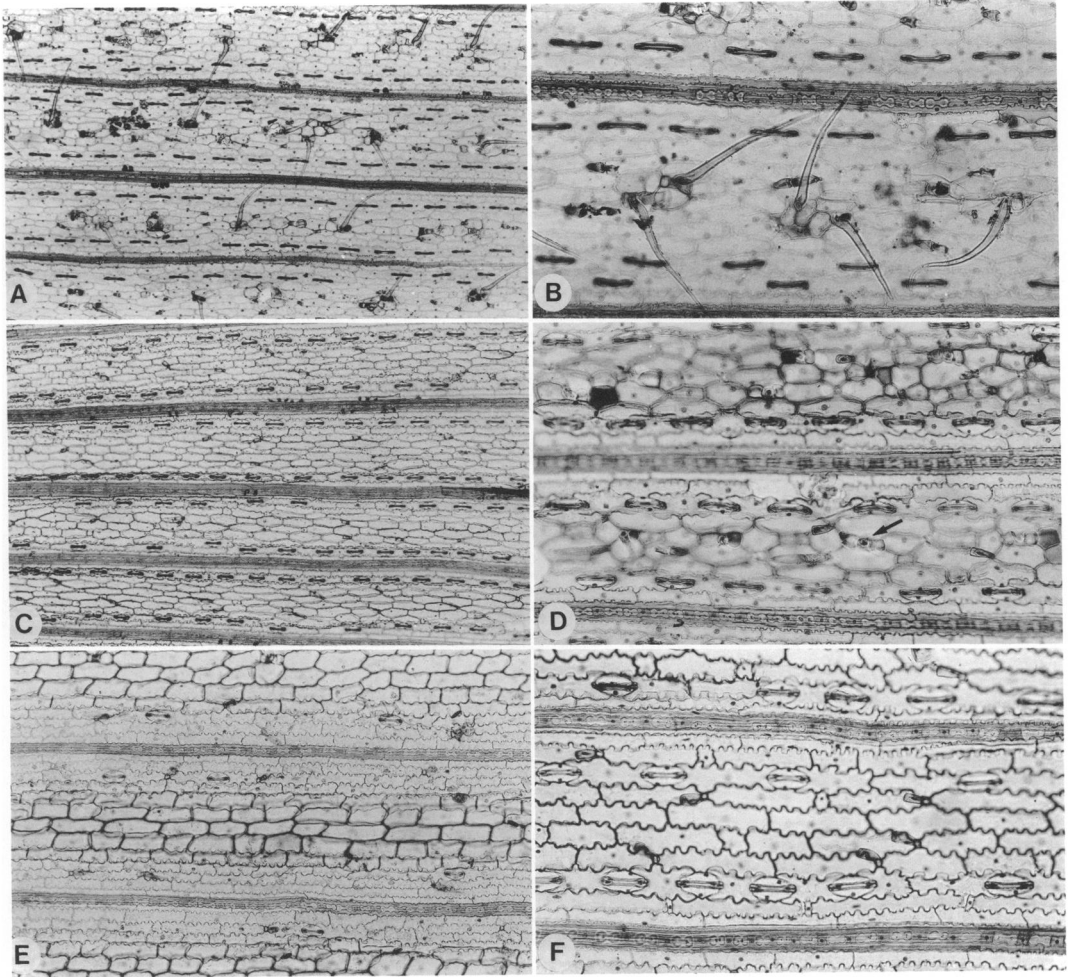


FIGURE 13. Abaxial epidermis of *Panicum sabulorum*.—A. Epidermal pattern with short macrohairs restricted to the center of the intercostal zones; note numerous stomata in two files immediately adjacent to the costal zones.—B. Detail of macrohair bases and few associated epidermal cells, irregular arrangement of dumbbell-like silica bodies in costal zones, and short bicellular microhairs.—C. Specimen without abaxial macrohairs and somewhat wider costal zones (but still consisting of three cell files).—D. Specimen without macrohairs, but note pairs of inflated epidermal cells indicative of deciduous macrohair bases (arrowed); the microhairs are clearly visible, particularly the basal cell.—E. Specimen in which the intercostal zones can be subdivided into two areas: those adjacent to the costal zones with sinuous-walled long cells, few stomata, and few microhairs, and the centrally located files which are bulliformlike; a few small macrohairs were observed in these central files.—F. Intercostal zones with rectangular, sinuous-walled long cells throughout, stomata in two separate files near the costal zones and bicellular microhairs common along the central cell files (A, B, based on Zuloaga 2060; C, based on Zuloaga 1972; D, based on Zuloaga 2128; E, based on Zuloaga 2352; F, based on Zuloaga 2380; A, C $\times 160$; E $\times 250$; B, D, F $\times 400$).

Panicum hebotos is unique in section *Dichantheium* in having three-celled microhairs (Fig. 9B, D). Multicellular microhairs are rare in the Poaceae, where they have only been reported for the Guaduelleae, a primitive bambusoid tribe (Soderstrom & Ellis, 1987), lodicules of *Streptogyna crinita* (Soderstrom & Judziewicz, 1988), a few species of *Pentachistis* from the Arundinoideae (Ellis & Linder, 1991), *Paspalum* L. (Türpe, 1966)

and *Panicum validum* Mez (Zuloaga et al., 1989) of the Panicoideae.

Multicellular glands are present in the abaxial intercostal zones of the epidermis of *P. adenorachis* (Morrone & Zuloaga, 1991).

CONCLUSIONS

This study of species of *Dichantheium* from Mexico and the West Indies to Argentina dem-

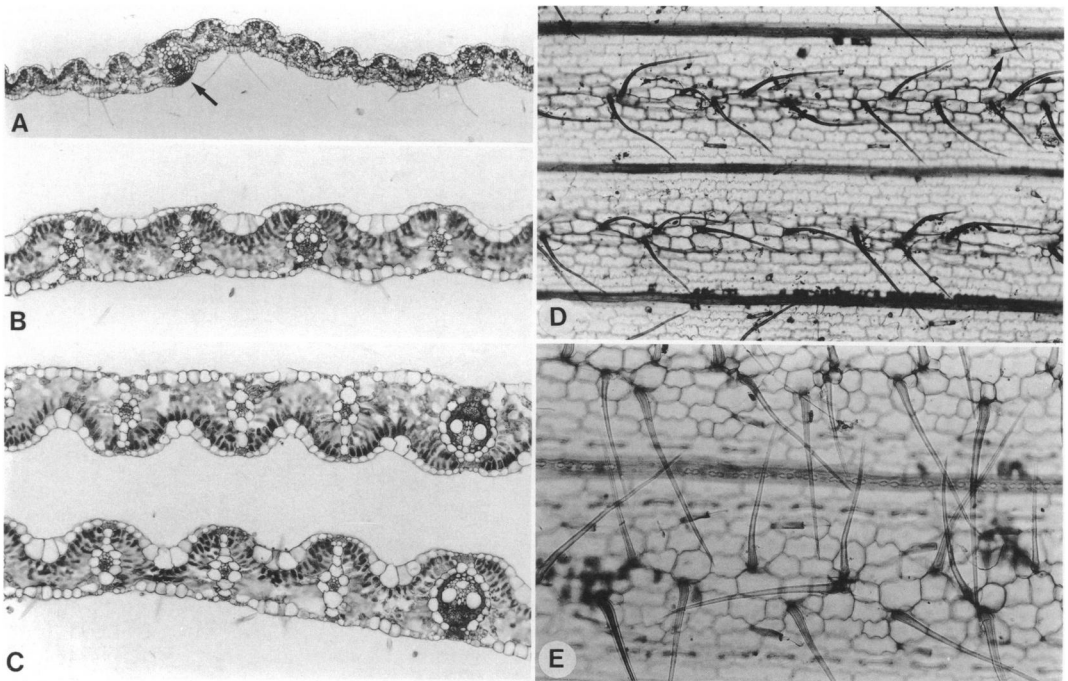


FIGURE 14. Leaf blade anatomy of *Panicum sciurotoides*. A-C. Anatomy in transverse section.—A. Central lamina showing keel with additional sclerenchyma and parenchyma development (arrowed); note macrohairs.—B. Thin blade with palisade and spongy mesophyll tissue distinguishable; bundle sheath extensions very short.—C. Thin lamina with extensive intercellular air spaces in the spongy mesophyll tissue; bundle sheath extensions visible in association with the third-order bundles. D, E. Abaxial epidermis.—D. Curved macrohairs without cushion bases common along central files of intercostal zones, these files with bulliformlike cells; lateral files of intercostal zones with rectangular long cells with sinuous walls; elongate, fingerlike microhairs occur along these files (arrowed); stomata absent.—E. Detail of macrohairs and their bases, microhairs, and long cells, which are very short and irregular in shape (A, B, D, based on Zuloaga *et al.* 2349; C, E, based on Zuloaga *et al.* 2354; A $\times 100$; B, C, D $\times 250$; E $\times 400$).

onstrates that there are insufficient differences to justify separation of *Dichantherium* from *Panicum* as a distinct genus. The data presented also show a significant variation in the characters traditionally used to separate these taxa at the generic level. The rosettes and foliar and floral dimorphism are traditionally used to delimit *Dichantherium* as a genus, but are only characteristic of species with a boreal distribution, and are absent in the rest of the species of the subgenus (Morrone & Zuloaga, 1991). This even applies to widespread species of *Dichantherium* distributed from the United States to northern South America. Morrone & Zuloaga (1991) suggested that these characters could represent an evolutionary adaptation to harsh winters.

Gould & Clark (1978) noted that *Dichantherium* includes mostly diploid species, with only three known polyploids. They contrasted this with *Panicum*, in which polyploid species predominate. Dubcovsky & Zuloaga (1992) confirmed the presence of additional polyploid species, including tetraploids

and octoploids, in *Dichantherium* representatives from South America. Consequently, differences in the ploidy level between *Dichantherium* and other subgenera of *Panicum* are considered to be taxonomically insignificant.

Brown & Smith (1975) and Gould & Clark (1978) justified the separation of *Dichantherium* from *Panicum* on the basis of the Kranz syndrome. These authors characterized *Dichantherium* as C_3 or non-Kranz and *Panicum* as C_4 or Kranz. However, many non-Kranz species of *Panicum* are placed in subgenus *Phanopyrum* (Zuloaga, 1987), so this distinction does not seem useful in separating *Dichantherium*. There are also no consistent differences in the ornamentation of the upper antherium between *Dichantherium* and other groups of *Panicum* (Zuloaga, 1987). This difference was used by Gould & Clark (1978) to distinguish *Dichantherium* from *Panicum*.

Within *Panicum*, *Dichantherium* can be distinguished at the subgeneric level by the following set

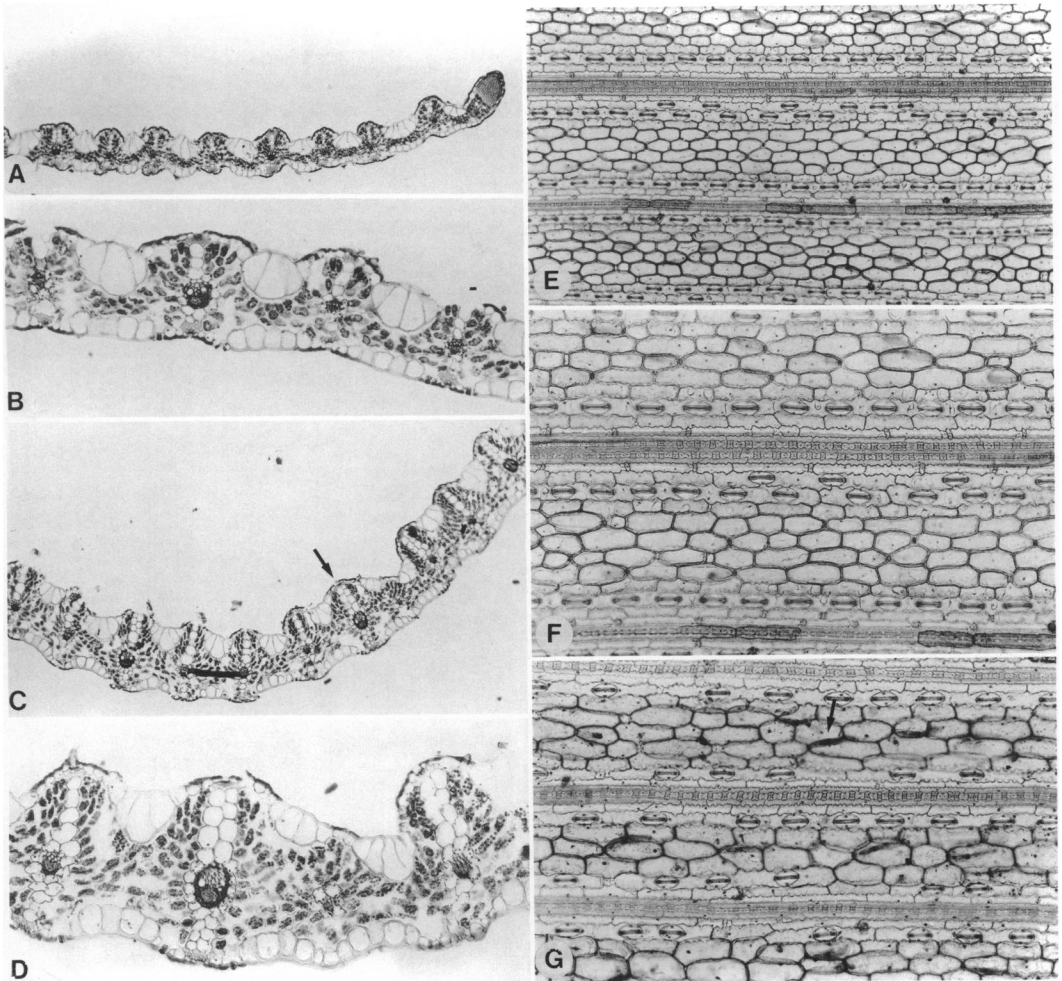


FIGURE 15. Anatomy of *Panicum sphaerocarpon*. A–D. Transectional anatomy.—A. Lateral part of expanded lamina with sclerenchyma cap in margin.—B. Detail showing large, restricted bulliform cells; note uniseriate bundle sheath extensions and thick cuticle.—C. Central part of lamina with median vascular bundle indistinguishable from other first-order bundles (arrowed); note transverse vein connecting two third-order bundles.—D. Bundle sheath extensions unusual in being biseriate (but may be uniseriate); mesophyll characteristic in that spongy and palisade tissue are not differentiated. E–G. Abaxial epidermis.—E. Epidermal pattern showing absence of macrohairs, short intercostal long cells, and two files of stomata per intercostal zone.—F. Costal zones of five cell files, two with dumbbell-shaped silica bodies; intercostal long cells with thickened periclinal cell walls, particularly the bulliformlike centrally located cells; lateral long cells more rectangular in shape with files of stomata; no microhairs evident.—G. Bicellular microhairs present in the central files of the intercostal zones (A, B, G, based on Zuloaga 4035; C, D, E, F, based on Zuloaga 4249; A, C $\times 100$; E $\times 160$; B, D, F, G $\times 250$).

of characters: lax inflorescences; ellipsoid to obovoid spikelets; upper glume and lower lemma usually 7–11-nerved; upper antherium apiculate or shortly crested, and simple papillae on the lemma and palea. Anatomically, all species are non-Kranz or C_3 , with the outer parenchymatous sheath lacking specialized chloroplasts; a complete inner mesotome sheath surrounds first-order vascular bundles; mesophyll irregularly radiating, and palisadelike toward the adaxial surface, with 5–8(–10) meso-

phyll cells between consecutive vascular bundles; extensions of the outer bundle sheath extending toward both epidermides and of 1–4 cells deep; dumbbell-shaped or nodular silica bodies; bicellular microhairs; and the stomatal complex dome-shaped or triangular.

Section *Cordovensia* (A. Hitchc. & Chase) L. Parodi differs from section *Dichantherium*, as circumscribed here, in the membranous ligules, spikelets with the upper glume and lower lemma usually

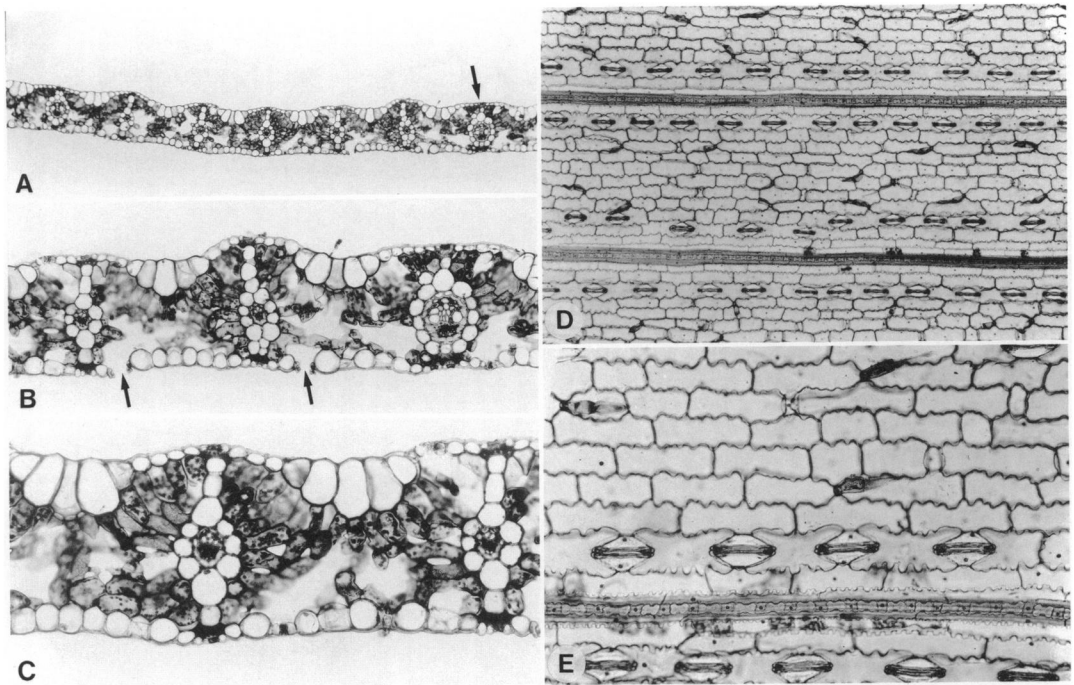


FIGURE 16. Leaf anatomy of *Panicum stigosum*. A–C. Leaf blade in transverse section.—A. Central part of lamina showing median vascular bundle.—B. Third-order vascular bundles with uniseriate sheath extensions; note abaxial stomata (arrowed).—C. Detail showing diffuse mesophyll with large intercellular air spaces in the spongy tissue. D, E. Abaxial epidermis.—D. Epidermal zonation with wide intercostal zones and very narrow intercostal zones.—E. Detail of stomata with triangular subsidiary cells, rectangular long cells with sinuous walls, bicellular microhairs, and costal zones three cells wide with central file with dumbbell-shaped silica bodies alternating with short cork cells (A–E, based on Zuloaga *et al.* 2351; A $\times 100$; C $\times 160$; B $\times 250$; D, E $\times 400$).

5-nerved, and the lower flower and palea absent. Anatomically, species of section *Cordovensia* have midribs with rounded adaxial and abaxial projections; they have restricted groups of 5–7 large,

inflated bulliform cells that lie parallel to the epidermis; the abaxial epidermis has homogeneous intercostal zones; long cells have very deeply undulating cell walls. In section *Cordovensia* the ex-

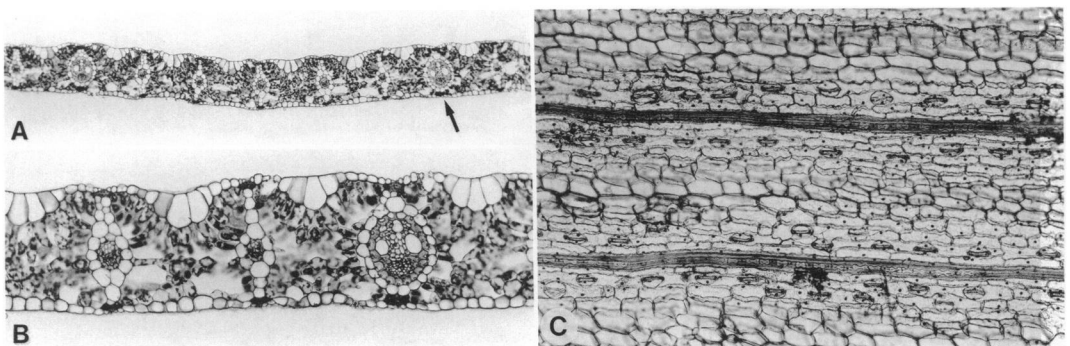


FIGURE 17. Leaf anatomy of *Panicum superatum*. A, B. Transectional anatomy.—A. Median part of blade showing median vascular bundle (arrowed) identical to other first-order vascular bundles.—B. Anatomical detail of conspicuous, translucent outer bundle sheath and extension cells and diffuse mesophyll tissue.—C. Abaxial epidermis without macrohairs and with inflated, short intercostal long cells (A–C, based on Zuloaga *et al.* 2374; A $\times 100$; B, C $\times 250$).

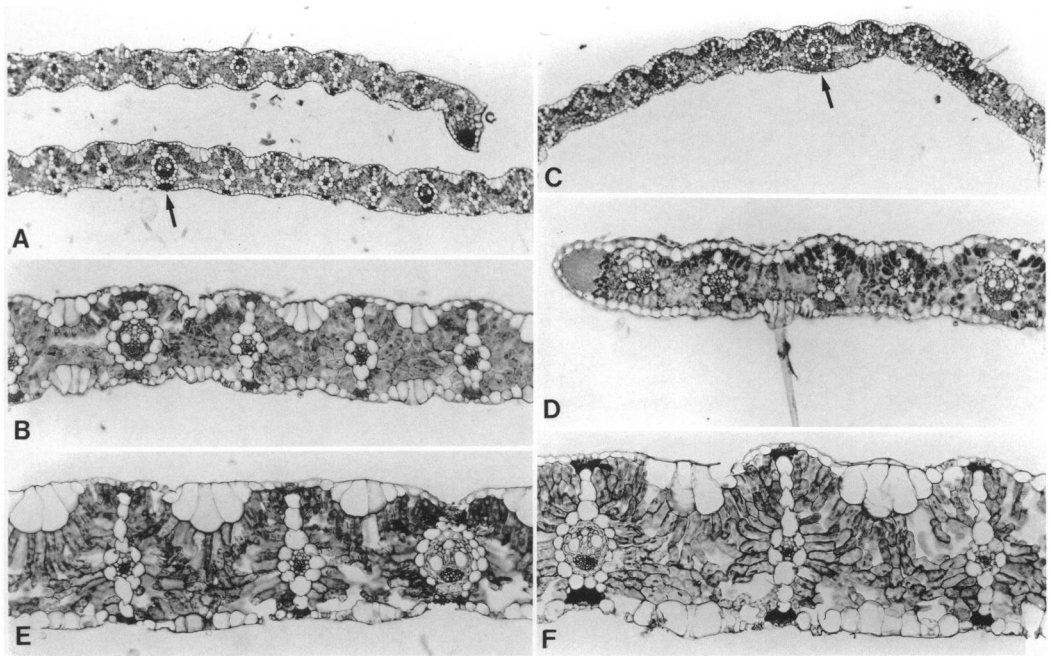


FIGURE 18. Transsectional leaf blade anatomy of *Panicum viscidellum*.—A. Lateral and median part of blade showing sclerenchyma cap in margin and median vascular bundle (arrowed).—B. Detail of uniseriate bundle sheath extensions associated with third-order bundles and much shorter, biseriate adaxial extensions from the first-order bundles.—C. Midrib bundle (arrowed) with slightly larger sclerenchyma girders than are associated with the laterally located first-order vascular bundles.—D. Margin showing sclerenchyma cap and cushion-based macrohair.—E. Detail of mesophyll tissue tending to radiate type of arrangement; note intercellular air spaces and uniseriate bundle sheath extensions.—F. Chlorenchyma cell arrangement clearly evident with the adaxial cells somewhat radiately arranged whereas the abaxial tissue is irregular, resembling spongy mesophyll; note uniseriate sheath extensions and small adaxial and abaxial sclerenchyma strands associated with all vascular bundles (A, B, based on Zuloaga et al. 4532; C, D, based on Zuloaga et al. 4530; E, based on Davidse 32336; F, based on Stevens 25420; A, C $\times 100$; B, D–F $\times 250$).

tensions of the outer parenchymatous sheath are composed of 1(–2) cells, or are occasionally absent.

TAXONOMIC TREATMENT

Panicum* subgenus *Dichantherium A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 142. 1910. TYPE SPECIES: *Panicum dichotomum* L.

Panicum* section *Dichantherium

Panicum section *Dichotoma* (A. Hitchc. & Chase) Hsu, J. Fac. Sci. Univ. Tokyo, sect. 3, Bot. 9: 119. 1965. Group *Dichotoma* A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 179. 1910, nom. inval.

Perennials with or without a basal rosette of shorter, broader leaves than those of the culms. Culms erect or decumbent-erect, usually freely branching at the upper nodes; internodes hollow, with or without glands. Sheaths striate, pilose or glabrous, with or without conspicuous glands. Lig-

ules membranous-ciliate, the membranous portion small, the cilia variable in length. Blades linear to ovate-lanceolate, flat or inrolled, densely pilose to glabrous; foliar dimorphism present or absent. Inflorescence terminal and axillary, lax, open, occasionally contracted, axis of the branches with or without glands, pilose or glabrous. Spikelets ellipsoid to obovoid, pilose or glabrous, cleistogamous flowers present or absent. Lower glume of variable length, usually $\frac{1}{4}$ – $\frac{1}{3}$ the length of the spikelet, up to $\frac{3}{4}$ in several species, 1–7-nerved, acute or truncate, a short internode between the lower and upper glume present or absent. Upper glume acute to obtuse, usually not covering the apex of the upper antherium, (5–)7–15-nerved. Lower lemma glumiform, (5–)7–15-nerved. Lower palea conspicuous, as long as its lemma to small, absent in *P. aciculare* and *P. penicillatum*; lower flower staminate or absent. Upper antherium indurate, smooth, shiny, with simple papillae all over its surface, pilose toward the apex of the lemma or glabrous, shortly

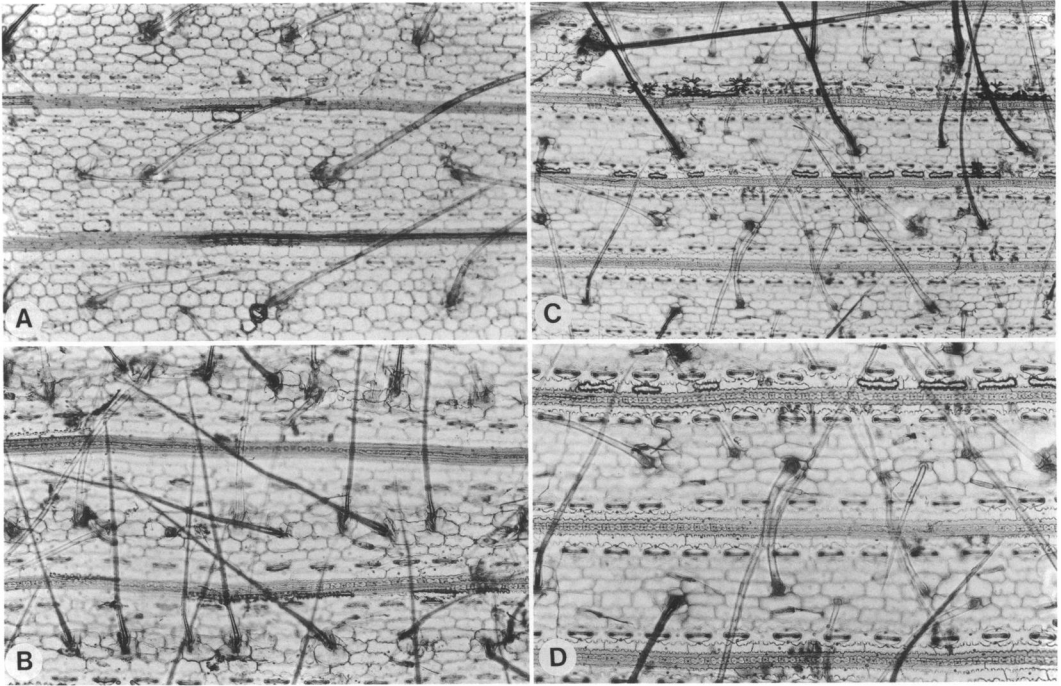


FIGURE 19. Abaxial leaf blade epidermis of *Panicum viscidellum*.—A. Prominent macrohairs common in the central files of the intercostal zones; these hairs have small cushions associated with their bases.—B. Long, slender macrohairs inserted between a few specialized epidermal cells.—C. Epidermal pattern showing narrow costal zones with files of stomata on either side; the central files of the wide intercostal zones with numerous long, slender macrohairs.—D. Detail of macrohair bases that are inserted between three or four inflated epidermal cells; numerous small elongated microhairs (A, based on *Stevens 25420*; B, based on *Zuloaga et al. 4537*; C, D, based on *Zuloaga et al. 4532*; A, C $\times 160$; B, D $\times 250$).

apiculate or crested; lodicules 2, conduplicate, truncate; stamens 3; styles 2, free, the stigmas 2, plumose. Caryopsis with hilum punctiform, embryo $\frac{1}{2}$ or less the length of the caryopsis. Basic chromosome number: $x = 9$. Anatomy: C_3 , non-Kranz.

A section with 37 species in Mesoamerica, the West Indies, and South America, inhabiting edges of forest in west habitats or in open places, on moist or dry sandy soils.

KEY TO THE SPECIES

- | | | |
|-------|---|----------------------------|
| 1. | Upper glume and lower lemma 10–15-nerved | 2 |
| 1. | Upper glume and lower lemma (5–)7–9-nerved | 8 |
| 2(1). | Lower palea absent; culms scandent, leaning on vegetation, to 10 m tall; internodes solid toward the base; leaf blades pseudopetiolate; lower glume as long as or a little shorter than the upper glume | 20. <i>P. penicillatum</i> |
| 2. | Lower palea present; culms decumbent to erect or scandent, 0.15–0.60(–2.2) m tall; internodes hollow; leaf blades not pseudopetiolate; lower glume $\frac{1}{2}$ – $\frac{2}{3}$ the length of the spikelet | 3 |
| 3(2). | Inflorescences contracted; spikelets obovoid | 33. <i>P. superatum</i> |
| 3. | Inflorescences lax, open; spikelets narrowly ellipsoid to ellipsoid | 4 |
| 4(3). | Spikelets 1.5–1.9 mm long | 27. <i>P. sciurotoides</i> |
| 4. | Spikelets 3–6.8 mm long | 5 |
| 5(4). | Culms erect, 15–30(–60) cm tall; spikelets hirsute with papillose-pilose hairs; Mexico | 19. <i>P. pedicellatum</i> |
| 5. | Culms leaning on vegetation, to 2.2 m tall; spikelets glabrous; Brazil | 6 |
| 6(5). | Spikelets 3–3.3 mm long; lower palea 2.1–2.4 mm long; lower glume 3-nerved; leaf blades with scabrous margins, ciliate toward the base; the sheaths and nodes hirsute; Venezuela and northwestern Brazil, Roraima | 11. <i>P. davidsei</i> |
| 6. | Spikelets 4.6–6.8 mm long; lower palea 4–5.5 mm long; lower glume 5-nerved; leaf blades with ciliate margins; the sheaths and nodes glabrous; Brazil, Rio de Janeiro and Espírito Santo | 7 |
| 7(6). | Spikelets 4.6–5 mm long; upper anthercium 4–4.2 mm long; leaf blades 10–12 cm long | 17. <i>P. itatiaiae</i> |
| 7. | Spikelets 5.9–6.8 mm long; upper anthercium 5.2 mm long; leaf blades 14–21 cm long | 7. <i>P. caparaense</i> |

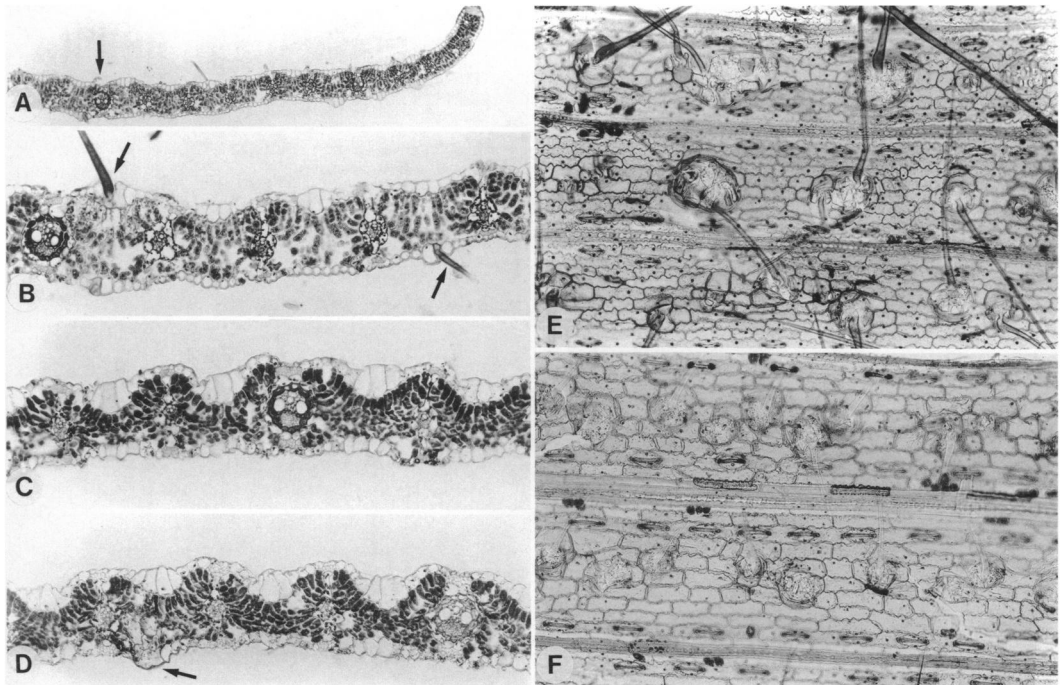


FIGURE 20. *Panicum viscidellum* specimens with silicified cushion bases of the macrohairs. A–D. Transectional leaf anatomy.—A. Leaf section showing margin and median vascular bundle (arrowed).—B. Detail of macrohairs with cushion bases (arrowed): these cushion cells do not appear to be silicified; note the outer bundle sheath cells, which contain chloroplastlike bodies.—C. Section with chloroplasts in bundle sheath and extension cells; mesophyll relatively compact.—D. Section through silicified cushion-base cells (arrowed). E, F. Abaxial epidermis.—E. Prominent macrohairs inserted into cushion bases, the cells of which are refractive, indicating silicification.—F. Specimen with small, indistinct macrohairs, but with conspicuous cushion bases that contain crystalline material resembling opaline silica (A, B, E, based on Zuloaga & Londoño 4203; C, D, F, based on Zuloaga 4184; A $\times 100$; B–F $\times 250$).

- | | | | | | |
|---------|--|---|-------------------------|--|--|
| 8(1). | Spikelets usually geminate, at least in portions of the inflorescence; lower glume dimorphic; upper anthecium black at maturity; blades asymmetrical at the base | 15. <i>P. hebotos</i> | | | |
| 8. | Spikelets not geminate; lower glume isomorphic; upper anthecium whitish to pale, not black at maturity; blades usually symmetrical at the base | 9 | | | |
| 9(8). | Lower palea conspicuous, as long as or nearly as long as the lower lemma; lower flower present or absent | 10 | | | |
| 9. | Lower palea small or absent, shorter than the lower lemma; lower flower absent | 14 | | | |
| 10(9). | Lower glume not embracing the upper glume; stipe inconspicuous between the lower and upper glume; spikelets narrowly ellipsoid, 1.8–2.2 mm long | 34. <i>P. surrectum</i> | | | |
| 10. | Lower glume embracing the upper glume; stipe present between the lower and upper glume; spikelets obovoid to ellipsoid, (1.9–)2–3.2 mm long | 11 | | | |
| 11(10). | Inflorescences contracted, spiciform or with the first-order branches slightly divergent, the spikelets congested on the branches | 33. <i>P. superatum</i> | | | |
| 11. | Inflorescences lax, first-order branches divergent, and spikelets not congested on the branches | 12 | | | |
| | 12(11). | Spikelets ellipsoid, 3–3.2 mm long, minutely puberulent; inflorescences short-exserted or included on the upper leaves, 3–5 cm long; Serra do Sol, Venezuela | 35. <i>P. telmatum</i> | | |
| | 12. | Spikelets obovoid, 1.9–3(–3.2) mm long, glabrous; terminal inflorescences exserted, 3–20 cm long; eastern Brazil, Bolivia, Paraguay, Uruguay, Chile, and Argentina | 13 | | |
| | 13(12). | Robust plants leaning on vegetation; leaf blades 10–22 cm long, 1–2.2 cm wide; spikelets glabrous, (1.9–)2.4–3.2 mm long; inflorescence 9–21 cm long, glandular; foliar dimorphism absent | 30. <i>P. stigmosum</i> | | |
| | 13. | Caespitose or decumbent perennials not leaning on vegetation; leaf blades 1–9(–15) cm long, 0.2–1.4(–2) cm wide; spikelets hirsute to glabrous, when glabrous 1.9–2.3(–2.6) mm long; inflorescences 2–10 cm long, the axis glandular or eglandular; foliar dimorphism present ... | 25. <i>P. sabulorum</i> | | |
| | 14(9). | Plants branching only at the base, with short internodes and basal leaves numerous in a rosette | 15 | | |
| | 14. | Plants normally branching above the base, | | | |

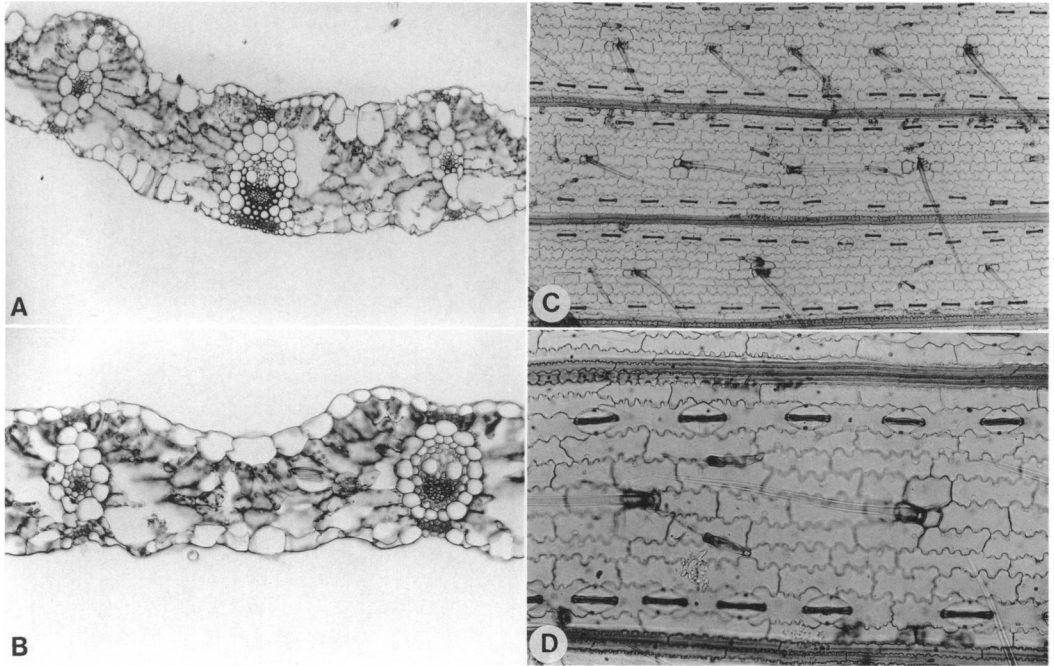


FIGURE 21. Leaf blade anatomy of *Panicum boscii*. A, B. Transectional anatomy.—A. Midrib showing slight keel development due to presence of additional parenchyma cells associated with the median vascular bundle.—B. Widely spaced vascular bundles and very diffuse chlorenchyma tissue. C, D. Abaxial epidermis.—C. Epidermal pattern showing narrow costal zones, wide intercostal zones, stomatal files, and macrohairs.—D. Detail of macrohairs and their associated basal cells, long, fingerlike microhairs, low-triangular subsidiary cells, and rectangular intercostal long cells with sinuous walls (A–D, based on *Davidse 30822*; A $\times 250$; C $\times 160$; B, D $\times 400$).

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|---------|--|--------------------------|--|---|-----------------------------|
| | with internodes elongated and basal leaves not in a rosette | 17 | 20(19). Viscid glandular band present just below the nodes | 28. <i>P. scoparium</i> | |
| 15(14). | Blades linear, length : width ratio 10–30:1, with scabrous margins; caryopsis black | 14. <i>P. ensifolium</i> | 20. | Glandular band absent below the nodes | <1 |
| 15. | Blades lanceolate to linear-lanceolate, length : width ratio 3–10:1, with long-ciliate margins; caryopsis brownish | 16 | 21(20). | Blades 1–7 cm long, 0.2–0.5(–1.2) mm wide; inflorescences few-flowered, 1–8 cm long, 1–3 cm wide | 22 |
| 16(15). | Spikelets 1–1.7 mm long, glabrous or puberulous; upper antherium 1–1.4 mm long; sheaths and blades glabrous to sparsely pilose | 32. <i>P. strigosum</i> | 21. | Blades 2.5–10(–16) cm long, 0.5–1.7 cm wide; inflorescences multiflowered, (2–)5–22 cm long, 3.5–10 cm wide | 23 |
| 16. | Spikelets 2–2.7 mm long, short-hirsute; upper antherium 1.8–2.3 mm long; sheaths and blades densely pilose with long papillose-pilose hairs | 18. <i>P. laxiflorum</i> | 22(21). | Blades narrowed at base; sheaths, nodes, and internodes glabrous to short-pilose; spikelets 0.6–1 mm wide; lower glume $\frac{1}{4}$ – $\frac{1}{2}$ the length of the spikelet | 12. <i>P. dichotomum</i> |
| 17(14). | Spikelets obovoid; lower glume $\frac{1}{5}$ – $\frac{1}{3}$ (– $\frac{1}{2}$) the length of the spikelet | 18 | 22. | Blades subcordate; sheaths, nodes, and internodes pilose; spikelets 1.1–1.3 mm wide; lower glume $\frac{1}{4}$ – $\frac{1}{2}$ the length of the spikelet | 23. <i>P. portoricense</i> |
| 17. | Spikelets ellipsoid; lower glume $(\frac{1}{4}$ –) $\frac{1}{2}$ – $\frac{1}{3}$ the length of the spikelet | 24 | 23(21). | Spikelets 1–1.8 mm long; lower glume $\frac{1}{5}$ the length of the spikelet, occasionally $\frac{1}{3}$ – $\frac{1}{2}$; axis of the panicles glabrous and glandular; blades glabrous | 29. <i>P. sphaerocarpon</i> |
| 18(17). | Pseudoligule present | 2. <i>P. acuminatum</i> | 23. | Spikelets (2.1–)2.3–3.2 mm long; lower glume $\frac{1}{4}$ – $\frac{1}{2}$ the length of the spikelet; axis of the panicles hispid, occasionally glabrous, with or without glands; blades with papillose-pilose hairs | 13. <i>P. divergens</i> |
| 18. | Pseudoligule absent | 19 | 24(17). | Blades clasping the culm, cordate, the length : width ratio 3–5(–7):1 | 25 |
| 19(18). | Blades linear, length : width ratio 10–20:1; lower palea absent; inflorescences contracted, few-flowered | 1. <i>P. aciculare</i> | | | |
| 19. | Blades ovate-lanceolate to lanceolate or linear-lanceolate, length : width ratio 3–10:1; lower palea present; inflorescences lax, few-to many-flowered | 20 | | | |

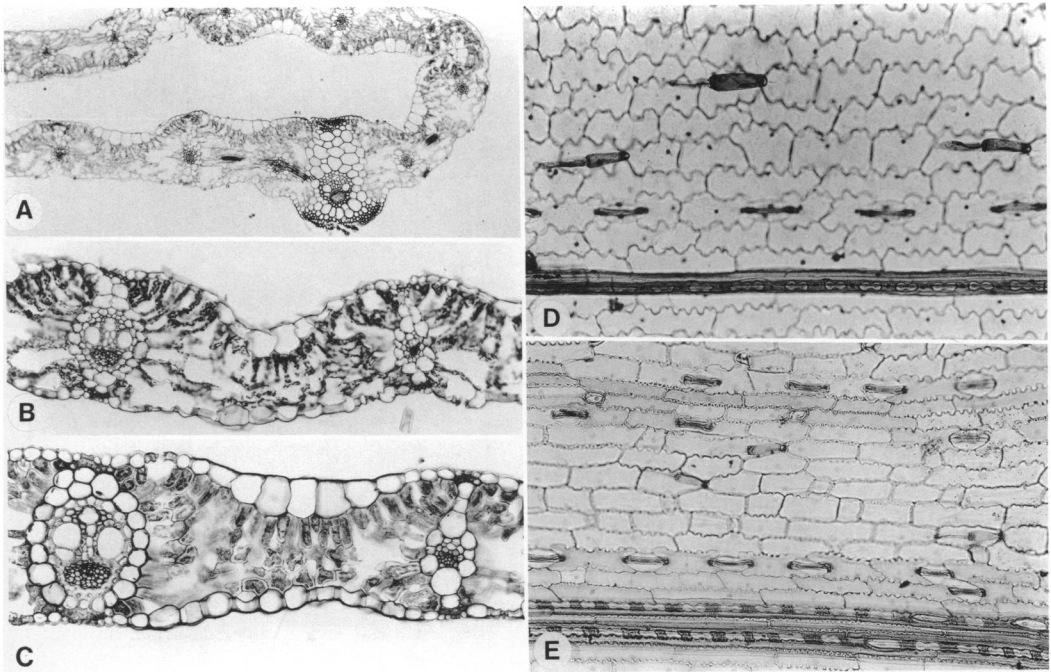


FIGURE 22. Leaf anatomy of *Panicum clandestinum*. A-C. Anatomy in cross section.—A. Central keel including a single vascular bundle.—B. Detail of diffuse mesophyll and short biseriate bundle sheath extensions.—C. Detail of spongy and palisade mesophyll and intercellular air spaces; note absence of extension on first-order bundle. D, E. Abaxial epidermis.—D. Long cells rectangular with very flexuous walls, large bicellular microhairs, and silica bodies irregularly dumbbell-shaped to nodular.—E. Thicker cuticle with less undulating long cell walls and wider costal zones; note microhairs, which are at least twice as long as the stomata (A, B, C, based on *Davidse 30816*, MO; D, E, based on *Davidse 30818*, MO; A $\times 100$; B $\times 250$; C, D, E $\times 400$).

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|---------|---|---------------------------|---|---|
| 24. | Blades not clasping the culm, narrowed to subcordate, the length: width ratio 10-30:1 | 34 | 1 mm long; main axis of the inflorescence densely hirsute | 27. <i>P. sciurotoides</i> |
| 25(24). | Upper glume and lower lemma 5(-7)-nerved, the nerves inconspicuous; lower lemma inflated at base | 26. <i>P. sciurotis</i> | 30. | Spikelets glabrous, 1.7-2.5 mm long; inflorescences 10-15 cm long; main axis glabrous or short, sparsely pilose |
| 25. | Upper glume and lower lemma 7-9(-11)-nerved, with manifest nerves; lower lemma not inflated at base | 26 | 31(30). | Blades amplexicaulous, ovate-lanceolate, 1.5-3 cm wide, velutinous; upper antherium 2.2 mm long |
| 26(25). | Inflorescences few-flowered, 1-2.5(-3) cm long; blades overlapping, 1-3 cm long, 0.3-0.6 cm wide | 10. <i>P. cumbucana</i> | 31. | Blades not amplexicaulous, linear-lanceolate, 0.5-1.3 cm wide, hispid or glabrous; upper antherium 1.6-1.9 mm long |
| 26. | Inflorescences multiflowered, 2.5-12 cm long; blades not overlapping, 2-12 cm long, 0.5-2 cm wide | 27 | | 4. <i>P. aequivaginatatum</i> |
| 27(26). | Pseudoligule manifest with long whitish hairs | 28 | 32(29). | Blades with margins cartilaginous and covered with manifest cilia |
| 27. | Pseudoligule absent | 29 | 32. | Blades without cartilaginous margins and without cilia on the upper portions of the margins |
| 28(27). | Spikelets 2.2-2.8 mm long | | 33(32). | Lower glume $\frac{1}{2}$ - $\frac{3}{4}$ the length of the spikelet; inflorescences 3-6(-10) cm long; Ecuador, Peru, Venezuela, Brazil |
| | | 36. <i>P. umbonulatum</i> | 33. | Lower glume $\frac{1}{4}$ - $\frac{2}{3}$ the length of the spikelet; inflorescences (5-)10-22 cm long; United States, Mexico, Honduras |
| 28. | Spikelets 1.5-2(-2.2) mm long | | 34(24). | Lower glume $\frac{1}{4}$ - $\frac{1}{2}$ the length of the spikelet |
| 29(27). | Spikelets 1.5-2.5 mm long, without a manifest stipe between the lower and upper glume | 30 | | 35 |
| 29. | Spikelets 2.2-3.3 mm long, with a stipe between the lower and upper glume | 32 | 34. | Lower glume $\frac{3}{4}$ - $\frac{1}{2}$ the length of the spikelet |
| 30(29). | Spikelets short-hispid, 1.5-1.9 mm long; inflorescences 2.5-9 cm long; lower palea 0.7- | | 35(34). | Pseudoligule present |
| | | | | 2. <i>P. acuminatum</i> |

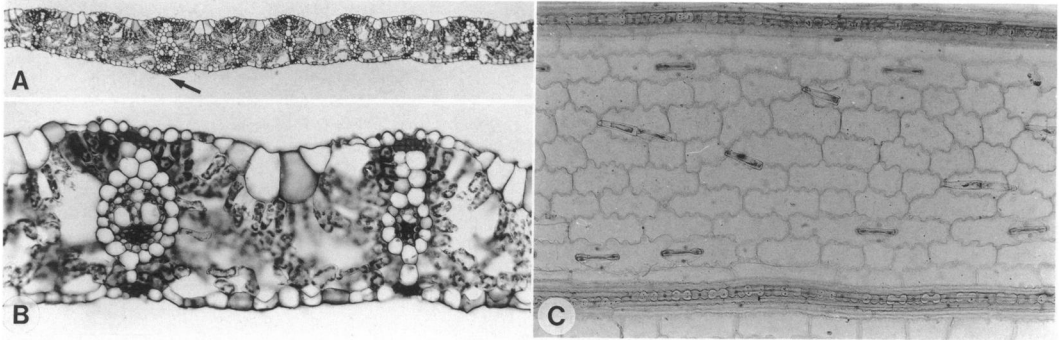


FIGURE 23. Leaf blade anatomy of *Panicum oligosanthos*. A, B. Transectional anatomy.—A. Central part of expanded lamina showing median vascular bundle (arrowed).—B. Detail of diffuse mesophyll and biseriate bundle sheath extensions.—C. Abaxial epidermis with dumbbell-shaped costal silica bodies, low triangular subsidiary cells, and bicellular microhairs; macrohairs absent (A–C, based on *Davidse 30819*, MO; A $\times 100$; B, C $\times 400$).

- | | | | | | |
|---------|---|-------------------------------|---------|---|------------------------------|
| 35. | Pseudogligule absent | 36 | 43. | Spikelets hirsute, 2.8–3.2 mm long; lower glume 5–7-nerved; panicles contracted, blades congested on the culms | 8. <i>P. congestum</i> |
| 36(35). | Lower palea absent; inflorescences contracted, few-flowered; blades linear | | 44(42). | Culms 10–25 cm tall; blades 2–5 cm long, 0.1–0.3 cm wide; panicles 2–4 cm long, spikelets glabrous, 2.4–2.6 mm long | 22. <i>P. petropolitanum</i> |
| 36. | Lower palea present; inflorescences lax, multiflowered; blades lanceolate to linear-lanceolate | 37 | 44. | Culms 50–1,000 cm tall; blades 4–32 cm long, 0.3–3.2 cm wide; panicles 4–45 cm long, spikelets pilose or glabrous, 2.6–4.2 mm long | 45 |
| 37(36). | Plants densely hispid; spikelets hirsute | 38 | 45(44). | Lower palea absent; blades 18–32 cm long, 0.1–3.2 cm wide, pseudopetiolate; panicles 30–45 cm long | 20. <i>P. penicillatum</i> |
| 37. | Plants sparsely pilose or glabrous; spikelets short-hispid or glabrous | 39 | 45. | Lower palea present; blades 4–12 cm long, 0.3–1 cm wide; panicles 4–16 cm long | 46 |
| 38(37). | Blades lanceolate, 3–15 cm long, 0.2–0.8(–1) cm wide, flat, the margins ciliate; spikelets 2–2.7 mm long; lower glume $\frac{1}{3}$ – $\frac{1}{2}$ the length of the spikelet; eastern United States to Costa Rica and the West Indies | 18. <i>P. laxiflorum</i> | 46(45). | Spikelets hispid, 2.6–3.1 mm long; upper glume and lower lemma 7-nerved; blades linear lanceolate, 4–5(–12) cm long, 0.3(–1) cm wide, peduncle and main axis hirsute | 16. <i>P. heliophilum</i> |
| 38. | Blades linear-lanceolate, 4–6 cm long, 0.2 cm wide, the margins involute, scabrous; spikelets 2–2.3 mm long; lower glume $\frac{1}{2}$ or more the length of the spikelet; Brazil | 6. <i>P. cabrerarae</i> | 46. | Spikelets glabrous to sparsely pilose between the nerves, 3.3 mm long; upper glume and lower lemma 9-nerved; blades linear-lanceolate, 8–12 cm long, 0.7–1 cm wide, peduncle and main axis glabrous | 5. <i>P. assurgens</i> |
| 39(37). | Blades 4–6 cm long, 0.3–0.5 cm wide; plants with manifest glands on sheaths, blades and axis of the panicles; panicles 5–7 cm long | 3. <i>P. adenorhachis</i> | | | |
| 39. | Blades 3.5–12(–16) cm long, 0.2–1.3(–1.5) cm wide; plants without glands, occasionally present on the axis of the panicles; panicles 3–22 cm long | 40 | | | |
| 40(39). | Spikelets glabrous, 1.7–2.5 mm long; Venezuela, Guyana, and Brazil | 4. <i>P. aequivaginatatum</i> | | | |
| 40. | Spikelets pilose, (2.1–)2.3–4.1 mm long; United States, Mexico, and Honduras | 41 | | | |
| 41(40). | Spikelets papillose-pilose, 3.3–4.1 mm long | 19. <i>P. pedicellatum</i> | | | |
| 41. | Spikelets sparsely pilose, (2.1–)2.3–3.2 mm long | 13. <i>P. divergens</i> | | | |
| 42(34). | Spikelets with a stipe between the lower and upper glume | 43 | | | |
| 42. | Spikelets without a stipe between the lower and upper glume | 44 | | | |
| 43(42). | Spikelets glabrous, 2.2–2.7 mm long; lower glume 1(–3)-nerved; panicles lax, blades regularly spaced on the culms 9. <i>P. cucaense</i> | | | | |

1. *Panicum aciculare* Desv. ex Poirlet, Encycl. Suppl. 4: 274. 1816. *Dichantheium aciculare* (Desv. ex Poirlet) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1116. 1978. TYPE: "Habitat in India Orientali" (holotype, P; fragment, US 2808908).

Plants perennial, with or without a basal rosette of broader leaves. *Culms* erect to decumbent and geniculate at base, then erect, freely branching, 10–30(–65) cm tall, internodes hollow, terete, densely covered with short hairs, greenish to purplish, nodes compressed, brownish, pilose to glabrous. *Sheaths* shorter or longer than the inter-

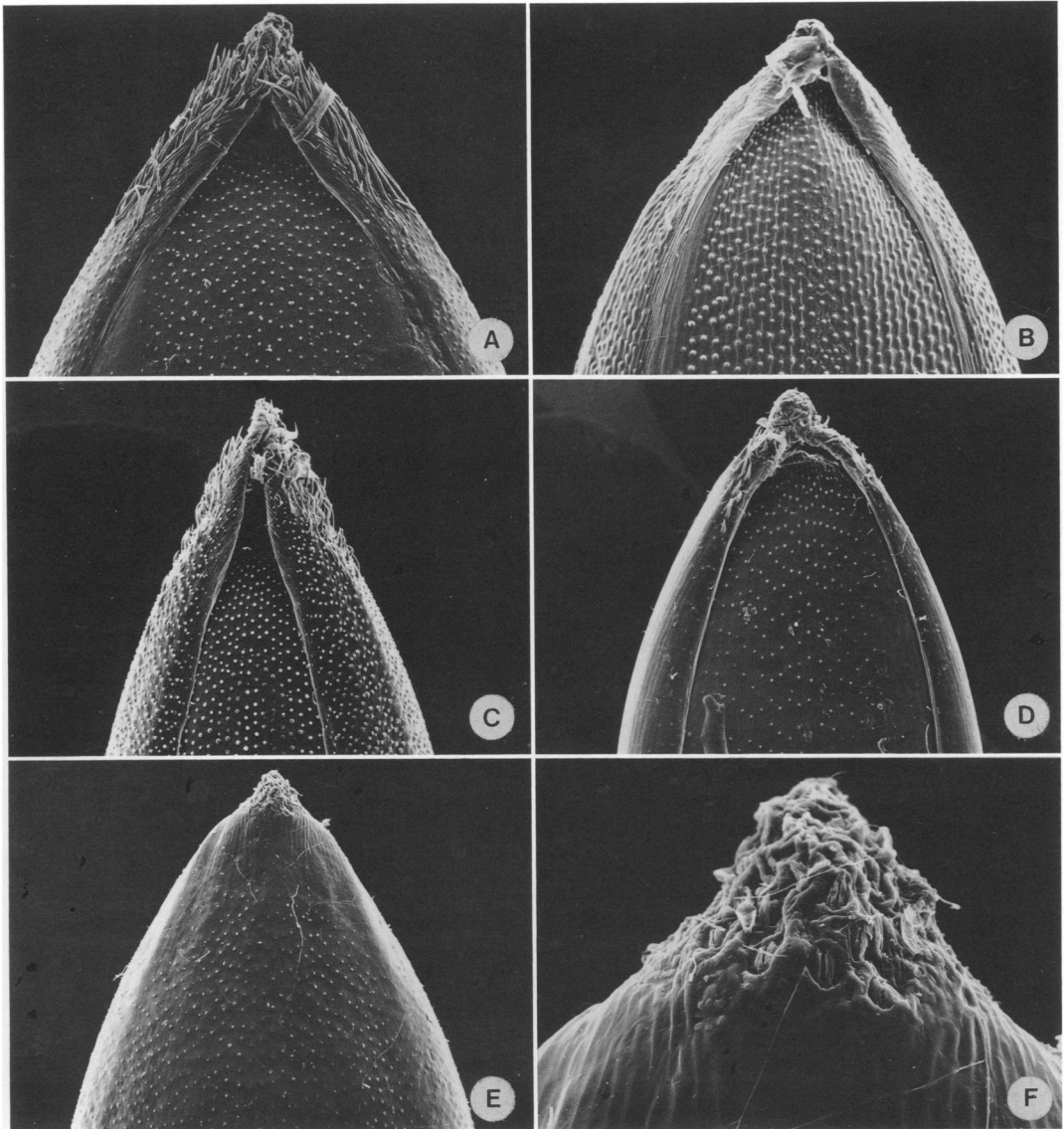


FIGURE 24. Scanning electron micrographs of upper anthercia of species of *Panicum*.—A. *Panicum assurgens* $\times 50$ (from Harley et al. 15229).—B. *Panicum aequivaginatam* $\times 75$ (based on Harley et al. 17383).—C. *Panicum cumbucana* $\times 100$ (based on Harley et al. 16869).—D. *Panicum surrectum* $\times 50$ (based on Chase 9380). E, F. *Panicum divergens*.—E. Upper portion of the lemma $\times 50$.—F. Apex of the lemma $\times 250$ (based on Joor 35).

nodes, greenish to purplish, with whitish appressed hairs or glabrous, striate, one margin ciliate, the other glabrous, the upper margins long-ciliate. *Ligules* 0.5–1.2 mm long, short-membranous at base and long-ciliate at the apex; collar densely pilose. *Blades* linear, 2.8–7(–13) cm long, 0.2–0.4 cm wide, flat or with the margins involute, long-ciliate to scaberulous, attenuate at the base, adaxial surface short-pilose or with scattered papillose-pilose hairs, abaxial surface scaberulous to glabrous. *In-*

florescence terminal, exserted, peduncle cylindric, glabrous, up to 25 cm long, or short-exserted; *panicles* few-flowered, contracted, 1.5–4.5 cm long, 2–2.5 cm wide; *main axis* flexuous, short-pilose or scabrous, pulvini short-pilose, first- and second-order branches flexuous, short-pilose or scabrous, pedicels claviform, pilose. Axillary panicles similar to the terminal one. *Spikelets* solitary, obovoid to ellipsoid, 1.9–2.8(–4.2) mm long, 1.3 mm wide, greenish or tinged with purple, densely

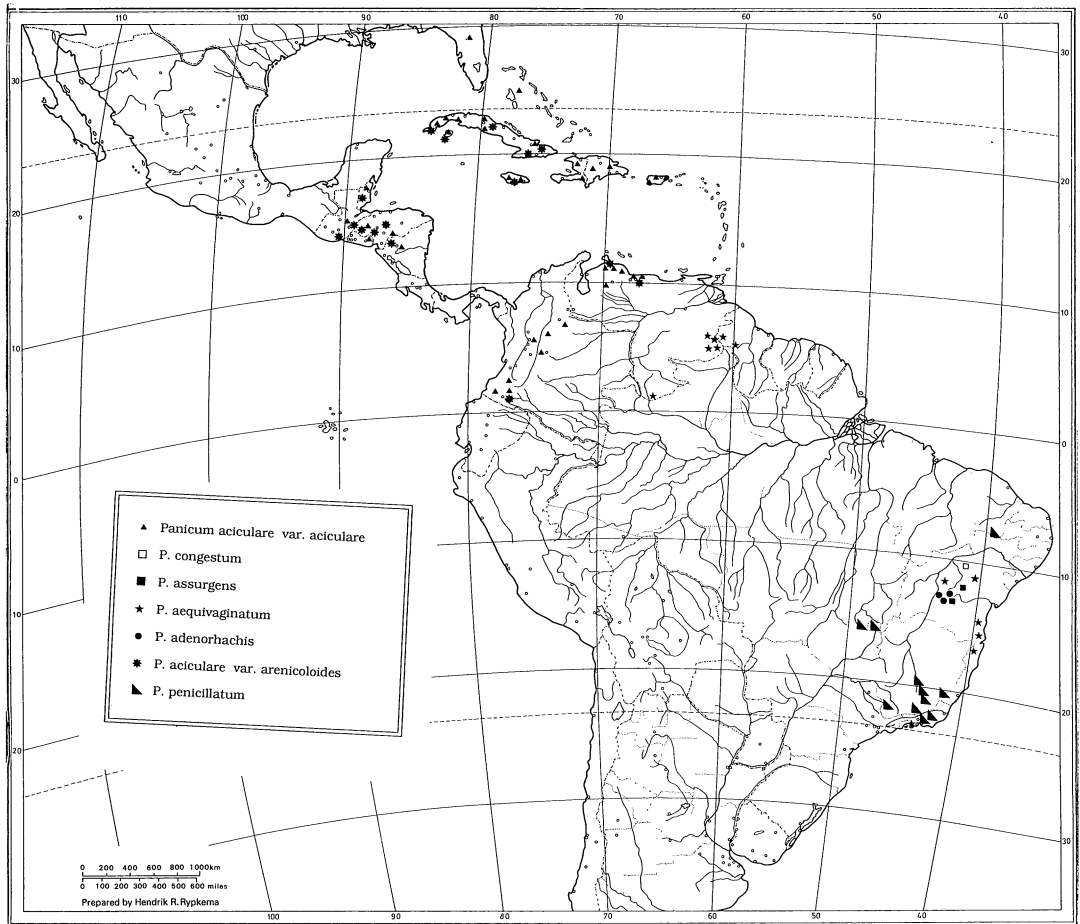


FIGURE 25. Distribution of *Panicum aciculare* var. *aciculare*, *P. congestum*, *P. assurgens*, *P. aequivaginatam*, *P. adenorrhachis*, *P. aciculare* var. *arenicoloides*, and *P. penicillatum*.

pilose or glabrescent. *Lower glume* ovate, 1.3 mm long, $\frac{1}{3}$ – $\frac{1}{2}$ the length of the spikelet, acute to truncate, nerveless to 3-nerved, with a small internode between the lower and upper glume. *Upper glume* ovate, obtuse, 7-nerved, hispid on the abaxial surface. *Lower lemma* 7-nerved, acute. *Lower palea* absent; lower flower absent. *Upper antheridium* obovoid, 1.8–2.1 mm long, 1.2 mm wide, pale, shiny, pilose toward the apex of the lemma, short-apiculate, lemma 7-nerved. *Caryopsis* obovoid, brownish, 1.1–1.3 mm long, 1.1 mm wide, hilum punctiform, embryo less than half the length of the caryopsis.

Distribution and ecology: southern United States, Mexico, Mesoamerica, the West Indies, Colombia, and Venezuela, at edge of forests or in open, wet, and sandy places between sea level and 2,400 m.

Although Poiret mentioned in the original de-

scription that the species was from “India Orientali,” it was obviously collected in the West Indies.

KEY TO THE VARIETIES

1. Spikelets 1.9–2.8 mm long, without a manifest internode between the lower and upper glume 1a. var. *aciculare*
1. Spikelets 2.8–3.3(–4.2) mm long, with an internode 0.3–0.6 mm long between the lower and upper glume 1b. var. *arenicoloides*

1a. *Panicum aciculare* var. *aciculare*. Figures 1, 25.

Panicum neuranthum Griseb., Cat. Pl. Cuba: 232. 1866. TYPE: Cuba. Oriente: without locality, anno 1860, *Wright 3453* (lectotype, GOET not seen; isolectotypes, G, K, NY).

Panicum areniculum Ashe, J. Elisha Mitchell Sci. Soc. 15: 56. 1898. TYPE: United States. North Carolina: in the vicinity of Chapel Hill, *Ashe s.n.* (isolectotype, NY).



FIGURE 26. Distribution of *Panicum acuminatum* var. *acuminatum*, *P. acuminatum* var. *longiligulatum*, *P. acuminatum* var. *villosum*, and *P. cabreræ*.

Panicum chrysopsidifolium Nash in Small, Fl. Southeast. U.S.: 100, 1327. 1903. TYPE: United States. Florida: Leon Co., Lake Jackson, 12 May 1886, *Curtiss s.n.* (holotype, NY; isotype, US 2808891).

Selected specimens cited. BAHAMAS. New Providence, swamp near Tea House, *Britton et al.* 599 (K). BELIZE. ORANGE WALK DISTRICT: between London and Rancho along the old northern highway to Maskall, *Davidse & Brant* 32927 (MO, SI). COLOMBIA. ANTIOQUIA: Río Chico Valley, 6 km NE of San Pedro, *Wood* 5352 (K). BOYACA: Sáchica, 1,990 m, *Saravia* 4363 (COL). CAUCA: de Balboa a Argelia, 10 km de Balboa, 2,180 m, *Zuloaga & Londoño* 4201* (COL, SI). NARIÑO: Mun. La Florida, margen derecha del Río Barrancos, 2,300 m, *Díaz et al.* 983 (COL). CUBA. HABANA: Batabanó, in coastal swamps, *Ekman* 12581 (US). ISLA DE LA JUVENTUD: Nueva Gerona, *Ekman* 11630 (G). ORIENTE: Sierra de Nipe, in pinelands at the foot of Loma Mensura, 725 m, *Ekman* 6372 (G), 9066 (G, US). PINAR DEL RIO: Los Pozos, *Ekman* 12794 (G, K, US). SANTA CLARA: Sabana de la Gloria, Banao Mountains, *Roca* 7944 (US). DOMINICAN REPUBLIC. LA VEGA: vicinity of Piedra Blanca, *Allard* 16089 (US). GUATEMALA. ZACAPA: Sierra de las Minas, *Steyermark* 29707 (US). HAITI. Massif de la Selle, *Ekman* 6855 (G, US); vicinity of Furcy, 1,300 m, *Leonard* 4331 (US). HONDURAS. COMAYAGUA: near Siguatepeque, *Juncker et al.* 5715 (US). EL PARAISO: cumbre on Yuscarán road, 1,500 m, *Standley* 29366 (F, GH). FRANCISCO MORAZAN:

between Cuesta de Los Muertos and Monte Oscuro, near La Montañita, *Molina* 14707 (US). JAMAICA. Mason River Savanna, 2.75 mi. due NW of Kellits, 2,100–2,300 ft., *Proctor* 26565 (US); Pick Lam, Upper Clarendon, *Harris* 12812 (US). NICARAGUA. MATAGALPA: 5 km N of Santa María de Ostuma, between Matagalpa and Jinotega, *Williams et al.* 23906 (G). PUERTO RICO. Las Marías, *Sintenis* 5985 (G, US, W); Monte Mesa, vicinity of Mayagüez, *Chase* 6273 (US). UNITED STATES. FLORIDA: Lake County, vicinity of Eustis, *Nash* 1243 (P). NORTH CAROLINA: E of Wilmington, *Hitchcock s.n.*, *Amer. Gr. Hb.* 88 (P). VENEZUELA. ARAGUA: carretera a Choroní, 1,300 m, *Chardon* 151 (US). DISTRITO FEDERAL: 5.5 km down road to Carayaca, between El Junquito and Colonia Tovar, *Davidse & Tillett* 4070 (MO). FALCON: sierra de San Luis, Montaña de Paraguariba, entre el hotel Parador y Curimagua, 1,300 m, *Steyermark* 85871 (VEN). LARA: selva siempreverde a lo largo de la quebrada sobre rocas calcáreas, 7 km de Barbaças, entre Barbaças y La Peña, *Steyermark* 85862 (VEN). MIRANDA: Sebastopol, *Badillo s.n.* (US 1760675). PORTUGUESA: Dto. Sucre, Fila del Helechal, 1,500–1,600 m, *Ramírez-Reyes* 2513 (PORT).

Panicum aciculare is anatomically distinct from the rest of species of section *Dichantherium* in having a narrow, inrolled leaf blade, stomata absent, and intercostal short cells occurring between

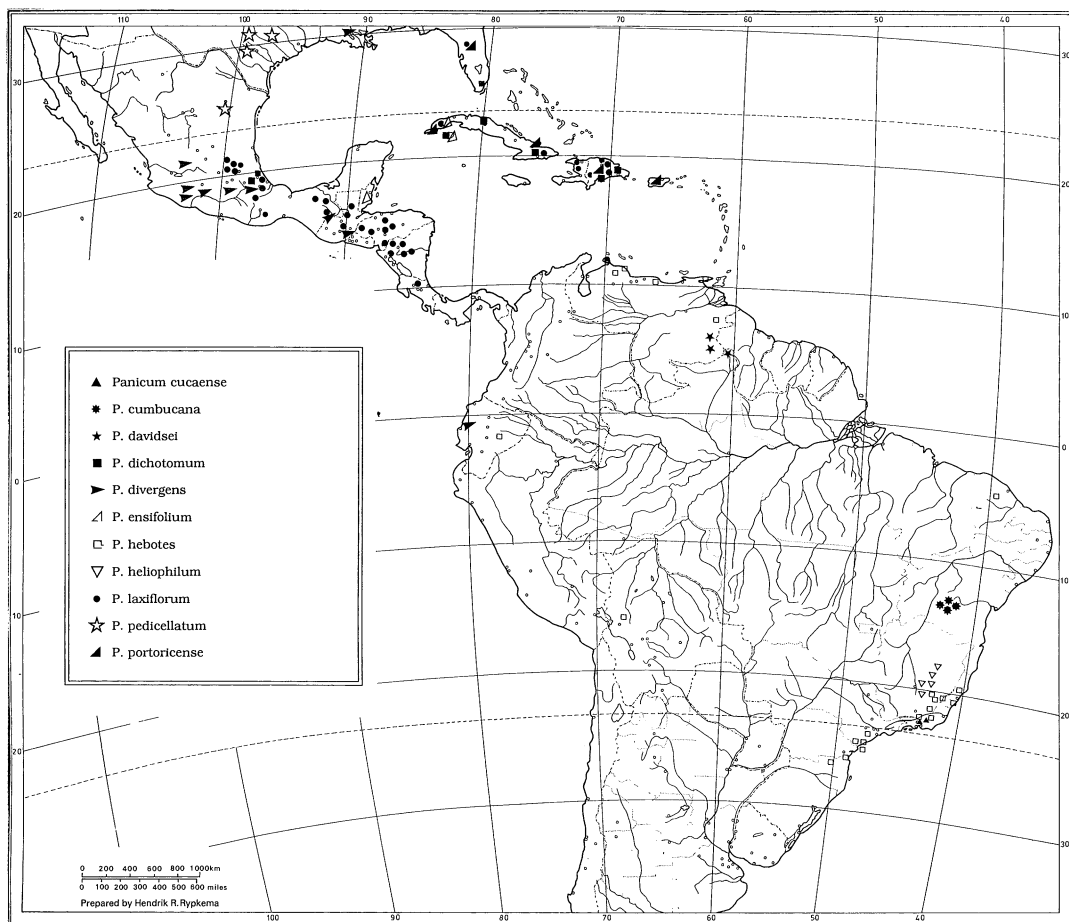


FIGURE 27. Distribution of *Panicum cucaense*, *P. cumbucana*, *P. davidsei*, *P. dichotomum*, *P. divergens*, *P. ensifolium*, *P. hebotes*, *P. heliophilum*, *P. laxiflorum*, *P. pedicellatum*, and *P. portoricense*.

the rectangular long cells. The mesophyll tissue also exhibits no pattern of cellular arrangement.

1b. *Panicum aciculare* Desv. ex Poiret var. **arenicoloides** (Ashe) Beetle, *Phytologia* 48: 192. 1981. *Panicum arenicoloides* Ashe, *J. Elisha Mitchell Sci. Soc.* 16: 89. 1900. TYPE: United States. North Carolina: New Hanover Co., near Wilmington, 7 June 1899, *Ashe s.n.* (fragment and photo, US). Figure 25.

Panicum angustifolium Elliott, *Sketch Bot. S. Carolina* 1: 129. 1816. *Panicum nitidum* Lam. var. *angustifolium* (Elliott) A. Gray, *N. Amer. Gram.* 2: 112. 1835. *Chasea angustifolia* (Elliott) Nieuwl., *Amer. Midl. Naturalist* 2: 64. 1911. *Dichantherium angustifolium* (Elliott) Gould, *Brittonia* 26: 59. 1974. TYPE: United States. South Carolina: without locality, *Elliott s.n.* (holotype, CHARL not seen; fragment and photo, US).

Panicum neuranthum Griseb. var. *ramosum* Griseb., *Cat. Pl. Cuba*: 232. 1866. *Dichantherium aciculare* (Desv. ex Poiret) Gould & C. A. Clark var. *ramosum* (Griseb.) Davidge, *Novon* 2: 104. 1992. *Panicum fusiforme* A. Hitchc., *Contr. U.S. Natl. Herb.* 12: 222. 1909. TYPE: Cuba. Without locality, anno 1863, *Wright 3454* (holotype, GOET not seen; isotypes, K, MO, NY, P, US, W, fragment and photo, US 2808979).

This variety has a similar habitat and distribution to that of variety *aciculare*.

Selected specimens cited. BELIZE. EL CAYO: Mountain Pine Ridge, San Agustín, *Lundell 6561* (US). ORANGE WALK: savanna ca. 5 km N of August Pine Ridge on the road to Trinidad, *Davide & Brant 32806* (MO). TOLEDO: Swasey Branch, Monkey River, *Gentle 3903* (MO). CUBA. ISLA DE LA JUVENTUD: San Pedro, *Britton & Wilson 14305* (US). ORIENTE: Sierra Maestra, Pinar de Bayamita, *Ekman 10329* (US). PINAR DEL RIO: 17 km S of Pinar del Río, *Hitchcock 23257* (US). SANTA CLARA: sabanas W of Manacas, *León & Cazañas 5840* (US). GUATEMALA.



FIGURE 28. Distribution of *P. itatiaiae*, *P. peristypum*, *P. petropolitatum*, *P. pycnocladus*, *P. sciurotis*, *P. sciurotoides*, and *P. scoparium*.

CHIQUIMULA: on moist pine forest bank between Guatemala–Honduras border and Atulapa, 900 m, *Molina & Molina 25283* (MO, US). HONDURAS. COMAYAGUA: Cononita pass above Siguatepeque, *Williams & Williams 18842* (US). COPAN: Hacienda Espíritu Santo to Quebrada Mojanales, *Blake 7458* (US). FRANCISCO MORAZAN: faldas de la Mt. Uyuca, entre Las Flores y Quebrada El Granadillo, *Williams & Molina 14813* (US). OCOTEPEQUE: rocky hillsides of Machuca, 900 m, *Molina & Molina 27868* (MO, US). JAMAICA. Halliss Savanna, Upper Clarendon, *Harris 12234* (US); Bull Head Mountain and vicinity, *Hitchcock 9552* (US). MEXICO. CHIAPAS: Mun. Palenque, 8–12 km N of Palenque on road to Catazaja, *Breedlove & Davidse 55333* (MO). NICARAGUA. San Rafael del Norte, 1,200–1,350 m, *Miller & Griscom 132* (US). VENEZUELA. MIRANDA: Sebastopol, *Badillo*, Aug. 1938 (US).

2. *Panicum acuminatum* Sw., Prodr. 23. 1788. *Dichantherium acuminatum* (Sw.) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1123. 1978. TYPE: Jamaica. Without locality,

Swartz s.n. (holotype, S not seen; fragment and photo, US 2808906; isotype, M).

Plants perennial, 10–35(–60) cm tall; *culms* decumbent and geniculate, then erect, branching at the middle and upper nodes; internodes 2–5 cm long, hollow, striate, densely hirsute or glabrous, nodes densely pilose with whitish retrorse hairs or glabrous. *Sheaths* 1–5 cm long, striate, greenish to purplish, short-pilose, hirsute, the margins largely ciliate or glabrous. *Ligules* membranous-ciliate, 0.2–1 mm long, with a pseudoligule formed by long, whitish hairs up to 4 mm; collar puberulous to densely pilose. *Blades* linear-lanceolate to lanceolate, 2–6.5(–9) cm long, 0.2–0.8(–1) cm wide, subcordate, acute, flat, long-hispid to glabrous on the adaxial surface and pilose on the abaxial one, the margins scabrous to ciliate, the basal ones long-ciliate. *Inflorescence* terminal, long-exserted, peduncle hispid, up to 30 cm long; panicles lax,



FIGURE 29. Distribution of *Panicum sphaerocarpon* var. *floridanum*, *P. sphaerocarpon* var. *sphaerocarpon*, *P. stigosum*, *P. stipiflorum*, and *P. strigosum*.

diffuse, multiflowered, 2–4.5(–9) cm long, 1–4(–9) cm wide; *main axis* flexuous, long hispid to nearly glabrous, glands occasionally present, first- and second-order branches flexuous, glabrous to sparsely pilose, glands occasionally present, pulvini densely pilose, pedicels terete, sparsely pilose or glabrous. Axillary panicles numerous, smaller than the terminal one, short-exserted. *Spikelets* obovoid or ellipsoid, (0.9–)1.5–2(–2.4) mm long, 0.7–1 mm wide, hispid, greenish to purplish, without an internode between the lower and upper glume, upper glume and lower lemma subequal. *Lower glume* ovate-acuminate, 0.6–0.8 mm long, $\frac{1}{3}$ – $\frac{1}{2}$ the length of the spikelet, obtuse to truncate, 1(–3)-nerved. *Upper glume* ovate, 1.5 mm long, 9-nerved. *Lower lemma* glumiform, 7–9-nerved. *Lower palea* lanceolate, small, 0.6–0.9 mm long, 0.3 mm wide, hyaline, glabrous, lower flower absent. *Upper antheridium* ovoid, 1.3–1.5 mm long, 0.9 mm wide, globose, pale, shiny. *Caryopsis* ellipsoid, 1 mm long, 0.7 mm wide, hilum punctiform, embryo $\frac{1}{3}$ the length of the caryopsis.

KEY TO THE VARIETIES

1. Spikelets 0.9–1.5 mm long, blades glabrous or sparsely pilose with hairs up to 0.1 mm long ... 2b. var. *longiligulatum*
1. Spikelets 1.5–2.4 mm long, blades usually densely pilose 2
2. Spikelets 1.5–1.9(–2.4) mm long, the leaves not densely pilose, the hairs only 0.4–1.5 mm long 2a. var. *acuminatum*
2. Spikelets 1.9–2.4 mm long, leaves densely pilose with hairs 2–4 mm long 2c. var. *villosum*

2a. *Panicum acuminatum* var. *acuminatum*. Figures 2, 3, 4, 26.

Panicum tennesseense Ashe, J. Elisha Mitchell Sci. Soc. 15: 52. 1898. *Panicum lindheimeri* Nash var. *tennesseense* (Ashe) Farwell, Amer. Midl. Naturalist 11: 45. 1928. TYPE: United States. Tennessee: La Vergne Co., 7 Aug. 1897, *Biltmore Herb.* 7087 (holotype, US).

Panicum commophyllum Nash, Bull. Torrey Bot. Club 30: 380. 1903. TYPE: Puerto Rico. Santurce, 9 Jan. 1899, *Heller & Heller 12* (holotype, NY; fragment, US 80593).



FIGURE 30. Distribution of *Panicum surrectum* and *P. viscidellum*.

Panicum olivaceum A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 225. 1910. TYPE: Guatemala. Alta Verapaz: Cobán, 1,400 m, Feb. 1888, von Tuerckheim 428 (holotype, US; fragment, US 823309; isotype, US).

Distribution and ecology: United States, Mexico, the West Indies, Mesoamerica, and northern South America in Colombia, Ecuador, and Venezuela, growing in forests, moist banks, and open ground, from sea level to 2,800 m.

Selected specimens cited. BELIZE. BELIZE: Belize International Airport, *Dwyer* 9110 (MO). CAYO: Mountain Pine Ridge, along Coona Cairn Road, *Davidse & Brant* 33054 (MO). STANN CREEK: Mullins River pine ridge, *Gentle* 8551 (US). TOLEDO: Monkey River, near Jenkins Creek, *Gentle* 4122 (MO, US). COLOMBIA. ANTIOQUIA: Medellín, 2,000 m, *Archer* 1077 (US). BOYACA: entre Chinavita y Tibaná, 1,700 m, *Zuloaga & Londoño* 4119, 4120 (COL, MO, SI). CAUCA: de Balboa a Argelia, 10 km de Balboa, 2,180 m, *Zuloaga & Londoño* 4202* (MO,

SI). CUNDINAMARCA: subida a Alto del Tigre, 1,700 m, *Zuloaga* 4025 (COL, MO, SI). MAGDALENA: Santa Marta, *Smith* 2140 (G, K, MO, NY, P, US). NARIÑO: San José de Albán, 1,800 m, *Martínez & Martínez* 59 (COL). RISARALDA: Mun. Santuario, vereda San Rafael, Los Planes, por la carretera hacia Pueblo Rico, 2,000 m, *Camargo & Londoño* 7281 (COL). VALLE DEL CAUCA: Hoya del Río Cali, Pichinde, *Cuatrecasas* 18559 (US). COSTA RICA. CARTAGO: La Estrella, *Standley* 39320 (US). GUANACASTE: Cordillera de Guanacaste, Volcán Rincón de la Vieja, Hacienda Guachipelín, *Pohl & Davidse* 11676 (US), 11677 (MO). SAN JOSE: between Aserrí and Tarbaca, 1,900 m, *Standley* 34048 (US), 1,675 m, *Davidse & Pohl* 972 (MO). CUBA. ISLA DE LA JUVENTUD: near Nueva Gerona, *Curtiss* 307 (G, M, P, US). ORIENTE: Sierra Maestra, Pinar de Bayamita, *Ekman* 10330 (G, US). PINAR DEL RIO: environs de Sumidero, *León & Schafer* 3472 (P, US). SANTA CLARA: at the mines of Motembo, *Ekman* 16841 (US). DOMINICAN REPUBLIC. Loma de la Sal, 1,300–1,400 m, *Liogier* 13365 (NY). LA VEGA: vicinity of Jarabacoa, 500–1,200 m, *Allard* 14508 (US). SAN JUAN: Sabana Nueva, Cordillera Central, N of Río Arriba, 6,200 ft., *Howard* 9162 (P, US). ECUADOR. IM-



FIGURE 31. Distribution of *Panicum superatum*, *P. telmatum*, and *P. umbonulatum*.

BABURA: Collapi, 840 m, *Acosta-Solis 12834* (F, US). PICHINCHA: without locality, *Padilla 1122* (MO). EL SALVADOR. CHALATENANGO: along Hwy. 4, 4 km SSE of La Palma, *Pohl & Davidse 11894* (MO). GUATEMALA. ALTA VERAPAZ: along Río Cachá, 1,360 m, *Standley 89929* (US). EL QUICHE: 2 km NW of Nebaj, *Metzler 21* (MO). HUEHUETENANGO: Cerro Cananá, between Nucapuxlac and Cananá, Sierra de los Cuchumatanes, 2,500–2,800 m, *Steyermark 49025* (US). IZABAL: trail from Los Amantes to Izabal, *Blake 7739, 7762, 7780* (US). PETEN: 1 km N of Poptún, *Harmon & Dwyer 2708* (MO). SOLOLA: pine woods bordering Río Bravo, in vicinity of Finca Mocá, S-facing slopes of Volcán Atitlán, 1,000 m, *Steyermark 47958* (US). HAITI. Massif de la Selle, Grand-Cosier, *Ekman 6856* (G). HONDURAS. COMAYAGUA: Zacate, La Libertad, *Caballero 124* (MO). COPAN: Hacienda Espíritu Santo, *Blake 7436* (US). EL PARAISO: Las Casitas, *Swallen 11075* (US). FRANCISCO MORAZAN: Mt. Uyuca, near Zamorano, 1,500 m, *McKee 11293* (US). OCOTEPEQUE: ca. 8 km SW of Santa Fe, near Guatemala border, *Williams et al. 31265* (MO). OLANCHO: Mata de Tarro, cerca de 18 km NE de Pisijire, *Nelson & Clewell 656* (MO). JAMAICA. Abbey Green, in the Blue Mountains, 1,200 m, *Hitchcock s.n., Amer. Gr. Hb. 133* (P, US, W). MEXICO.

CHIAPAS: Mun. Las Margaritas, near albergue Tizscao, along W side of Lago Tizscao, 1,450 m, *Davidse et al. 29845* (MO). TABASCO: near the 21 km post W of Huimanguillo on the Huimanguillo–Francisco Rueda road, *Davidse & Davidse 9368* (MO). NICARAGUA. CHONTALES: along road from Juticalpa NE toward La Libertad, ca. 17.4 km NE of Río Mayales, at ford of Río El Bizcocho, *Stevens 4118* (MO). ZELAYA: Puerto Isabel, *Atwood 2941* (MO). PANAMA. CHIRIQUI: El Boquete, *Killip 4525a* (US), *Davidson 766* (MO). PUERTO RICO. Maricao, *Sintenis 355* (G, M, US, W). UNITED STATES. ARKANSAS: Clark County, *Demaree 66629* (MO). MARYLAND: Without locality, *Zuloaga 2490** (SI). MISSOURI: Franklin County, Shaw Arboretum of the Missouri Botanical Garden, near Gray's Summit, *Davidse & Ellis 30807**, *30825** (MO). VIRGINIA: Alexandria, *Zuloaga 2492** (SI). VENEZUELA. ARAGUA: Colonia Tovar, 1,900 m, *Pittier 9962* (VEN). DISTRITO FEDERAL: Sabanas de El Junquito, 2,000 m, *Pittier 13773* (VEN). MIRANDA/DISTRITO FEDERAL: Campamento Las Rocas, below Topo Galindo, W of Pico Naiguata, Cordillera de la costa, *Tillett et al. 27* (VEN). MERIDA: 7 km SE of Santo Domingo along Mérida–Barinas highway, 1,700 m, *Davidse 3201* (MO). TRUJILLO: La Cristina, *Tamayo 1861* (US, VEN).



FIGURE 32. Distribution of *Panicum sabulorum* var. *cordatum*, *P. sabulorum* var. *polycladum*, and *P. sabulorum* var. *sabulorum*.

A sample of five specimens from both North America and South America was studied anatomically. The anatomical variation exhibited by the specimens originating from either continent is no greater than the variation observed between specimens from the same continent. The transectional anatomy clearly shows this trend. Only two of the specimens from the United States have a slightly differentiated midrib (Fig. 3A), whereas the other two North American specimens, as well as the South American specimens, all only have median vascular bundles (Fig. 2A). The semiradiate nature of the chlorenchyma tissue arrangement and bundle sheath extensions are consistent features of all the specimens.

Panicum acuminatum is the only species studied in which the anatomy of the basal rosette leaves was compared with that of the upper culm leaves. This comparison indicates that the rosette leaves

lack adaxial ribs and furrows and have a denser mesophyll than the upper leaves (Fig. 4).

2b. *Panicum acuminatum* var. *longiligulatum* (Nash) Lelong, *Brittonia* 36: 270. 1984. *Panicum longiligulatum* Nash, *Bull. Torrey Bot. Club* 26: 574. 1899. *Dichantherium acuminatum* (Sw.) Gould & Clark var. *longiligulatum* (Nash) Gould & Clark, *Ann. Missouri Bot. Gard.* 65: 1127. 1978. *Dichantherium longiligulatum* (Nash) Freckmann, *Phytologia* 48: 102. 1981. TYPE: United States. Florida: Franklin Co., Apalachicola, anno 1892, *Vasey s.n.* (holotype, NY; photo and fragment, US 78339). Figure 26.

Panicum leucothrix Nash, *Bull. Torrey Bot. Club* 24: 41. 1897. *Panicum acuminatum* Sw. var. *leucothrix* (Nash) Lelong, *Brittonia* 36: 271. 1984. *Dichantherium leucothrix* (Nash) Freckmann, *Phy-*

tologia 58: 101. 1981. TYPE: United States. Florida: Lake Co., near Eustis, July 1894, *Nash 1338* (holotype, NY; isotypes, US 208336, 742828, 742830).

Panicum wrightianum Scribner, U.S.D.A. Div. Agrost. Circ. 11: 44. 1898. *Dichantheium acuminatum* (Sw.) Gould & Clark var. *wrightianum* (Scribner) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1126. 1978. *Dichantheium wrightianum* (Scribner) Freckmann, Phytologia 48: 101. 1981. TYPE: Cuba. Without locality, *Wright 3463* (holotype, US 2808947; isotype, G).

Panicum pilatum Swallen, Fieldiana, Bot. 28: 26. 1951. TYPE: Venezuela. Sucre: Cerro Turimiquire, rocky sandstone summit of E peak, 2,500 m, 6 May 1945, *Steyermark 62606* (holotype, US 1911673; isotypes, F, NY).

Distribution and ecology: United States, Mexico, the West Indies, Mesoamerica, Colombia, and Venezuela, 0–2,500 m, in open, wet savannas on sandy soils and forest edges.

Selected specimens cited. BELIZE. BELIZE: ca. 6 km N of Sand Hill along the old Northern Highway to Maskall, *Davidse & Brant 32844* (MO). CAYO: Mountain Pine Ridge, Baldy Beacon and vicinity, *Davidse & Brant 33069* (MO, SI). STANN CREEK: in pine ridge, Commerce Bight Pine Ridge, *Gentle 8170* (US). TOLEDO: savanna between the foothills of the Maya mountains at Chun Bank and the Southern Highway, *Davidse & Brant 32452* (MO, SI). COLOMBIA. SANTANDER: Mesa de los Santos, 1,500 m, *Killip & Smith 15193* (MO, US). CUBA. ISLA DE LA JUVENTUD: Santa Bárbara, white-sand savannas, *Alain & Killip 2108* (US). PINAR DEL RIO: Arroyo Mántua, *Ekman 10937* (G, US). DOMINICAN REPUBLIC. Cordillera Central, Prov. de Samana, Sabana de la Mar, *Ekman 15636* (G, US). HONDURAS. GRACIAS A DIOS: alrededores de Puerto Lempira, *Gorgun 18* (MO). MEXICO. CHIAPAS: Mun. Ocosingo, a 16 km al NW de Boca Lacantum, camino a Palenque, *Martínez 16348* (MO). NICARAGUA. Comarca del Cabo, Puente Pozo Azul, *Seymour 4576, 4741, 4743* (MO). ZELAYA: Puerto Cabezas, *Svenson 4486* (MO, SI). VENEZUELA. ANZOATEGUI: Distrito Libertad, ridges and tops of Montañas Negras, along the Sucre and Anzoátegui border, 20 airline km NE of Bergantín, NE of Buenos Aires, Serranía de Turimiquire, *Davidse & González 19537, 19611* (MO, SI). LARA: Dto. Morán, hacia las “filas de las vacas,” 1 km del caserío La Peña a 16.5 km de Humocar Alto, *Burandt Jr. V0383* (MO).

2c. *Panicum acuminatum* var. *villosum* (A. Gray) Beetle, Phytologia 48: 192. 1981. *Panicum nitidum* Lam. var. *villosum* A. Gray, N. Amer. Gram. & Cyp. 2: 111. 1835. *Dichantheium acuminatum* (Sw.) Gould & Clark var. *villosum* (A. Gray) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1124. 1978. *Panicum ovale* Elliott var. *villosum* (A. Gray) Le-long, Brittonia 36: 272. 1984. TYPE: United States. New York: Ontario Co., without locality, *Sartwell s.n.* (isotype, MO).

Panicum villosissimum Nash, Bull. Torrey Bot. Club 23: 149. 1896. TYPE: United States. Georgia: Bibb Co.,

Ocmulgee River, swamp below Macon, 18–24 May 1895, *Small s.n.* (holotype, NY; isotypes, NY, US). *Panicum pseudopubescens* Nash, Bull. Torrey Bot. Club 26: 577. 1899. TYPE: United States. Alabama: Lee Co., Auburn, 7 May 1898, *Earle & Baker 1537* (holotype, NY; isotype, US).

Distribution and ecology: widespread in the eastern United States; also in Mexico, Honduras, Guatemala, and Nicaragua, in forests up to 2,500 m.

Selected specimens cited. GUATEMALA. CHIMALTENANGO: near Río Pixcayó, between Chimaltenango and San Martín Jilotepeque, *Standley 64360* (F). HUEHUETENANGO: around Laguna de Oculibá, E of Huehuetenango, 1,900 m, *Standley 82760* (F, US). HONDURAS. FRANCISCO MORAZAN: vicinity of Suyapa, 1,200 m, *Swallen 11287* (MO). MEXICO. CHIAPAS: Mun. Teopisca, marsh near Teopisca, 1,800 m, *Breedlove & Davidse 54820* (MO). OAXACA: ca. 11 mi. SW of Sola de Vega along the road to Puerto Escondido, pine-oak forest on mountain slope, 2,080 m, *Davidse & Davidse 9688* (MO). SAN LUIS POTOSI: San Luis Potosí, *Schaffner 146* (NY). NICARAGUA. ESTELI: along new road from Hwy. 1 (at km 135.5 and ca. 10.6 km W of bridge at La Trinidad) to San Nicolás, ca. 9.5 km from Hwy. 1, 1,200–1,400 m; pine-oak forest, *Stevens & Montiel 14796, 17972* (MO). NUEVO SEGOVIA: 3 km N of Dipilto, pine forest on steep hills, 900 m, *Pohl & Davidse 12199* (MO).

3. *Panicum adenorhachis* Zuloaga & Morrone, Ann. Missouri Bot. Gard. 78: 154. 1991. TYPE: Brazil. Bahia: Mun. Rio de Contas, 6–10 km ao NO de Rio de Contas, na estrada para o Pico das Almas, 13°32'S, 41°53'W, 1,000 m, 21 July 1979, *Mori, King, dos Santos & Hage 12451a* (holotype, CEPEC; isotypes, MO, US). Figure 25.

Plants perennial; culms trailing, leaning over vegetation, many-noded, sparingly branched, internodes cylindrical, hollow, glabrous, nodes brownish, short-pilose or glabrous. *Sheaths* striate, caducous, glabrous, covered with small glands, the margins long-ciliate; collar short-pilose. *Ligule* 0.2–0.6 mm long, a ciliate membrane. *Blades* narrowly lanceolate, 4–6 cm long, 0.3–0.5 cm wide, flat, subcordate, the adaxial surface scabrous, the abaxial surface glabrous and covered with small glands; margins long-ciliate with tuberculate hairs near base, otherwise scabrous. *Inflorescence* terminal, a lax, diffuse panicle 5–7 cm long, 4–5 cm wide, few-flowered; *main axis* flexuous and glandular, the nodes distant; first-order branches widely divergent, solitary at each node with scabrous and glandular axes and long-pilose axils; spikelets solitary and widely spaced; pedicels claviform, short-pilose. Axillary panicles similar to the terminal one. *Spikelets* narrowly ellipsoid, 2.7–3 mm long, 0.9 mm

wide, upper glume and lower lemma short-hispid and subequal, without a stipe between the lower and upper glume. *Lower glume* 0.7–0.8 mm long, less than $\frac{1}{3}$ the length of the spikelet, acuminate, nerveless or 1-nerved, hyaline. *Upper glume* 9-nerved. *Lower lemma* 9-nerved. *Lower palea* lanceolate, 1.8 mm long, 0.4 mm wide, hyaline, ciliolate on the margins; lower flower absent. *Upper anthercium* narrowly ellipsoid, 2.3 mm long, 0.8 mm wide, stramineous, brownish at maturity, papillose with simple papillae in longitudinal rows; lemma short-mucronate and with small microhairs at the apex; rachilla prolonged beyond the upper anthercium as a short mucro. *Caryopsis* ellipsoid, brownish, 1.5 mm long, 0.7 mm wide; hilum punctiform, embryo less than half the length of the caryopsis.

Distribution and ecology: known only from Pico das Almas in Bahia, Brazil, growing in campos rupestres on rocky, humid soils, 1,000–1,850 m.

Additional specimens examined. BRAZIL. BAHIA: Alto do Pico das Almas, 1,850 m, 20 Feb. 1987, *Harley et al.* 24460 (K); Mun. Rio de Contas, Pico das Almas, Vertente leste, subida do pico do Campo do Queiros, 13°32'S, 41°58'W, *Harley et al.* 26437 (K, MO, SI).

Affinities of *P. adenorhachis* are discussed in Zuloaga & Morrone (1991).

4. *Panicum aequivaginatatum* Swallen, Contr. U.S. Natl. Herb. 29: 271. 1949. TYPE: Brazil. Bahia: between Bom Gosto e Olivença, 15 Mar. 1943, *Fróes 19950* (holotype, US 1910768; photo of the holotype, K; isotype, US 2146782). Figures 5, 24B, 25.

Panicum appressifolium Swallen, Mem. New York Bot. Gard. 9: 258. 1957. TYPE: Guyana. Samwaraknati (Holi-tipu), Kamarang River, Wenamu Trail, 1,100 m, 10 Nov. 1951, *Maguire & Fanshawe 32564* (holotype, F 1449017; isotypes, K, NY, P, RB).

Panicum belmonte Renvoize, Kew Bull. 37: 325. 1982. TYPE: Brazil. Bahia: 24 km SW of Belmonte, on road to Itapebí, 24 Mar. 1974, *Harley et al.* 17383 (holotype, CEPEC 10051; isotypes, K, MO, US 2955112).

Panicum thinophilum Renvoize, Kew Bull. 39: 180. 1984. TYPE: Brazil. Bahia: Mun. Salvador, Dunas do Abaeté, 17 Dec. 1976, *Araujo et al.* 96 (holotype, CEPEC; isotypes, CEN, K).

Apparently annual, 20–100 cm tall. *Culms* decumbent, rooting and branching at the lower nodes, then erect; internodes hollow, 3.5–10.5 cm long, short-hispid or glabrous, nodes compressed, pilose with appressed whitish hairs. *Sheaths* 3–8.5 cm long, usually shorter than the internodes, hispid or glabrous, striate, the margins ciliate. *Ligules* 0.3–

0.6 mm long, membranous, the apex ciliate; collar pilose with whitish hairs. *Blades* linear-lanceolate, 3.5–12 cm long, 0.5–1.3 cm wide, ascendent, hispid or glabrous, long-pilose toward the base on the adaxial surface, cordate to subcordate, acute, the margins scaberulous and ciliate, the midnerve conspicuous. *Inflorescences* exserted, a terminal, lax and diffuse panicle 10–15 cm long, 3–7 cm wide; *main axis* glabrous, flexuous, smooth, the pulvini short-pilose or glabrous, first-order branches alternate, divergent from the main axis and flexuous, pedicels smooth and glabrous, flexuous. *Spikelets* paired or solitary, ellipsoid, 1.7–2.5 mm long, 0.7 mm wide, glabrous, with a short, inconspicuous internode between the lower and upper glume. *Lower glume* ovate-acuminate, 0.9–1.3 mm long, $\frac{1}{2}$ or less the length of the spikelet, glabrous, not embracing the upper glume, 3-nerved, the nerves either anastomosing or not toward the apex. *Upper glume* usually not covering the apex of the upper anthercium, 9-nerved, the nerves anastomosing or not toward the apex. *Lower lemma* glumiform, 9-nerved. *Lower palea* linear-lanceolate, small, hyaline, glabrous; lower flower absent. *Upper anthercium* ellipsoid, 1.6–1.9 mm long, 0.6 mm wide, with simple papillae, apiculate; stigmas whitish. *Caryopsis* ellipsoid, brownish, hilum punctiform, embryo $\frac{1}{3}$ or less the length of the caryopsis.

Distribution and ecology: occurring in Venezuela, in the states of Bolívar and Amazonas, Guyana, and northern Brazil, from 900 to 2,000 m. Frequent in savannas or mountain slopes, in sandy soils in Venezuela; in Brazil it grows in sandy soils of campos rupestres and restingas.

Additional specimens examined. BRAZIL. BAHIA: El Salvador, coastal dunes 2 km N of town of Itapua, near sea level, *Plowman & Almeida 10045* (CEPEC, MO, US); Estrada de Bom Gosto a Olivença, *Fróes 19950* (US); Lençóis, along BR 242, ca. 15 km NW of Lençóis at km 225, *Mori & Boom 14257* (CEPEC, MO); caminho de Maraú a Ubaitaba, 15 km de Maraú, *Zuloaga et al.* 2469* (MO, RB, SI, US); margen da Rodovia Camacã-Canavieiras, 32 km W de Canavieiras, *Belém 1692* (CEPEC, IAN, NY, SI, UB, US); rodovia Brasília-Fortaleza, BR-242, 8 km da estrada para Lençóis, campo rupestre, *Coradin et al.* 6530 (CEN, K, MO, SP). RIO DE JANEIRO: restinga de Jacarepaguá, do lado NW da Pedra de Itaúna, *Sucre 5349* (RB, SI); Guanabara, estrada BR-6, *Hoehne 5991* (SI, SP); Rio de Janeiro, próximo ao Recreio dos Bandeirantes, *Hoehne 5789* (SI, SP). RORAIMA: Mt. Roraima, Philipps Camp, 5,200–6,000 ft., *Tate 281* (NY, US). GUYANA. Pakaraima Mountains, Mt. Aymatoi, *Maas et al.* 5769 (K, MO, NY, US). VENEZUELA. AMAZONAS: Cerro de la Neblina, Río Yatua, along Cañón Grande E of Cumbre Camp, 1,100 m, *Maguire et al.* 42193 (NY, P, US, VEN). BOLIVAR: La Gran Sabana, km 167, S of El Dorado along highway to Santa Elena, 24 km S of La

Ciudadela, *Davidse 4762* (MO, SI, VEN); la Gran Sabana, a 2 km al sur de La Ciudadela, 5°47'N, 61°25'W, 1,300 m, *Zuloaga et al. 4408* (MO, SI, VEN); a 3 km al N de Kamoirán, Gran Sabana, 5°35'N, 61°20'W, 1,100 m, *Zuloaga et al. 4470** (MO, SI, VEN); Uaipán-tepui, near the top of Salto Hacha on plateau at S foot of the peak of Uaipán, *Koyama & Agostini 7391* (VEN); Mun. Gran Sabana, inmediaciones del Monumento al Soldado Pionero, 38.5 km al S del sitio "Piedra de la Virgen," *Huber et al. 12908* (MYF, SI).

This species is related to *P. pycnocladus* and *P. sciurotooides*, but has spikelets intermediate in size between both species. It also differs from *P. sciurotooides* in that the latter species has cordate and amplexicaulous leaves, the main inflorescence axis hirsute, and usually pilose spikelets. *Panicum pycnocladus* differs from *P. aequivaginatatum* by its cordate and amplexicaulous, asymmetrical leaf blades, smaller inflorescences, 3–6(–10) cm long, spikelets 2.2–3(–3.3) mm long with a conspicuous internode between the lower and upper glume; lower glume $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet.

Panicum thinophilum only represents a depauperate variant of *P. aequivaginatatum* with profusely branching culms and axillary panicles.

- 5. *Panicum assurgens*** Renvoize, Kew Bull. 37: 325. 1982. TYPE: Brazil. Bahia: on road to Abaira, ca. 8 km to N of the town of Rio de Contas, 13°33'S, 41°47'W, 1,000 m, 18 Jan. 1972, *Harley et al. 15229* (holotype, CEPEC; isotypes, K, MO, NY, US 2955120). Figures 24A, 25.

Probably perennial. *Culms* leaning on adjacent vegetation, to 2 m long, internodes 4–10 cm long, cylindrical, glabrous; nodes glabrous, compressed. *Sheaths* 3–7 cm long, shorter than the internodes, striate, sparsely hispid, with one margin ciliate, the other glabrous. *Ligules* membranous, the membranous portion 0.2 mm long, short-pilose at the apex with hairs nearly 0.1 mm long; collar shortly pilose. *Blades* linear-lanceolate, 8–12 cm long, 0.7–1 cm wide, flat, sparsely hispid, attenuate at base and with the apex acute, the margins finely scabrous. *Inflorescences* terminal, long-exserted, lax, diffuse, 12–15 cm long, 7–10 cm wide, first-order branches whorled toward the base of the inflorescence, otherwise subopposite or alternate, axis of the branches flexuous, glabrous, eglandular, pulvini glabrous, pedicels glabrous. *Spikelets* ellipsoid, 3.3 mm long, 1.2 mm wide, glabrous or sparsely pilose between the nerves, greenish, without a conspicuous internode between the lower and upper glume, upper glume and lower lemma subequal. *Lower glume* ovate-lanceolate, 2.1–2.7 mm

long, $\frac{3}{4}$ – $\frac{1}{2}$ the length of the spikelet, not embracing the upper glume at its base, glabrous, 3-nerved, the nerves anastomosing toward the apex. *Upper glume* 2.7 mm long, as long as the lower lemma or a little shorter and not covering the apex of the upper anthercium, 9-nerved. *Lower lemma* 9-nerved, 2.7–2.9 mm long. *Lower palea* lanceolate, 2 mm long, 0.3 mm wide, hyaline, sparsely pilose; lower flower absent. *Upper anthercium* ellipsoid, 2.7 mm long, 1 mm wide, papillose, upper lemma slightly apiculate, the upper margins indurate, sparsely pilose at the apex. *Caryopsis* ellipsoid, 2.1 mm long, 0.9 mm wide; hilum punctiform, embryo $\frac{1}{3}$ or less the length of the caryopsis.

Distribution and ecology: known only from the type collection, where it grows at edges of forests in the state of Bahia, Brazil, at approximately 1,000 m.

- 6. *Panicum cabreræ*** Zuloaga & Morrone, Ann. Missouri Bot. Gard. 78: 156. 1991. TYPE: Brazil. Bahia: Mun. Rio de Contas, Pico das Almas, a 18 km ao SNW de Rio de Contas, 13°33'S, 41°57'W, 1,600–1,850 m, 22 July 1979, *Mori, King, dos Santos & Hage 12475* (holotype, CEPEC; isotypes, MO, US). Figure 26.

Perennial. *Culms* ca. 50 cm tall, leaning on vegetation, sparingly branching, internodes cylindrical, hollow, sparsely pilose with whitish hairs, nodes many, densely pilose with long whitish hairs. *Sheaths* striate, 1.5–2 cm long, longer than the internodes, long-hispid, the margins pilose with whitish hairs, more so toward the upper portion; auricles small, pilose; collar pilose. *Ligules* ciliate-membranous ca. 0.2 mm long. *Blades* linear-lanceolate, 4–6 cm long, 2 mm wide, attenuate at base, acuminate at apex, the margins involute, densely pilose and scabrous, with long, whitish hairs on both surfaces, deciduous at maturity. *Inflorescence* terminal, a lax, diffuse panicle 4.5–6 cm long, 3.5–6 cm wide, peduncles hispid, 5–7 cm long; *main axis* cylindrical, densely hispid on the lower portion, otherwise glabrous, the nodes distant; first-order branches alternate, divergent and reflexed, hispid basally, glabrous distally, pulvini pilose to glabrous; pedicels claviform, smooth, glabrous, 2–9 mm long. *Spikelets* solitary, ellipsoid, 2–2.3 mm long, 0.8–0.9 mm wide, plano-convex, hirsute, with whitish hairs on the glumes and lower lemma. *Lower glume* 1.1–1.3 mm long, $\frac{1}{2}$ or more the length of the spikelet, 3-nerved, acute, a small stipe present between the lower and upper glume. *Upper glume* 9-nerved, nerves anastomosing toward the apex.

Lower lemma 9-nerved. *Lower palea* lanceolate, 1.5–1.8 mm long, 0.3 mm wide, glabrous, truncate, hyaline; lower flower absent. *Upper anthercium* ellipsoid, 1.9 mm long, 0.7 mm wide, papillose, with simple papillae all over its surface, glabrous or with a few microhairs toward the apiculate apex; lodicules truncate, ca. 0.2 mm long, anthers 3, 1.2 mm long; rachilla prolonged or not beyond the upper anthercium as a short mucro. *Caryopsis* obovoid, 1.1 mm long; hilum oblong, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: growing in campos rupestres, in the state of Bahia, Brazil.

Additional specimens examined. BRAZIL. BAHIA: Mun. Rio de Contas, Pico das Almas, vertente leste, subida do pico do campo N do Queiroz, 13°32'S, 41°58'W, 1,600 m, Harley, Giuliatti, Stannard & Hind 26320 (K).

Panicum cabreræ shares with *P. aciculare* a similar vegetative pattern, with linear, pilose blades, small panicles and spikelets of more or less the same size. *Panicum cabreræ* differs from *P. aciculare* in that the latter species has obovoid spikelets with the upper glume and lower lemma 7-nerved, and the lower palea absent; also, *P. aciculare* is found from the southern United States to Colombia and Venezuela.

7. *Panicum caparaense* Zuloaga & Morrone, sp. nov. TYPE: Brazil. Espírito Santo: Mun. Muñiz Freire, Rodovia BR-262, 1,000 m, 21 July 1982, Hatschbach & Guimaraes 45170 (holotype, K; isotype, MBM not seen). Figure 36.

Ligula membranacea 0.8 mm longa; lamina lanceolata 14–21 cm longa, 1 cm lata, complanata; paniculae laxae, diffusae, 23 cm longae; spiculae modice ellipsoideae, 5.9–6.8 mm longae, glabrae; gluma inferior $\frac{2}{3}$ spiculae longitudine, acuminata, 5-nervia; gluma superior 13–15 nervia; lemma inferius 13–15-nervium, palea inferior lanceolata, 5.5 mm longa, 1.2 mm lata, margine longe pilosa; anthoecium longe ellipsoideum, 5.2 mm longum, 1.6 mm latum, papillis simplicibus praeditum, necnon lemmate marginibus superioribus cristato ac piloso.

Plants perennial?, the base not seen; internodes hollow, cylindric, glabrous, nodes dark, compressed, glabrous. *Sheaths* striate, one margin ciliate, otherwise glabrous. *Ligules* membranous at the base and lacinate at the apex, 0.8 mm long, brownish, surmounted by long whitish hairs on the adaxial surface of the blade; collar densely and shortly pilose. *Blades* lanceolate, 14–21 cm long, 1 cm wide, flat, attenuate at the base and apex, the adaxial surface with scattered, appressed hairs, the abaxial surface glabrous, commonly purplish,

the margins ciliate. *Inflorescence* terminal, exserted, peduncle terete, ca. 22 cm long, glabrous; panicles lax, diffuse, 23 cm long, ca. 20 cm wide; *main axis* terete, glabrous, the pulvini brownish, glabrous; first-order branches alternate, divergent, the axis of the branches and pedicels smooth, glabrous. *Spikelets* solitary, narrowly ellipsoid, 5.9–6.8 mm long, glabrous. *Lower glume* 4.1 mm long, $\frac{2}{3}$ the length of the spikelet, acuminate, 5-nerved, separated from the upper glume by a conspicuous internode. *Upper glume* scaberulous toward the apex, 13–15-nerved, the nerves anastomosing toward the apex. *Lower lemma* scaberulous toward the apex, 13–15-nerved, the nerves anastomosing toward the apex. *Lower palea* lanceolate, 5.5 mm long, 1.2 mm wide, hyaline, the margins long-pilose with whitish hairs; lower flower male, anthers ca. 3 mm long. *Upper anthercium* narrowly ellipsoid, 5.2 mm long, 1.6 mm wide, smooth, shiny, indurate, with simple papillae regularly distributed over the lemma and palea, lemma 9-nerved, crested and pilose on the upper margins, greenish at the apex, palea pilose on the upper margins; lodicules 2, conduplicate, 0.4 mm long; stamens 3, the anthers 3 mm long; styles free, stigma plumose; rachilla prolonged beyond the upper anthercium as a short mucro. *Caryopsis* unknown.

Distribution and ecology: known from the state of Espírito Santo in Brazil, where it grows in edge of forests.

Paratype. BRAZIL. ESPÍRITO SANTO: Castelo, Braço do Sul, Brade 19172 (US).

Panicum caparaense is related to *P. itatiaiae* and *P. davidsei*. *Panicum itatiaiae* has spikelets 4.6–5 mm long, the lower palea glabrous or sparsely pilose, and the leaf blades subcordate. *Panicum davidsei* has spikelets 3–3.3 mm, lower flower absent, and upper anthercium glabrous or shortly pilose.

The specific epithet makes reference to the type locality of this new species, the Serra do Caparaó in Espírito Santo, Brazil.

8. *Panicum congestum* Renvoize, Kew Bull. 37: 329. 1984. TYPE: Brazil. Bahia: 22 km NW of Lagoinha, which is 5.5 km SW of Delfino, on side road to Minas do Mimoso, 980 m, 6 Mar. 1974, Harley, Renvoize, Erskine, Brighton & Pinheiro 16869 (holotype, CEPEC 10082; isotypes, K, MO, NY, RB, US 2955113). Figure 25.

Caespitose perennial. *Culms* erect, freely branching at the upper nodes, 30–50 cm tall, rigid;

internodes elongated toward the base of the plant, terete, hollow, densely hirsute, nodes brownish, pilose. *Sheaths* persistent or deciduous, striate, densely hirsute, the margins membranous. *Ligules* membranous-ciliate, ca. 1 mm long, with whitish hairs; collar pilose. *Blades* linear-lanceolate, 1.5–5 cm long, 0.2–0.4 cm wide, congested on the culms, the margins involute, narrowed at base and acuminate at the apex, densely hirsute on both surfaces with rigid whitish hairs. *Inflorescences* with base included within the upper leaves, with a peduncle ca. 0.5 cm long; panicles 2 cm long or smaller, contracted, with only 2–3(–9) spikelets per panicle; *main axis* hirsute, flexuous, first-order branches short, the axis of the branches and pedicels densely hirsute. *Spikelets* solitary, ellipsoid, 2.8–3.2 mm long, 1 mm wide, hirsute, with short-papillose hairs, upper glume and lower lemma subequal or the upper glume a little shorter. *Lower glume* 2.2–2.6 mm long, $\frac{3}{4}$ or more the length of the spikelet, acute, 5–7-nerved, the nerves anastomosing toward the apex, with a conspicuous internode between the lower and upper glume. *Upper glume* 2.6 mm long, 9-nerved. *Lower lemma* 9-nerved, glumiform. *Lower palea* lanceolate, 1.7 mm long, 0.4 mm wide, hyaline, the margins ciliate; lower flower absent. *Upper antheridium* ellipsoid, 2.4 mm long, 0.8 mm wide, papillose, with simple papillae regularly distributed over the lemma and palea, apiculate and pilose at the tip of the lemma, lemma 5-nerved; internodes conspicuous between the upper glume and the upper antheridium. *Caryopsis* ellipsoid, brownish, hilum oblong, embryo $\frac{1}{3}$ the length of the caryopsis.

Distribution and ecology: known only from campos rupestres in the state of Bahia, Brazil, where it is found on sandstone rocks at approximately 1,000 m.

This species is distinguished by its densely hirsute and profusely branching culms, hirsute sheaths and blades, and few-flowered inflorescences that are short-exserted with the base included in the upper leaves.

9. *Panicum cucaense* Zuloaga & Morrone, Ann. Missouri Bot. Gard. 78: 158. 1991. TYPE: Brazil. Rio de Janeiro: Mun. Petrópolis, Morro do Cuca, entre Vale dos Videiras e Araras, campo de altitude, 1,600 m, 27 Jan. 1983, *Martinelli & Simonis 9011* (holotype, RB; isotypes, MO, SI). Figure 27.

Caespitose, shortly rhizomatous perennial. *Culms* 20–30 cm tall, many-noded, erect to geniculate-ascending and rooting at the lower nodes, freely

branching; internodes 1–4 cm long, cylindrical, striate, glabrous; nodes compressed, glabrous, brownish. *Sheaths* striate, ca. 1.2 cm long, longer than the internodes, strongly distichous, long-pilose on the distal portion, otherwise glabrous, one margin pilose with long, whitish hairs, the other one membranous. *Ligule* ciliate-membranous, the membranous portion ca. 0.1 mm long, the ciliate portion 0.4 mm long. *Blades* linear, 1.5–5.5 cm long, 0.1–0.2 cm wide, folded, attenuate toward the apex, pilose on the adaxial surface toward the ligule, otherwise glabrous, the borders scabrous. *Primary inflorescences* lax, diffuse, few-flowered, 2–3.5 cm long, 1.5–3.5 cm wide; peduncles to 6 cm long, glabrous; *main axis* striate, flexuous, glabrous, somewhat glandular, the branches alternate, divergent and widely spaced, glabrous, the axils of the branches pilose; pedicels glabrous, 1–6 mm long. *Secondary inflorescences* similar to the terminal one. *Spikelets* ellipsoid, 2.2–2.7 mm long, 0.8–0.9 mm wide, gaping at maturity, glabrous. *Lower glume* lanceolate, 1.5–1.9 mm long, $\frac{2}{3}$ – $\frac{3}{4}$ the length of the spikelet, acuminate, 1(–3)-nerved, a small stipe present between the lower and upper glume. *Upper glume* and *lower lemma* subequal, 7–9-nerved, acute. *Lower palea* lanceolate, 1.7–1.9 mm long, 0.4–0.7 mm wide, hyaline, glabrous; lower flower absent. *Upper antheridium* narrowly ellipsoid, 2.1–2.3 mm long, 0.7–0.8 mm wide, papillose, with simple papillae evenly distributed over the lemma and palea, apiculate, the apex scabrous, otherwise glabrous; lodicules ca. 0.2 mm long; stamens 3, anthers 1.2 mm long. *Caryopsis* ellipsoid, 1.4 mm long, 0.7 mm wide, brownish; hilum oblong; embryo less than half the length of the caryopsis.

Distribution and ecology: inhabiting open and dry habitats, in rocky, granitic soils of high-altitude campos of mountains in eastern Brazil, at 2,000–2,500 m.

Additional specimens examined. BRAZIL. RIO DE JANEIRO: Teresópolis, Serra dos Orgãos, Pedra do Sino, 2,100–2,170 m, Feb. 1953, *J. Vidal II-6467, II-6485* (R, SI); Mun. Petrópolis, Vale das Videiras, Morro do Cuca, 1,800 m, 17 Apr. 1976, *Martinelli 814* (RB); without locality, *Glaziou 13319* (W).

Affinities of *P. adenorhachis* are discussed in Zuloaga & Morrone (1991).

10. *Panicum cumbucana* Renvoize, Kew Bull. 37: 332. 1982. TYPE: Brazil. Bahia: by Rio Cumbuca, 3 km S of Mucugê, near site of small dam on road to Cascavel, 850 m, 4 Feb. 1974, *Harley, Renvoize, Erskine, Brighton*

& *Pinheiro 15930* (holotype, CEPEC 10042; isotypes, K, MO, NY, US 2955114). Figures 24C, 27.

Short-rhizomatous perennial. *Culms* long decumbent, then erect, to 35 cm tall, freely branching at the upper nodes, internodes 1–2.8 cm long, hispid, hollow, nodes hispid. *Sheaths* 1–2 cm long, usually shorter than the internodes, hispid or glabrous, one margin long-ciliate, the other short-pilose. *Ligules* 0.4–0.6 mm long, shortly membranous at the base, ciliate at the apex, arcuate; collar shortly pilose. *Blades* lanceolate, 1–3 cm long, 0.3–0.6 cm wide, rigid, ascending and slightly divergent from the culms, cordate and amplexicaulous, acute, glabrous or shortly and densely hispid on both surfaces, with or without long hairs toward the base on the adaxial surface, the margins scaberulous, long-ciliate toward the base of the blades, the midnerve inconspicuous. *Inflorescences* exerted or with the base included within the upper leaves, panicles lax, few-flowered, 1–2.5(–3) cm long, 1–2 cm wide; *main axis* hispid to sparsely pilose, first- and second-order branches shortly pilose, divergent, eglandular, the pulvini pilose; pedicels sparsely pilose. *Spikelets* solitary or paired, ellipsoid, 1.9–2.4 mm long, 0.6–0.8 mm wide, shortly hispid or glabrous, upper glume and lower lemma subequal. *Lower glume* ovate, 1–1.3 mm long, 0.9 mm wide, ½ the length of the spikelet, pilose or glabrous, not embracing the upper glume at its base, (1–)3-nerved, with a conspicuous internode ca. 0.3 mm long between the lower and upper glume. *Upper glume* 1.5–1.9 mm long, pilose, 7–9-nerved, usually not covering the apex of the upper antherium. *Lower lemma* 1.5–1.9 mm long, glumiform. *Lower palea* linear-lanceolate, 1.2–1.5 mm long, 0.2–0.3 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 1.5–1.8 mm long, 0.5–0.7 mm wide, pale, indurate, papillose, and pilose; lemma 5-nerved, palea 2-nerved, anthers 0.9 mm long, purplish. *Caryopsis* ellipsoid, 1.2–1.5 mm long, 0.2–0.3 mm wide; hilum punctiform, embryo less than ½ the length of the caryopsis.

Distribution and ecology: found in campos rupestres in the state of Bahia, Brazil, in sandy, rocky soils from 900 to 1,400 m.

Additional specimens examined. BRAZIL. BAHIA: 10 km NW of Mucugê, *Mori et al. 12698* (CEPEC, MO, SI, US); Serra do Sincorá, 2–3 km approximately SW of Mucugê on the road to Cascavel, 950 m, *Harley et al. 18329* (CEPEC, MO, NY, US); Mucugê, Serra do Sincorá, 7 km N of Mucugê on road to Andaraí, growing in small patches under Velloziaceae and other plants, *Calderón et al. 2425** (SI, US); Mucugê, Serra do

Sincorá, 26 km S of Andaraí, 1,000 m, on rocks, between mosses with water running over, *Calderón et al. 2414* (US); Mun. Mucugê, Rio Apiaba, *Hatschbach 48266* (CTES, K, US); Serra do Rio de Contas, lower N slopes of the Pico das Almas, ca. 25 km WNW of the town of Rio de Contas, *Harley et al. 15420* (CEPEC, K, NY, US); Mun. Mucugê, Rio Mucugê, *Hatschbach 47961* (K); Serra Larga a W de Lençóis, perto de Caeté-Açu, Mun. Lençóis, 1,400 m, 19 Dec. 1984, *Harley et al. s.n.* (K, MO); Mun. Jacobina, scrub and woodland with *Vellozia*, hills of marble rock on N side of Jacobina, 600–650 m, *Webster et al. 25725* (MO); estrada entre Andaraí–Mucugê, *Noblick & Pinto 2870* (K).

Panicum cumbucana is closely allied to, and perhaps conspecific with *P. stipiflorum*, which only differs by having leaf blades 2–4.5 cm long, usually not overlapping, and inflorescences 3–4.5 cm long. The culms and leaf blades are usually purplish in *P. cumbucana*, and the blades are, in many cases, overlapping.

Anatomically, the abaxial epidermis of *P. cumbucana* closely resembles that of *P. hebotos*, *P. peristypum*, and *P. sciurotoides* due to the numerous, needlelike macrohairs without cushion bases and because of the short, angular, intercostal cells, which resemble bulliform cells in surface view. However, in transverse section this resemblance is not so evident because *P. cumbucana* does not have well-developed adaxial ribs and furrows and lacks a keel (Fig. 6A, B).

11. *Panicum davidsei* Zuloaga & Morrone, *Ann. Missouri Bot. Gard.* 78: 158. 1991. TYPE: Venezuela. Bolívar: Cabanayén, La Gran Sabana, wet inundated savanna, 1,300, 3 Dec. 1973, *Davidse, Ramia & Montes 4796* (holotype, MO). Figures 7, 27.

Perennial. *Culms* decumbent, rooting and branching at the lower nodes, then becoming erect, leaning or not on vegetation, to 2.2 m long, internodes 8–22 cm long, cylindrical, striate, hispid, compressed, nodes hirsute. *Sheaths* 5–8 cm long, sparsely hirsute with long-tuberculate hairs, one of the margins long-ciliate, the other one membranous; collar long-pilose with whitish hairs. *Ligules* membranous-ciliate, ca. 0.2 mm long. *Blades* narrowly lanceolate, 9–13 cm long, 1–1.3 cm wide, flat, subcordate, the apex acuminate, the adaxial surfaces long-pilose toward the base, otherwise glabrous, the abaxial surfaces sparsely pilose, the margins scabrous and ciliate toward the base, the midnerve conspicuous. *Inflorescence* terminal, long-exserted, a lax, diffuse panicle 12–20 cm long and 7–12 cm wide, peduncle 10–40 cm long; *main axis* cylindrical, striate, pilose near the branches, otherwise glabrous, eglandular, lower branches

whorled, the upper ones subopposite to alternate, the axis of the branches flexuous, glabrous, eglandular, the pulvini pilose; pedicels glabrous, flexuous. *Spikelets* ellipsoid, 3–3.3 mm long, 1 mm wide, scaberulous, attenuate toward the base and with a small stipe between the lower and upper glume, upper glume and lower lemma subequal with manifest nerves. *Lower glume* ovate-acuminate, 1.5–1.8 mm long, nearly $\frac{1}{2}$ the length of the spikelet, 3-nerved. *Upper glume* 2.4–2.7 mm long, not covering the apex of the upper antherium, 11–14-nerved, the nerves anastomosing toward the apex. *Lower lemma* ca. 2.7 mm long, 10–12-nerved, the nerves anastomosing toward the apex. *Lower palea* lanceolate, 2.1–2.4 mm long, 0.3 mm wide, glabrous, hyaline; lower flower absent. *Upper antherium* ellipsoid, 2.4–2.7 mm long, 1 mm wide, papillose, apiculate, the lemma with a green, scabrous crest on the apex and with the upper margins membranous, prolonged toward the apex as small wings; rachilla prolonged beyond the upper antherium as a small mucro; lodicules ca. 0.4 mm long; stamens 3, anthers ca. 1.2 mm long. *Caryopsis* ellipsoid, 1.8 mm long, 0.9 mm wide, hilum punctiform, embryo $\frac{1}{3}$ the length of the caryopsis.

Distribution and ecology: found in Bolívar Venezuela, and Roraima, Brazil, on forest edges (where it leans on the vegetation), or in open places in sandy soils, 1,200–1,300 m.

Additional specimens examined. BRAZIL. RORAIMA: Aldeia do Tuchana, *Rondón s.n.*, July 1927 (RB 110786). VENEZUELA. BOLIVAR: entre piedra de La Virgen y la parte alta de la Escalera, carretera a la Gran Sabana, 6°00'N, 61°25'W, 1,300 m, *Zuloaga et al.* 4406* (MO, SI, VEN); a 1 km al S del Puente Sakaika, Gran Sabana, 1,200 m, *Zuloaga et al.* 4427* (MO, SI, VEN).

Affinities of *P. adenorhachis* are discussed in Zuloaga & Morrone (1991).

The large number of nerves in the upper glume and lower lemma of this new species suggests a relationship to *P. itatiaiae* and *P. caparaense*, species from eastern Brazil with spikelets 4.6–6.8 mm long.

Panicum davidsei has a thick leaf blade without a midrib, well-developed adaxial ribs and furrows, and conspicuous, long bundle sheath extensions (due to the thickness of the lamina) (Fig. 7A–C).

12. *Panicum dichotomum* L., Sp. Pl.: 58. 1753. *Dichantherium dichotomum* (L.) Gould, Brittonia 26: 59. 1974. TYPE: United States. Virginia: "Habitat in Virginia," Clayton 458 (lectotype, BM not seen; photo and fragment, US 2808912).

Perennial. *Culms* decumbent, 10–25(–80) cm long, fasciculate and densely branching at the middle and upper nodes, internodes glabrous, cylindrical, hollow, nodes glabrous or short-pilose. *Sheaths* glabrous, glandular or eglandular, the margins membranous, one margin long-ciliate. *Ligules* membranous-ciliate, 0.1–0.6 mm long; collar glabrous. *Blades* linear-lanceolate, 2–7 cm long, 0.2–0.5(–1.2) cm wide, flat or slightly involute, glabrous to sparsely pilose, narrowed at the base, attenuate at the apex, the margins scaberulous, cartilaginous or not, usually ciliate toward the base, otherwise glabrous. *Inflorescences* terminal, short- to long-exserted, peduncle glabrous, 3–16 cm long; panicles 1–5 cm long, 1–3 cm wide, lax, few-flowered; *main axis* scabrous or glabrous, glandular or eglandular, the pulvini glabrous, first-order branches alternate, divergent, glandular or eglandular; pedicels flexuous, 2–9 mm long, scabrous or glabrous. Axillary panicles similar to the terminal one. *Spikelets* solitary, obovoid or ellipsoid, 1.4–2.3 mm long, 0.6–1 mm wide, glabrous or shortly hispid, greenish or tinged with purple, the upper glume and lower lemma subequal. *Lower glume* ovate, 0.3–0.7 mm long, $\frac{1}{4}$ to $\frac{1}{3}$ the length of the spikelet, obtuse to truncate, glabrous, nerveless or 1-nerved. *Upper glume* 1.2–1.8 mm long, not covering the apex of the upper antherium, 7-nerved, separated from the lower lemma by a short internode. *Lower lemma* 1.2–1.7 mm long, glumiform, 7-nerved. *Lower palea* lanceolate, small, 0.8–1 mm long, 0.3 mm wide, glabrous, hyaline; lower flower absent. *Upper antherium* obovoid, 1.1–1.7 mm long, 0.7–1 mm wide, pale, indurate, acute, papillose, scaberulous toward the apex. *Caryopsis* obovoid, dark, 1.2 mm long, 0.8 mm wide; hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

KEY TO THE VARIETIES

1. Blades without cartilaginous margins; spikelets 1.8–2.3 mm long 12a. var. *dichotomum*
1. Blades with cartilaginous margins; spikelets 1.4–1.6 mm long 12b. var. *tenue*

12a. *Panicum dichotomum* var. *dichotomum*. Figure 27.

Panicum nitidum Lam., Tabl. Encycl. 1: 172. 1791. *Panicum dichotomum* L. var. *nitidum* (Lam.) Alph. Wood, Class-Book Bot., ed. 3: 786. 1861. TYPE: United States. "E. Carolina," *Fraser s.n.* (holotype, P-LAM; fragment and photo, US 80880).

Panicum nodiflorum Lam., Encycl. 4: 744. 1798. *Panicum dichotomum* L. var. *nodiflorum* (Lam.) Griseb., Cat. Pl. Cuba 234. 1866. TYPE: United States. South Carolina: without locality, *Fraser s.n.* (holotype, P-LAM; fragment and photo, US 2808963).

- Panicum barbuiatum* Michaux, Fl. Bor. Amer. 1: 49. 1803. *Panicum dichotomum* L. var. *barbuiatum* (Michaux) Alph. Wood, Class-Book Bot., ed. 3: 786. 1861. *Panicum pubescens* Lam. var. *barbuiatum* (Michaux) Britton, Cat. Pl. New Jersey 280. 1889. *Panicum nitidum* Lam. var. *barbuiatum* (Michaux) Chapman, Fl. South. U.S., ed. 3: 586. 1897. TYPE: Canada. "Hab. in Canada P. capillari affine. Ad ripas amnis: Riviere a Jacques Cartier dicti legi," *Michaux s.n.* (lectotype, P-MICH; fragment, US).
- Panicum maculatum* Ashe, J. Elisha Mitchell Sci. Soc. 15: 44. 1898, non Aublet 1775. *Panicum yadkinense* Ashe, J. Elisha Mitchell Sci. Soc. 16: 85. 1900. *Panicum dichotomum* L. var. *yadkinense* (Ashe) Lelong, Brittonia 36: 266. 1984. TYPE: United States. North Carolina: Wake Co., Raleigh, May 1895, *Ashe s.n.* (lectotype, US).
- Panicum roanokense* Ashe, J. Elisha Mitchell Sci. Soc. 15: 44. 1898. *Panicum dichotomum* L. var. *roanokense* (Ashe) Lelong, Brittonia 36: 265. 1984. TYPE: United States. North Carolina: Dare Co., Roanoke Island, June 1898, *Ashe s.n.* (lectotype, US).
- Panicum multirameum* Scribner, U.S.D.A. Div. Agrost. Circ. 19: 2. 1900. TYPE: Mexico. Veracruz: near Jalapa, 1889, *Pringle 7882* (lectotype, US 743295; isotype, MO).
- Panicum caeruleum* Hackel ex A. Hitchc., Contr. U.S. Natl. Herb. 12: 219. 1909. TYPE: United States. Florida: Dade Co., Miami, 3 Apr. 1906, *Hitchcock 706* (holotype, US; isotype, NY).

Distribution and ecology: common in North America, from Canada to Mexico, in moist ground, open swampy wood and wet meadows. In South America it is known from the Cerro Santa Ana, Falcón, Venezuela.

Selected specimens cited. CUBA. HABANA: Batabanó, *León 6152* (US). ISLA DE LA JUVENTUD: along road to Santa Isabel near SE base of Cerro Daguilla, sabanas, *Killip 44853* (US). ORIENTE: Sierra de Nipe, Loma Mensura, *León 19828* (US). SANTA CLARA: Sabana de San Marcos, *León 9203* (US). DOMINICAN REPUBLIC. AZUA: Sierra de Ocoa, San José de Ocoa, 1,550 m, *Ekman 11942* (US). LA VEGA: vicinity of Jarabacoa, 500–1,200 m, *Allard 14509a* (US). MONTE CRISTI: Cordillera Central, on the ridge between Río Cenobí and Río de la Cidra, 700 m, *Ekman 12697* (US). GUATEMALA. ALTA VERAPAZ: large swamp just E of Tactic, 1,300 m, *Steyermark 43942* (F, US). ZACAPA: between Loma El Picacho and Cerro de Monos, 2,000–2,600 m, *Steyermark 42770* (F, US). JAMAICA. Bull Head Mountain, *Hitchcock 9532* (US). MEXICO. CHIAPAS: Municipio de Jitotol, 5 km SE of Jitotol along road to Bochil, *Breedlove & Davidse 55114* (MO). VERACRUZ: San Miguel Jalapa, 6,500 ft., *Balls 4690* (US). VENEZUELA. FALCÓN: Paraguaná, Cerro Santa Ana, arriba de Santa Ana, 600 m, *Wingfield 7124* (VEN); Cerro Santa Ana, arriba de Santa María, 1,200 m, *Wingfield 6844* (MO).

12b. *Panicum dichotomum* var. *tenu*
(Muhlenb.) Zuloaga & Morrone, comb. nov.
P. tenue Muhlenb., Descr. Gram. 118. 1817.
Dichantherium dichotomum (L.) Gould var.
tenu (Muhlenb.) Gould & C.A. Clark, Ann.

Missouri Bot. Gard. 65: 1119. 1978. TYPE: *Muhlenberg Herb. 192* (lectotype PH-M not seen; fragment and photo of lectotype, US not seen).

- Panicum unciphyllum* Trin., Gram. Panic. 242. 1826. *Panicum acuminatum* Sw. var. *unciphyllum* (Trin.) Lelong, Brittonia 36: 269. 1984. *Dichantherium ensifolium* (Elliott) Gould var. *unciphyllum* (Trin.) Hansen & Wunderlin, Ann. Missouri Bot. Gard. 75: 1647. 1988. *Dichantherium dichotomum* (L.) Gould var. *unciphyllum* (Trin.) Davidse, Novon 2: 104. 1992. TYPE: North America: without locality, *Trattinick s.n.* (lectotype, LE not seen).
- Panicum albomarginatum* Nash, Bull. Torrey Bot. Club 24: 40. 1897. TYPE: United States. Florida: Lake County, June 1894, *Nash 925* (holotype, US 208344).

Distribution and ecology: eastern United States, Texas, Mexico, Belize, and the West Indies, in moist white-sand savannas, moist sandy woods, and marshy areas.

Selected specimens cited. BELIZE. EL CAYO: Mountain Pine Ridge, 550–700 m, *Davidse & Brant 33037* (MO). CUBA. ISLA DE LA JUVENTUD: Howard Estate, along Río Callejón, *Killip 44805* (US). PINAR DEL RIO: Arroyo Mántua, savannas, *Ekman 10994* (US); S of Guane, Sabana de San Julián, *León & Roca 7009* (US). MEXICO. CHIAPAS: Mun. La Trinitaria, montane rainforest at Lagos de Colores, Lagos de Montebello National Park, *Breedlove & Davidse 55038* (MO).

13. *Panicum divergens* HBK, Nov. Gen. & Sp. 1: 102. 1816. TYPE: Ecuador. Pichincha: Sangolquí, *Humboldt & Bonpland s.n.* (holotype, P; fragment, US 80645). Figures 24E, F, 27.

- Panicum commutatum* Schultes, Mantissa 2: 242. 1824. *Dichantherium commutatum* (Schultes) Gould, Brittonia 26: 59. 1974. *Panicum nervosum* Muhlenb. ex Elliott, Sketch Bot. S. Carolina 1: 122. 1816, non Lam., 1797. *Panicum polyneuron* Steudel, Syn. Pl. Glumac. 1: 91. 1854. TYPE: United States. "Car. et Geor.," *Elliott Herb. s.n.* (lectotype, CHARL not seen; photo and fragment, US 80874).
- Panicum leiophyllum* Fourn., Mexic. Pl. 2: 20. 1886, non Nees, 1829. TYPE: Mexico. Veracruz: "in valle Cordobensi," Jan., *Bourgeau s.n.* (holotype, P).
- Panicum albomaculatum* Scribner, U.S.D.A. Div. Agrost. Cir. 19: 2. 1900. *Dichantherium albomaculatum* (Scribner) Gould, Brittonia 32: 357. 1980. TYPE: Mexico. Michoacán: Patzcuaro, 10 Nov. 1892, *Pringle 5203* (holotype, US 743918).
- Panicum jorii* Vasey, U.S.D.A. Div. Agrost. Bull. 8: 31. 1889. *Panicum commutatum* Schultes var. *jorii* (Vasey) Fernald, Rhodora 39: 388. 1937. TYPE: United States. Louisiana: near Baton Rouge, 1 Oct. 1885, *Joor 39* (holotype, US 2808925).
- Panicum alsophilum* Swallen, Contr. U.S. Natl. Herb. 29: 422. 1950. TYPE: Guatemala. Jalapa: collected in oak woods around the top of Cerro Alcoba, just

E of Jalapa, 1,300–1,700 m, 2 Dec. 1939, *Steyermark 32513* (holotype, F; isotype, US 2236475). *Panicum hintoni* Swallen, Contr. U.S. Natl. Herb. 29: 419. 1950. TYPE: Mexico. México: collected at Bejucos, Temascaltepec, 610 m, 8 Nov. 1932, *Hinton 2527* (holotype, US 1867697; isotype, US 1865776).

Short-rhizomatous perennial without basal rosettes of broader leaves, or rosettes occasionally present. *Culms* geniculate, decumbent and branching at the lower nodes to erect, freely branching at the middle and upper nodes, (15–)40–120 cm tall, internodes hollow, terete, short-pilose or glabrous, nodes dark, pilose. *Sheaths* striate, short papillose-pilose with caducous hairs or glabrous, one margin long-ciliate, the other glabrous. *Ligules* short-membranous at base and short- to long-ciliate at the apex, 0.2–0.4(–1) mm long; collar densely pilose. *Blades* lanceolate, 4–10(–16) cm long, 0.7–1.2(–1.7) cm wide, flat, clasping, asymmetric and cordate or subcordate at base, the apex attenuate, densely papillose-pilose with caducous hairs or glabrous, densely pilose toward the base on the adaxial surface, the margins ciliate toward the base, otherwise scabrous. *Inflorescences* terminal, exserted, peduncle glabrous, 20–30 cm long; *panicles* lax, diffuse, (3–)10–22 cm long, 6–10 cm wide; *main axis* flexuous, greenish to purplish, glabrous or short-hispid, glandular or eglandular, the pulvini brownish or purplish, glabrous, first-order branches alternate or subopposite, divergent, the axis of the branches and pedicels smooth, flexuous, scaberulous, glandular or eglandular. Axillary panicles present or absent, similar to the terminal one. *Spikelets* solitary, narrowly ellipsoid to obovoid, (2.1–)2.3–3.2 mm long, 1.2–1.3 mm wide, planoconvex, greenish to purplish, shortly and sparsely hispid. *Lower glume* 0.5–1.5 mm long, $\frac{1}{4}$ to less than $\frac{1}{2}$ the length of the spikelet, ovate, 1-nerved, separated from the upper glume by a short internode. *Upper glume* covering the upper antherium or not, acute, 7–9-nerved, the nerves anastomosing toward the apex. *Lower lemma* acute, 7–9-nerved, the nerves anastomosing toward the apex. *Lower palea* lanceolate, 1.3–2 mm long, 0.4 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid or obovoid, 2.3–3 mm long, 1–1.1 mm wide, smooth, whitish, indurate, shiny, papillose, the apex of the lemma shortly apiculate and with unicellular macrohairs. *Caryopsis* obovoid, 1.3 mm long, 1 mm wide; hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: eastern United States to Mexico and Guatemala and the West Indies (see discussion of the possible presence in Ecuador); it

grows at the margins of pine or oak woods or in open field borders, to 2,700 m.

Selected specimens cited. CUBA. HABANA: clearing in swampy wood, W of Batabanó, *León 14201* (US). ORIENTE: Guantánamo, Monte Libanon, *Ekman 10297* (US). SANTA CLARA: banks of a canal, S border of Ciénaga de Zapata, *Roig 2205* (US). GUATEMALA. CHIMALTENANGO: Chichavac, *Skutch 524* (US). HAITI. Massif du Nord, *Ekman 6189* (US). HONDURAS. OCOTEPEQUE: Aldea de Belén Gualcho y alrededores; 40 km al E de Nueva Ocotepeque, *Nelson et al. 3800* (UNAH). MEXICO. CHIAPAS: Mun. Jitotol, near Colonia El Laurel, ca. 5 km N of Jitotol, *Davidse et al. 29630* (MO). JALISCO: Zapotlán, *Hitchcock s.n.*, *Amer. Gr. Herb. 193* (MO, P). MICHOACAN: Uruapán, *Hitchcock s.n.*, *Amer. Gr. Herb. 226* (F, MO, P). MORELOS: Huitzilac, *Lyonnet 623* (MO). NAYARIT: 8 mi. W of Tepic, *McVaugh 18881* (US). NUEVO LEON: 12 mi. S of Monterrey, *Mueller 414* (US). VERACRUZ: Jalapa, *Hitchcock s.n.*, *Amer. Gr. Hb. 225* (MO).

The type locality of *P. divergens* is, according to Humboldt, Bonpland & Kunth, Sangolguí in Pichincha province, Ecuador. This is probably a label error since Humboldt also made collections in Mexico, where this species is commonly found. Another possible explanation is that the species has, as in the case of *P. umbonulatum*, a disjunct distribution.

14. *Panicum ensifolium* Baldwin ex Elliott, Sketch Bot. S. Carolina 1: 126. 1816. *Panicum nitidum* Lam. var. *ensifolium* (Elliott) Vasey, U.S.D.A. Div. Agrost. Bull. 8: 29. 1889. *Dichantheium ensifolium* (Elliott) Gould, Brittonia 26: 59. 1974. *Dichantheium dichotomum* (L.) Gould var. *ensifolium* (Elliott) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1119. 1978. TYPE: United States. Georgia: without locality, *Baldwin s.n.* (holotype, CHARL not seen; fragment, US). Figure 27.

Panicum chamaelonche Trin., Gram. Panic. 242. 1826. TYPE: "V. Spp. Am. bor. (*Trattinick ex coll. Enslini*)," (holotype, LE not seen).

Densely tufted perennial. *Culms* erect, 8–30 cm tall, frequently unbranched above the base; internodes terete, greenish to purplish, pilose, nodes shortly pilose. *Sheaths* striate, greenish or purplish, glabrous, the margins membranous, ciliate or only pilose near the ligule. *Ligules* 0.4 mm long, membranous-ciliate, the membranous portion reduced. *Blades* linear, 2–6.5 cm long, 0.1–0.3 cm wide, rounded at base, flat to slightly involute, greenish or purplish, sparsely pilose on the adaxial surface or glabrous, the margins scabrous. *Inflorescences* terminal and axillary from the uppermost nodes,

short-exserted, peduncles up to 5 cm long, cylindrical, glabrous; panicles 1–4.5 cm long, main axis purplish, flexuous, glandular or eglandular, scabrous or glabrous; pulvini glabrous, the branches alternate, divergent, axis of the branches and pedicels flexuous, scabrous or glabrous, greenish or purplish, glandular or eglandular. Axillary panicles numerous, similar to the terminal one. *Spikelets* obovoid to ellipsoid, 1–1.4 mm long, 0.5–0.6 mm wide, greenish to purplish, shortly hispid or glabrous. *Lower glume* 0.4 mm long, $\frac{1}{3}$ the length of the spikelet, truncate to acute, nerveless, hyaline. *Upper glume* obtuse, shorter than the lower lemma and not covering the upper antherium, 5–7-nerved. *Lower lemma* as long as the spikelet, 5-nerved. *Lower palea* lanceolate, 0.5–0.7 mm long, 0.3 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 0.9–1.2 mm long, 0.4–0.6 mm wide, indurate, smooth and shining, pale, papillose; lemma 5-nerved. *Caryopsis* obovoid, black, 0.6–0.8 mm long, 0.5 mm wide; hilum punctiform, embryo $\frac{1}{3}$ – $\frac{2}{5}$ the length of the caryopsis.

Distribution and ecology: United States, Belize, and Cuba, in pine white-sand savannas, 0–100 m.

Selected specimens cited. BELIZE. 3 mi. W of Boomtown, O'Neill 8500 (MO, US); pine ridge N of aviation field, Bartlett 11236 (MO, US). CUBA. ISLA DE LA JUVENTUD: vicinity of Los Indios, Britton et al. 14218 (US), 14221 (MO, US). PINAR DEL RIO: km 13 on La Coloma road, León & Alain 19474 (US); Damuji at Rincón del Prado, Ekman 11047 (US); Laguna Santa Bárbara, Ekman 11465 (US).

Panicum ensifolium has many fascicled culms branching from the base, spikelets 1–1.4 mm long, and a black caryopsis.

- 15. *Panicum hebotes*** Trin., Mém. Acad. Imp. St.-Petersb., Ser. 6, Sci. Math 1: 301. 1834. *Panicum hebotes* Trin. var. *genuinum* Doell in C. Martius, Fl. Bras. 2(2): 252. 1877, nom. illeg. TYPE: Brazil. "V. sp. Bras" (holotype, LE; fragment, US 974693). Figures 8, 27, 33.

Panicum mirandum Luces, J. Wash. Acad. Sci. 32: 163, fig. 8. 1942. TYPE: Venezuela. Miranda: Guinand Estate (Cárdenas), Siquire Valley, 500–1,000 m, 19–24 Mar. 1913, Pittier 6483 (holotype, US 602176; isotype, NY).

Panicum infusum Swallen, Phytologia 14: 82. 1966. TYPE: Brazil. Rio de Janeiro: Tijuca, 700 m, 28 Apr. 1930, Chase 12145 (holotype, US 1448475).

Panicum subtiliracemosum Renvoize, Kew Bull. 42: 922. 1987. *P. subtipaniculatum* Renvoize, Hatschbach's Paraná Grasses: 39. 1988, error for *P. subtiliracemosum*. TYPE: Brazil. Paraná: Cachoeira dos Tur-

cos, Hatschbach 46020 (holotype, MBM; isotype, K).

Plants perennial. *Culms* decumbent, rooting and branching at the lower nodes, then becoming erect, 30–90 cm tall, leaning on vegetation, internodes 3.5–15 cm long, hispid, hollow, nodes compressed, pilose, brownish. *Sheaths* 2.5–7.5 cm long, shorter than the internodes, hispid, one margin ciliate, the other membranous. *Ligules* 0.3 mm long, membranous and lacinate at the apex, collar hispid. *Blades* lanceolate, 4.5–15 cm long, 0.7–2.3 cm wide, flat, hispid or with the adaxial surface glabrous, narrowed at the base, occasionally cordate, the apex attenuate, the margins scabrous. *Inflorescences* terminal, usually long-exserted, peduncle 12–32 cm long, hirsute; panicles lax, diffuse, 7–22 cm long, 4.5–11 cm wide; *main axis* flexuous, hispid, eglandular, first-order branches alternate to subopposite, second- and third-order branches glabrous or sparsely pilose, eglandular; pedicels scabrous, terete. *Spikelets* ellipsoid, 1.5–1.9 mm long, 0.6–0.9 mm wide, scaberulous toward the distal portion of the upper glume and lower lemma, otherwise puberulous or glabrous, greenish, the upper glume and lower lemma subequal with manifest nerves; internodes inconspicuous between the lower glume and upper antherium. *Lower glume* 0.7–1.5 mm long, ovate, acute to obtuse, 3–7-nerved, glabrous, not embracing the upper glume, dimorphic, some small, $\frac{1}{3}$ the length of the spikelet, 1–3-nerved, other longer, $\frac{3}{4}$ the length of the spikelet, 7-nerved. *Upper glume* 1.4–1.7 mm long, 9-nerved, not covering the apex of the upper antherium. *Lower lemma* glumiform, 9-nerved. *Lower palea* lanceolate, 0.7–1.2 mm long, 0.3 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 1.3–1.7 mm long, 0.7–0.8 mm wide, indurate, smooth, shiny, pale to brownish or black at maturity, puberulous at the apex, papillose, shortly apiculate, lodicules 0.2 mm long, stamens 3, the anthers 0.7 mm long; stigma whitish. *Caryopsis* ellipsoid, 1 mm long, 0.6 mm wide, brownish, hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: forest edges in Venezuela, Ecuador, Bolivia, and Brazil, from 500 to 1,800 m.

Additional specimens examined. BOLIVIA. LA PAZ: Yungas, Bang s.n., 1890 (G, K, MO, NY, US 823922, W). BRAZIL. CEARA: Baturité, Eugenio 285 (RB, US), 2649 (RB). ESPÍRITO SANTO: Santa Teresa, Reserva Biológica de Nova Lombardia, Picada da Cachoeira, Zuloaga et al. 2423, 2425 (RB, SI, US). MINAS GERAIS: Itacolumi, E of Ouro Preto, 1,300 m, Chase 9408 (MO, NY, US);

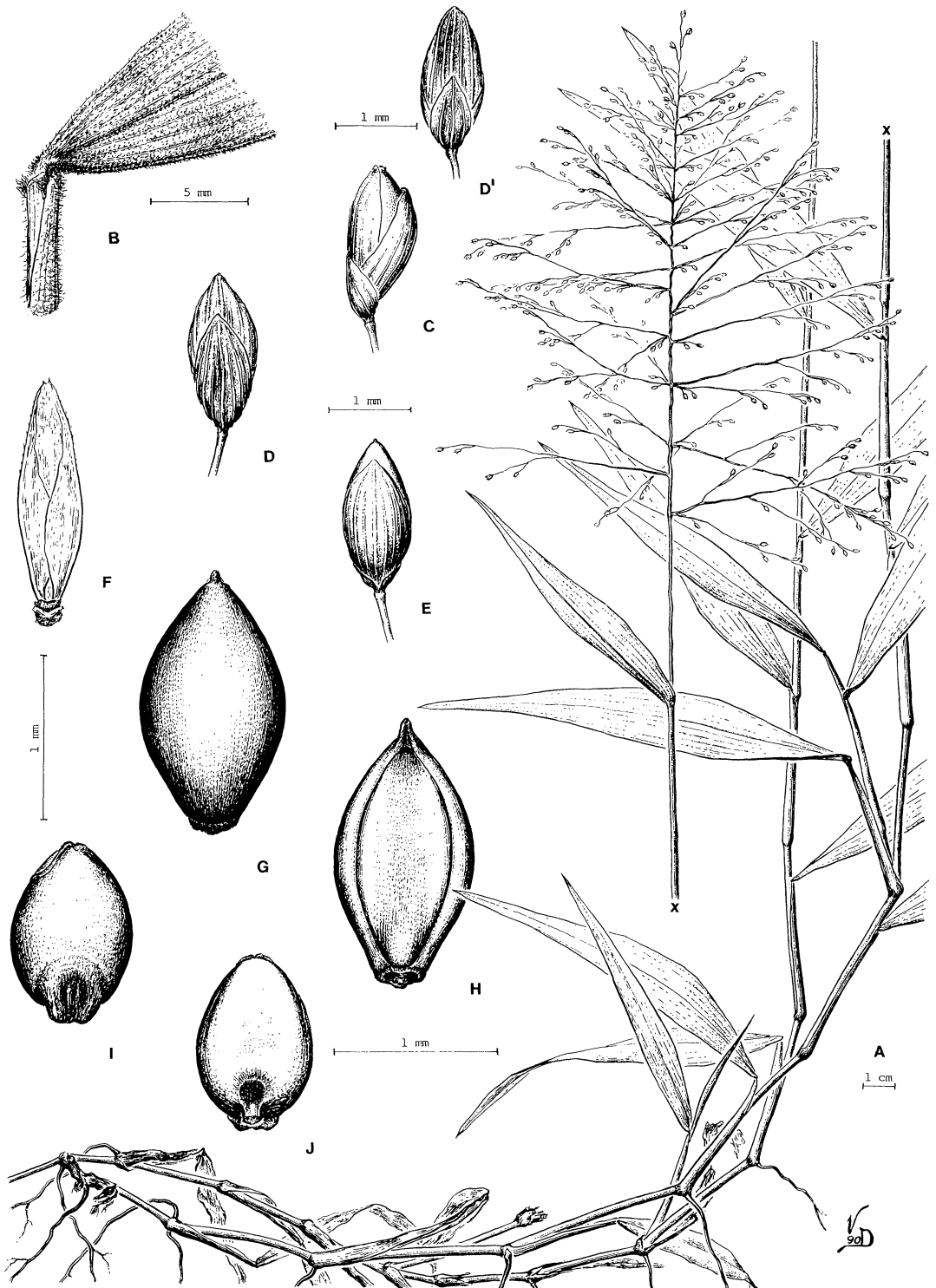


FIGURE 33. *Panicum hebotos*.—A. Habit, with panicle included.—B. Detail of ligule and lower portion of the blade.—C. Spikelet, lateral view.—D. Spikelet, lower glume view.—E. Spikelet, upper glume view.—F. Lower palea.—G. Upper antherium, lemma view.—H. Upper antherium, palea view.—I. Caryopsis, embryo view.—J. Caryopsis, hilum view. (A, based on *Brade 20119*, B–J, based on *Chase 9640*.)

Serra do Caparaó, *Chase* 9640 (F, MO, NY, US). PARANA: Marumbí, *Dombrowski* 3943 (K, PKDC). RIO DE JANEIRO: Tijuca, 1,000 m, *Chase* 12162, 12165 (US); Corcovado, *Chase* 8182, 9745 (MO, NY, US); Floresta sob regime de Preservação Permanente do IBDF, entre Vale dos Princesas y Rocío, *Zuloaga et al.* 2390* (MO, RB, SI, US); Parque Nac. Itatiaia, Picada Três Picos, *Zuloaga et al.* 2373* (RB, SI, US); S of Petrópolis, 530 m, *Davidse et al.* 11411 (MO, SI); vicinity of Rio de Janeiro, Pico da Tijuca, *Chase* 8484 (MO, NY, US); Vista Chinesa, *Brade* 20119 (US). RIO GRANDE DO SUL: without locality, *Orth* 1938 (US). SANTA CATARINA: Três Barras, Garuva, *Reitz & Klein* 5561 (US). SÃO PAULO: 38 km SW of Jacupiranga along Hwy. 116 to Curitiba, *Davidse et al.* 10949 (MO, SI, SP); Cananea Island, 1 km NE of city along W shore of island, *Clayton & Eiten* 4741 (K, NY, SP, UB, US); Parque do Estado, *Clayton & Eiten* 4190 (K, NY, SP); 19 km SW of Juquitiba, along Hwy. 116 to Curitiba, *Davidse et al.* 10933 (SP). COLOMBIA. NARIÑO: Mun. Ricaurte, vicinity of Ricaurte, along Río Imbí, ca. 2–3 km above Ecopetrol Campamento Palmar, 3 km NW of Ricaurte, along trail to Ramos, 1,150 m, *Croat* 71502 (MO). ECUADOR. TUNGURAHUA: valley of Pastaza River, between Baños and Cachurco, 1,300–1,800 m, *Hitchcock* 21862 (NY, US). VENEZUELA. ARAGUA: Alto de Choroní, Parque Nacional Henry Pittier, carretera de Maracay a Choroní, 1,560 m, *Zuloaga et al.* 4534* (MO, SI, VEN). BOLIVAR: E of Cerro El Picacho, N of Las Nieves and Las Chicharras, 45 km N of Tumeremo, vicinity of Deborah, Altiplanicie de Nuria, 600–650 m, *Steyermark* 89073 (NY, US, W). DISTRITO FEDERAL: El Junquito, en la sombra de la selva, 1,900 m, *Shnee* 484 (MY). SUCRE: Distrito Nariño and Distrito Arismendi, Península de Paria, trail between crossing of Río Tacarigua to summit of slopes E of Cerro Humo, descending to Las Melenas, *Steyermark et al.* 121762 (NY, US). YARACUY: Distrito Nirguá, 5 km N of Nirguá by road, 10°12'N, 68°34'W, 1,200 m, *Davidse et al.* 20904 (MO, VEN).

The type material of *P. hebotos* and *P. mirandum*, together with the other specimens examined, indicate that there are no differences between these taxa. Geminant spikelets, characteristic of Venezuelan specimens, are also occasionally present in other specimens from Bolivia and Brazil.

Panicum subtiliracemosum is also considered to be a synonym of *P. hebotos*. The Brazilian specimens cited by Renvoize (1987) under *P. subtiliracemosum* include *Dombrowski* 2899 and *Hatschbach* 38052, which are included under *P. schawckeanum* Mez, a species of section *Parvifolia* (A. Hitchc. & Chase) Pilger. *Hatschbach et al.* 13731 (K), considered by Renvoize as an intermediate specimen between *P. stigmatum* and *P. subtiliracemosum*, is indeed *P. surrectum*. *Chase* 9408 has peculiar cordate blades; however, it shares similar spikelets, dark anthercia, and asymmetrical blades with other specimens of *P. hebotos*.

Anatomically, *P. hebotos* has a distinctive keel incorporating three vascular bundles (Fig. 8A, C). Adaxial ribs and wide, shallow furrows are present, and the mesophyll is diffuse but nevertheless of the

semiradiate type (Fig. 8B, D). The three-celled microhairs (Fig. 9B, D) are unique to this species in the section and occur on all three specimens examined anatomically.

16. *Panicum heliophilum* Chase ex Zuloaga & Morrone, Ann. Missouri Bot. Gard. 78: 152. 1991. TYPE: Brazil. Minas Gerais: Chapéu do Sol, Serra do Cipó, 110 km NE of Belo Horizonte, 900 m, 28 Mar.–1 Apr. 1925, *Chase* 9147 (holotype, US; isotypes, F, GH, MO, NY). Figure 27.

Short-rhizomatous perennial. Culms 50–70(–100) cm tall, tangled, leaning on vegetation, the basal portion decumbent and geniculate, the upper portion erect, freely branching; internodes cylindrical, pilose, solid toward the base, otherwise hollow; nodes many, villous. Sheaths striate, 0.5–4 cm long, strongly distichous, hispid with short hairs, the margins long-ciliate; auricles small, pilose; collar brownish or purplish, covered with short whitish hairs. Ligule a ciliate membrane, 0.2–0.7 mm long, the cilia 0.1–0.6 mm long. Blades linear-lanceolate, 4–5(–12) cm long, 0.3(–1) cm wide, flat or folded, subcordate, densely hirsute on both surfaces, the margins cartilaginous, scabrous and short-ciliate. Primary inflorescences terminal, exserted, peduncles hispid, to 8 cm long; panicles lax, diffuse, 4–16 cm long, 3–13 cm wide; main axis flexuous, sparsely hirsute, eglandular, the pulvini brownish, hispid; first-order branches opposite or alternate, the lower ones whorled or not, diverging from the axis; axis of the branches short-hirsute or glabrous; pedicels smooth, glabrous, 2–13 mm long. Axillary panicles similar to the terminal one, smaller. Spikelets solitary, ellipsoid, 2.6–3.1 mm long, 1–1.1 mm wide, hirsute, greenish, without a stipe between the lower and upper glume. Lower glume 2–2.7 mm long, $\frac{3}{4}$ the length of the spikelet, acuminate, not embracing the upper glume at its base, 3-nerved, the nerves anastomosing toward the distal portion. Upper glume and lower lemma subequal, 7-nerved. Lower palea elliptic, 2 mm long, 0.3 mm wide, hyaline; lower flower absent. Upper anthercium narrowly ellipsoid, 2.4–2.7 mm long, 0.8–0.9 mm wide, stramineous, brownish at maturity, papillose, with simple papillae evenly distributed over the lemma and palea, densely pilose, with appressed, long hairs toward the apex of the lemma and palea; lemma 5–7-nerved, rachilla prolonged or not into a short mucro above the upper anthercium; lodicules ca. 0.6 mm long; stamens 3, the anthers ca. 1.3 mm long, purplish. Caryopsis ellipsoid, 1.4 mm long,

0.8 mm wide, brownish; hilum oblong, embryo $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: campos rupestres in Minas Gerais, Brazil, in sandy soils between 900 and 1,400 m.

Additional specimens examined. BRAZIL. MINAS GERAIS: Diamantina, summit of Serra de San Antonio, 1,400 m, *Chase 10354* (US); Mun. Jaboticatubas, Lagoa Santa a Conceição do Mato Dentro, *Sendulsky & Burman 1920* (SI, SP); km 114 ao largo da rodovia Lagoa Santa-Conceição do Mato Dentro, 1,160 m, *Sendulsky 1609* (SP); Saramenha, *Gomes 3955* (US); Serra de Santo Antonio, 2–5 km ao E de Diamantina, 1,050–1,100 m, *Burman & Sendulsky 696, 697, 709* (SI, SP); Serra do Cipó, ao longo da rodovia Lagoa Santa-Conceição, *Sendulsky 446* (SP); Serra do Cipó, *Burman 525* (SP), *Burman 485* (SP); Serra de Itatiaia e Serra de Lavras Novas, *Burman 384* (SP); Serra de Ouro Branco, *Castellanos 25628* (HB); Serra de Cipó, Mun. Jaboticatubas, km 116 ao longo da rodovia Lagoa Santa, 6 June 1970, *Joly et al. 100* (SP); Metallúrgica, Serra de Ouro Branco, 1,250–1,600 m, *Chase 10289* (MO).

Affinities of *P. adenorhachis* are discussed in Zuloaga & Morrone (1991).

17. *Panicum itatiaiae* Swallen, *Phytologia* 14: 82. 1966. TYPE: Brazil. Rio de Janeiro: Parque Nacional Itatiaia, Picada Macieiras, 1,700–1,800 m, 18 Jan. 1925, *Chase 8327* (holotype, US 1255836; isotypes, F 561591, GH, NY, US 1258426). Figures 28, 36.

Perennial. Culms geniculate, decumbent and rooting at the lower nodes, ascendent and branching at the upper nodes, more than 1 m tall, internodes 3–14 cm long, terete, rigid, hollow, glabrous, nodes purplish, glabrous. Sheaths 3–8 cm long, usually shorter than the internodes, glabrous with only one margin ciliate. Ligules 0.3–0.4 mm long, membranous at the base and short-ciliate or laciniate at the distal portion; collar purplish, short-pilose. Blades lanceolate or ovate-lanceolate, 10–12 cm long, 1–1.4 cm wide, flat, subcordate, glabrous, with long hairs close to the ligular region, the midnerve manifest, the margins ciliate and scabrous. Inflorescences terminal, exserted, peduncles cylindrical, to 40 cm long, glabrous; panicles lax, diffuse, 13–18 cm long, 10–20 cm wide; main axis flexuous, smooth, glabrous, pulvini brownish, glabrous, first-order branches divergent, alternate or opposite, the axis of the branches triquetrous, purplish, scabrous; pedicels smooth, glabrous, purplish, 3–8 mm long. Spikelets solitary, narrowly ellipsoid, 4.6–5 mm long, 1.6–1.7 mm wide, glabrous, greenish, tinged with purple, the upper glume and lower lemma subequal. Lower glume 2.6–3.2 mm long, $\frac{1}{2}$ or more the length of the spikelet,

acuminate, 5-nerved, glabrous, separated from the upper glume by a short internode. Upper glume 4–4.3 mm long, usually not covering the apex of the upper antherium, obtuse, (11–)13-nerved, the nerves anastomosing toward the apex, the outer surface scaberulous, herbaceous. Lower lemma 4.3–4.6 mm long, 13-nerved, the nerves anastomosing toward the apex, acute, scaberulous. Lower palea ovate-lanceolate, 4–4.1 mm long, 1–1.1 mm wide, membranous, the margins short-ciliate; lower flower male, the stamens 3, the anthers 2.2 mm long. Upper antherium lanceolate, 4–4.2 mm long, 1.3–1.6 mm wide, apiculate, scabrous and sparsely pilose toward the apex, otherwise glabrous, papillose, with small simple papillae regularly distributed over its entire surface; lemma 7-nerved, the palea scabrous at its apex. Caryopsis obovoid, 2.5 mm long, 1.5 mm wide, brownish; hilum punctiform, embryo $\frac{1}{4}$ the length of the caryopsis.

Distribution and ecology: known only from the type collection made in the Sierra de Itatiaia, in Rio de Janeiro, Brazil, in forests at 1,700–1,800 m; collected under bamboo, with the base long-decumbent.

When describing this species, Swallen indicated that spikelets were 4–4.5 mm long, but none of the types examined had any spikelets within this range.

18. *Panicum laxiflorum* Lam., *Encycl.* 4: 748. 1798. *Dichantheium laxiflorum* (Lam.) Gould, *Brittonia* 26: 60. 1974. *Panicum dichotomum* L. var. *laxiflorum* (Lam.) Beal, *Grasses N. Amer.* 2: 139. 1896. TYPE: United States. Without locality and collector (holotype, P-LAM; fragment and photo, US 2808927). Figure 27.

Panicum xalapense HBK, *Nov. Gen. & Sp.* 1: 103. 1816. TYPE: Mexico. Veracruz: near Jalapa, *Humboldt & Bonpland s.n.* (holotype, P).

Panicum ruprechtii Fourn., *Mexic. Pl.* 2: 21. 1886, non Fenzl, 1854. TYPE: Mexico. Veracruz: Jalapa, *Galeotti 5733* (holotype, BR not seen).

Panicum caricifolium Scribner ex Ashe, *J. Elisha Mitchell Sci. Soc.* 15: 57. 1898. TYPE: United States. Maryland: Great Falls, *Kearney Jr.*, 23 May 1897 (isotype, NY).

Panicum pyriforme Nash, *Bull. Torrey Bot. Club* 26: 579. 1899. TYPE: United States. Florida: Lake County, Eustis, 12–31 Mar. 1894, *Nash 239* (holotype, NY; isotype, US 221672).

Panicum xalapense HBK var. *strictirameum* A. Hitchc. & Chase, *Contr. U.S. Natl. Herb.* 15: 161. 1910. TYPE: United States. Mississippi: in small close bunches, Jackson, 28 Apr. 1906, *Hitchcock 1311* (holotype, US 558449).

Perennial. *Culms* densely caespitose, fasciculate, internodes very short at base of the plants, culms decumbent, profusely branching at the lower nodes, then erect, few-noded, 5–30(–40) cm tall; internodes terete, glabrous, hollow; nodes brownish, densely pilose with long whitish hairs. *Sheaths* striate, hirsute with rigid papillose-pilose hairs, the margins membranous. *Ligules* membranous-ciliate, 0.3–0.9 mm long, the pseudoligule absent; collar pale, densely pilose. *Blades* lanceolate, 3–15 cm long, 0.2–0.8(–1) cm wide, flat, narrowed at base, acuminate, the margins long-ciliate, papillose-pilose on both surfaces or only on the upper portion of the adaxial surface or glabrous, the mid-nerve not manifest. Terminal and axillary *inflorescences* similar, short-exserted or included on the upper leaves; peduncle terete, hirsute or glabrous, to 15 cm long; *panicles* lax, 2–9 cm long, 2–7 cm wide; *main axis* flexuous, densely hirsute or glabrous, glandular or eglandular; *pulvini* long-pilose, first-order branches alternate, divergent, the axis of the branches smooth, sparsely hirsute or glabrous, glandular or eglandular; *pedicels* long, sparsely hispid. *Spikelets* solitary, plano-convex, ellipsoid to more commonly obovoid, 2–2.7 mm long, 1–1.4 mm wide, short-hirsute, greenish, upper glume and lower lemma subequal. *Lower glume* ovate-acuminate, 0.8–1.3 mm long, $\frac{1}{3}$ – $\frac{1}{2}$ the length of the spikelet, 1–3-nerved. *Upper glume* acute, 9-nerved, covering the apex of the upper antherium or not. *Lower lemma* glumiform, 9-nerved. *Lower palea* elliptical, 1–1.4 mm long, 0.5–0.7 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* broadly ellipsoid, 1.8–2.3 mm long, 1–1.4 mm wide, indurate, smooth, shiny, papillose, lemma apiculate, the apex greenish. *Caryopsis* broadly obovoid, brownish, 1.3 mm long, 1.2 mm wide; hilum punctiform, embryo a little less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: eastern United States and Mexico to Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and the West Indies, in Cuba, the Dominican Republic, and Haiti. Inhabits moist banks and edge of pine and oak woods or mixed hardwood forest, between 700 and 2,700 m.

Selected specimens cited. COSTA RICA. CARTAGO: 3 km up mountain from Tejar, Pan-American Hwy., *Taylor & Taylor 11842* (MO, US). SAN JOSE: 5.5 km by road NW of San Pablo, *Pohl & Pinette 13123* (MO). CUBA. ORIENTE: Sierra Maestra, La Gran Piedra above Daiquirí, *Ekman 1604* (G, US). PINAR DEL RIO: Consolación del Sur, pineland hills at Juan Moreno, *Ekman 10860* (G, NY, US). DOMINICAN REPUBLIC. AZUA: Sierra de Ocoa, San José de Ocoa, *Ekman 11855* (US). LA VEGA: 5 km N of Tiroe, NE of Constanza, *Gould & Jiménez 14112*

(MO). SAN JUAN: Sabana Nueva, 6,200 ft., N of Río Arriba, *Howard & Howard 9079* (US). SANTIAGO: Jiromé, 700 m, *Valeur 293* (MO, US). GUATEMALA. ALTA VERAPAZ: cut-over steep slopes 3 mi. E of Tactic on Route 7E toward Tamahu, *Wilbur 14916* (MO). BAJA VERAPAZ: 6 km N of El Chol, *Harmon & Dwyer 3168* (MO). HAITI. M. des Commissaires, *Holdridge 1729* (MO); vicinity of St. Louis du Nord, mountain SW of city, *Leonard & Leonard 14503* (US). HONDURAS. CHOLUTECA: San Marcos de Colón, *Izaguirre 53* (MO). INTIBUCA: Cerro San Cristóbal, La Esperanza, *Ordoñez 84* (MO). FRANCISCO MORAZAN: Parque La Tigrá, *Cruz 70* (MO). OCOTEPEQUE: Belén Gualcho, 4 km from town on road from Corquín, *Blackmore & Chorley 3838* (MO). OLANCHO: Montaña Los Zapotes, 10 km NO de Campamento, *Soto 44* (MO). MEXICO. Chinantla, *Liebmann 328* (MO). CHIAPAS: Mun. Tenejapa, in the Paraje Kurus Ch'en, *Breedlove 28188* (MO); 65 km N of the junction Mex 190 and 195 on Mex 195, *Brunken & Perino 336* (MO); Mun. Jitotol, near Colonia El Laurel, ca. 5 km N of Jitotol, *Davidse et al. 29621* (MO). HIDALGO: along Hwy. 105 between Pachuca and Tampico, along road to San Cristóbal which leaves main highway 100.8 mi. NE of Pachuca vicinity of turnoff, 1.5 km from San Cristóbal, *Croat & Hannon 65910* (MO). OAXACA: 3.5 km al S de San Andrés Yaa, en la desviación a Oaxaca, *Torres 2020* (MO). PUEBLA: 0.8 mi. S of Zacapoaxtla on road from Zaragoza, *Brunken & Perino 265* (MO); Trinidad Iron Works, *Pringle 13250* (MO). QUERETARO: off road from Jalpán to Xilitla, 5.8 mi. W of San Luis Potosí state line, *Thomas 2794* (MO). VERACRUZ: 3 km NE of Jilotepec on road to Naolinco, *Nee & Taylor 26237* (MO); Córdoba, *Bourgeau 2162* (MO). NICARAGUA. ESTELI: lado S del Cerro Tomabú, por el Valle Las Cuevas, *Moreno 18455* (MO); N slope of Cerro El Fraile, ca. 13°25'N, 86°16'W, *Stevens & Montiel 18103* (MO). JINOTEGA: along Hwy. 3 ca. 1.9 km NW of Aranjuez road entrance, *Stevens 5578* (MO). MADRIZ: San José de Cusmapa, 1 km al E del Cerro de Buenavista, *Moreno 14360* (MO). MATAGALPA: El Ocotal, 4 km al S de Matagalpa, *Moreno 17656, 17694* (MO).

19. *Panicum pedicellatum* Vasey, U.S.D.A. Div. Bot. Bull. 8: 28. 1889. *Dichantherium pedicellatum* (Vasey) Gould, Brittonia 26: 60. 1974. TYPE: United States. Texas: Kimble Co., rocky woods, June 1885, *Reverchon 1620* (holotype, US 2383607; isotypes, MO, NY). Figure 27.

Panicum transiens Swallen, J. Wash. Acad. Sci. 21: 436. 1931. TYPE: Mexico. Tamaulipas: Sierra de San Carlos, Mesa de Tierra, vicinity of San José, 1,000 m, 19 July 1930, *Bartlett 10454* (holotype, US 1501526).

Tufted perennial. *Culms* erect to ascending, 15–30(–60) cm tall, simple at the base, freely branching at the middle and upper nodes; internodes cylindrical, hollow, shortly pilose with tuberculate hairs, the margins membranous, glabrous or shortly pilose. *Ligules* membranous-ciliate, 0.3–0.6 mm long; collar shortly pilose. *Blades* lanceolate, 5–8.5 cm long, 0.2–0.8(–1.3) cm wide, flat, subcordate, the

lower margins long-ciliate, the adaxial surface pilose with appressed, whitish hairs, the abaxial surface shortly pilose or glabrous. *Inflorescence* terminal and axillary from the uppermost nodes, short to long-exserted, peduncle cylindrical, 5–20 cm long, shortly pilose; *panicles* few to multiflowered, 3–8(–10) cm long; *main axis* flexuous, shortly pilose, the pulvini shortly pilose, branches alternate, divergent, the axis of the branches pilose; pedicels paired, unequal, 2–12 mm long, triquetrous, pilose or scaberulous. *Spikelets* narrowly ellipsoid, 3.3–4.1 mm long, 1.3–1.5 mm wide, short-papillose-pilose, greenish to purplish. *Lower glume* ovate-acuminate, 1.8–2.2 mm long, ½ the length of the spikelet or less, 3–5-nerved, separated from the upper glume by a distinct internode, not embracing the upper glume. *Upper glume* obovate or ovate, 3.2 mm long, obtuse, not covering the apex of the upper antherium, 9–11-nerved, the nerves anastomosing toward the apex. *Lower lemma* 9-nerved, pilose. *Lower palea* 1.2–1.9 mm long, 0.4 mm wide, lanceolate, hyaline, glabrous; lower flower absent. *Upper antherium* narrowly ellipsoid, 3–3.5 mm long, 1.2 mm wide, indurate, smooth, shining, papillose and with prickle hairs at the apex. *Caryopsis* unknown.

Distribution and ecology: United States, in Texas, Mexico, and occasionally in Guatemala, growing in moist, shaded places, on rocky slopes, bordering rivers or in open pine or oak woods, to 2,500 m.

Additional specimens examined. GUATEMALA. EL PROGRESO: hills between Finca Piamonte and slopes SE of Finca Piamonte, *Steyermark* 43463 (F). MEXICO. COAHUILA: middle and upper reaches of Cañón de la Hacienda, almost due S of Rancho Cerro de la Madera, N slope of Sierra de la Madera, 2,000–2,500 m, 27°03'N, 102°25'W, *Chiang et al.* 9452 (MO), *Johnston et al.* 10974 (MO). NUEVO LEON: Dulces Nombres, 1,310 m, *Meyer & Rogers* 2663 (MO). UNITED STATES. TEXAS: Kerrville, *Heller* 1736 (MO), 2,000 ft.; Comanche Springs, *Lindheimer* 1265 (MO); along banks of Guadalupe River, near Kerrville, *Palmer* 33820 (MO).

20. *Panicum penicillatum* Nees ex Trin., Gram. Panic. 196. 1826. TYPE: Brazil. Without locality, *Langsdorff s.n.* (holotype, LE not seen). Figures 25, 36.

Panicum discolor Trin. ex Nees, Agrost. Brasil.: 144. 1829, non Sprengel, 1807. TYPE: Brazil. Minas Gerais: "Habitat in fruticetis umbrosis prope Tejuco," *Langsdorff s.n.* (holotype, LE; fragment, US).

Panicum phragmites Nees, Agrost. Brasil.: 190. 1829. TYPE: Brazil. Without locality, *Sellow s.n.* (holotype, B; fragment, BAA, US; isotype, K).

Perennial. Culms decumbent, rooting and branching at the lower nodes, leaning on vegetation

and scandent, reaching up to 10 m, internodes 8–18 cm long, solid on the lower portion, rigid, cylindrical and pilose; nodes dark, thickened, densely pilose with long whitish hairs or glabrous. *Sheaths* 10–14 cm long, the lower ones shorter and the upper ones longer than the internodes, papillose-pilose with long tuberculate, caducous hairs or glabrous, one margin ciliate, the other membranous, auricles membranous. *Ligules* ca. 0.5 mm long, membranous, lacerate on the upper portion; collar brownish, shortly pilose or glabrous. *Blades* lanceolate, 18–32 cm long, 1.2–3.2 cm wide, flat, pseudopetiolate, the pseudopetiole brownish, puberulous; blades narrowed to subcordate, slightly asymmetrical, the apex long-attenuate, sparsely pilose or glabrous, the abaxial surface usually glaucous, the margins scabrous. *Inflorescences* terminal, exserted, peduncle cylindrical, glabrous; *panicles* lax, diffuse, multiflowered, 30–45 cm long, 20–40 cm wide; *main axis* flexuous, scabrous or glabrous, the pulvini brownish, glabrous, first-order branches divergent, alternate or opposite, occasionally whorled toward the base, the axis of the branches scabrous; pedicels scabrous, triquetrous. *Spikelets* solitary, narrowly ellipsoid, 3–4.2 mm long, 1.1–1.4 mm wide, greenish to purplish, the upper glume and lower lemma subequal, acute, with strong nerves. *Lower glume* 2.8–3.6 mm long, as long as or a little shorter than the upper glume, 3–5-nerved, acuminate to subulate, pilose toward the apex, scabrous on the inner surface. *Upper glume* 3–4 mm long, acute, (7–)9–11-nerved, shortly pilose toward the apex, pilose on the inner surface. *Lower lemma* glumiform, 3–4.1 mm long, 9–11-nerved, pilose on the inner surface. *Lower palea* absent; lower flower absent. *Upper antherium* narrowly ovoid, 3.2–3.7 mm long, 1–1.3 mm wide, stramineous, with simple papillae regularly distributed over its entire surface, lemma apiculate, the apex and upper margins pilose. *Caryopsis* narrowly ellipsoid, 2.2–2.4 mm long, 1.2 mm wide, brownish; hilum punctiform, embryo a little less than ½ the length of the caryopsis.

Distribution and ecology: Brazil, in the Distrito Federal and the states of Goiás, Minas Gerais, and Rio de Janeiro, in dense colonies at forest edges, where it grows leaning on vegetation, from 450 to 1,500 m.

Additional specimens examined. BRAZIL. DISTRITO FEDERAL: Bacia do Rio São Bartoloméu, Equipe IBGE 3572 (IBGE); próximo a Sobradinho, *Filgueiras* 1964 (IBGE, MO). GOIAS: capoeira and gallery margin, ca. 12 km S de Corumbá de Goiás, 1,000 m, *Irwin et al.* 10848 (MO, NY, US); Santo Antonio do Descoberto, fazenda de Agricultura Natural, 13 Dec. 1989, *Alvarenga & Oliveira* 525 (IBGE, SI). MINAS GERAIS: Viçosa, *Chase* 9465,

(F, US), 640 m, between São Geraldo and Viçosa, *Chase 10200, 10217* (US), *Kuhlmann 1942* (IAN, RB), *Pires & Black 2844* (IAN, US); Fazenda do Aguada, Cabeceira do Matto, 750 m, *Mexía 5368* (F, G, GH, K, NY, P, US); Serra do Cipó, 1,200 m, *Anderson et al. 36155* (F, K, MO, UB, US), 800 m, km 103, *Chase 9288* (F, MO, NY, US); Serra do Espinhaço, Serra do Itabirito, 50 km SE of Belo Horizonte, *Irwin et al. 19727* (MO, UB, US); Barbacena, Serra Mantiqueira, *Chase 8716* (F, GH, NY, US); Anna Florencia, E of Ponte Nova, *Chase 9479* (F, MO, NY, US); Serra da Gramma, E of Araponga, *Chase 9608* (F, GH, MO, US); Lagoa Santa, *Warming s.n.* (NY). RIO DE JANEIRO: Antonio, *Glaziou 5718* (K, P, US); Corcovado, *Chase 9752* (MO); Serra dos Orgãos, *Luettelburg 6051* (NY). Without locality, *Riedel 2151* (K, US), *Glaziou 16626, 18633* (US), *16628* (P, US), *22612* (G).

Panicum penicillatum has a peculiar, bamboo-like habit, with rigid culms leaning on the vegetation and reaching up to 10 m high (T. Filgueiras, pers. comm.). The spikelet also lacks a lower palea.

21. *Panicum peristypum* Zuloaga & Morrone, *Novon* 1: 113. 1991. TYPE: Brazil. Espírito Santo: Mun. Domingos Martins, Domingos Martins, selva en cerro del Dr. Kautsky, 600–850 m, 7 May 1985, *Zuloaga, Martinelli & Vázquez Avila 2398** (holotype, RB; isotypes, MO, SI, US). Figures 10, 28.

Short-rhizomatous perennial. *Culms* decumbent and rooting at the lower nodes, then erect, ca. 80 cm tall, internodes 7–12 cm long, compressed, striate, glabrous; nodes compressed, glabrous, brownish. *Sheaths* striate, 5–9(–18) cm long, usually shorter than the internodes, glabrous, shiny, the margins membranous, ciliate toward the distal portion. *Ligules* 0.3 mm long, membranous at the base, then shortly ciliate, collar shortly pubescent. *Blades* ovate-lanceolate, 7–15 cm long, 1.5–3 cm wide, cordate, amplexicaulous, acute, velutinous, the lower margins long-ciliate, otherwise ciliate. *Inflorescences* terminal, exserted, *panicles* lax, diffuse, 15 cm long, 8 cm wide; *main axis* sparsely pilose, eglandular, the pulvini pilose, first-order branches alternate or subopposite, the axis of the branches scabrous, flexuous, eglandular; pedicels claviform, flexuous, scaberulous. *Spikelets* narrowly ellipsoid, 2.4–2.5 mm long, 1 mm wide, non-stipitate, glabrous, greenish or tinged with purple, the upper glume and lower lemma subequal. *Lower glume* ovate, 1.2–1.4 mm long, $\frac{1}{2}$ or a little more the length of the spikelet, glabrous, 1–3-nerved, not embracing the upper glume. *Upper glume* 1.9–2.3 mm long, (7–)9-nerved, with manifest nerves, not covering the tip of the upper antherium. *Lower lemma* glumiform, 2–2.3 mm long, 9-nerved. *Lower palea* lanceolate, 1.7 mm long, 0.4 mm wide,

hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 2.2 mm long, 0.8 mm wide, indurate, papillose, lemma crestate, scaberulous; the stamens 3, anthers 1.4 mm long, stigma pink. *Caryopsis* unknown.

Distribution and ecology: known only from the type collection in edge of forest in Espírito Santo, Brazil, at 650–850 m.

Related to *P. sciurotoides*, *P. peristypum* has amplexicaulous, 1.5–3-cm-wide leaves, spikelets 2.4–2.5 mm long, and lower palea 1.7 mm long. It differs from *P. sabulorum* and *P. stigmatum* by having narrowly ellipsoid spikelets (obovoid in *P. sabulorum* and *P. stigmatum*), lower glume not embracing the upper glume at its base, and without a short stipe between the lower and upper glume. *Panicum peristypum* also lacks the foliar dimorphism present in *P. sabulorum* and has, as another difference with *P. stigmatum*, amplexicaulous leaves.

The keel structure of *P. peristypum* deserves comment. Two different leaves of *Zuloaga et al. 2398* were examined, and the leaf illustrated (Fig. 10A) clearly has a keel containing three vascular bundles as well as extensive adaxial parenchyma tissue. However, the other leaf from the same plant is without a keel or even a midrib, having a median vascular bundle distinguishable only by its central location in the lamina.

22. *Panicum petropolitanum* Zuloaga & Morrone, *Ann. Missouri Bot. Gard.* 78: 161. 1991. TYPE: Brazil. Rio de Janeiro: Mun. Petrópolis, Araras, base de Pedra Maria Comprida, saxícola, heliófila, crescendo em beira de Rio, 23 Mar. 1968, *Sucre & Braga 2553* (holotype, RB). Figure 28.

Stoloniferous perennial? *Culms* geniculate, rooting and branching at the lower nodes, then becoming erect, freely branching, 10–25 cm tall, few-noded; internodes 1–4 cm long, cylindrical to compressed, hollow, glabrous; nodes compressed, brownish, covered with long hairs to glabrous. *Sheaths* striate, 1.5–5.5 cm long, longer than the internodes, one of the margins long-ciliate with whitish hairs, the other one membranous or with long hairs in the upper portion, the rest of the surface glabrous. *Ligules* membranous-ciliate, ca. 0.2 mm long; collar brownish, glabrous. *Blades* linear-lanceolate, 2–5 cm long, 0.1–0.3 cm wide, flat, glabrous, the margins scaberulous, the apex attenuate. *Inflorescences* terminal, exserted, peduncles to 16 cm long; *panicles* lax, diffuse, 2–4 cm long, 1–3.5 cm wide; *main axis* flexuous, cylindrical, glabrous, the pulvini glabrous, first-order

branches alternate, divergent, and distant, the axis of the branches glabrous, eglandular; pedicels triquetrous, scaberulous, 1–7 mm long. *Spikelets* solitary, narrowly ellipsoid, 2.4–2.6 mm long, 0.9 mm wide, glabrous, the upper glume and lower lemma subequal, without a stipe between the lower and upper glume. *Lower glume* 1.8–2 mm long, $\frac{3}{4}$ the length of the spikelet, lanceolate, not embracing the upper glume, 1(–3)-nerved, the mid-nerve scabrous toward the apex. *Upper glume* (7–)9-nerved, acute, embracing the lower lemma. *Lower lemma* 9-nerved, embracing the upper anthercium. *Lower palea* lanceolate, 1.5 mm long, 0.3–0.4 mm wide, hyaline, glabrous; lower flower absent. *Upper anthercium* narrowly ellipsoid, 2.3 mm long, 0.7 mm wide, glabrous, shiny, with simple papillae evenly distributed over its entire surface; lemma apiculate, apicule ca. 0.2 mm long, pilose; lodicules ca. 0.3 mm long, embracing the lower margins of the palea; the stamens 3, anthers 1 mm long. *Caryopsis* ellipsoid, 1.2 mm long, 0.6 mm wide; hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: Brazil, in mountains of the state of Rio de Janeiro, growing in open and humid places on borders of streams, on rocky soils.

Panicum petropolitanum differs from *P. cucuense* in its stoloniferous habit; culms geniculate, few-noded, rooting and branching at the lower nodes and then becoming erect; linear-lanceolate, flat leaf blades; and inflorescence with a peduncle to 16 cm long.

23. *Panicum portoricense* Desv. ex Ham., Prodr.: 11. 1825. *Dichantheium portoricense* (Ham.) Hansen & Wunderlin, Ann. Missouri Bot. Gard. 75: 1649. 1988. TYPE: Puerto Rico. Without locality, *Desvaux Herb. s.n.* (holotype, P). Figure 27.

Panicum lancearium Trin., Gram. Panic.: 223. 1826. TYPE: United States. "Am. bor.," *Trattinick s.n.* (holotype, LE not seen; fragment, US 557424).

Panicum nashianum Scribner, U.S.D.A. Div. Agrost. Circ. 7: 79. 1897. *Panicum portoricense* Desv. var. *nashianum* (Scribner) Lelong, Brittonia 36: 267. 1984. TYPE: United States. Florida: Lake County, Eustis, 15–30 Apr. 1894, *Nash 466* (holotype, US 208320).

Panicum patentifolium Nash, Bull. Torrey Bot. Club 26: 574. 1899. TYPE: United States. Florida: Lake County, Eustis, 12–31 Mar. 1894, *Nash 72* (holotype, NY; isotypes, MO, US).

Panicum nashianum Scribner var. *patulum* Scribner & Merr., U.S.D.A. Div. Agrost. Circ. 27: 9. Dec. 1900. *Panicum patulum* (Scribner & Merr.) A. Hitchc., Rhodora 8: 209. 1906. *Panicum lancearium* Trin. var. *patulum* (Scribner & Merr.) Fernald, Rhodora 36: 80. 1934. *Dichantheium sabulorum* (Lam.)

Gould & Clark var. *patulum* (Scribner & Merr.) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1113. 1978. TYPE: United States. Florida: Manatee County, Bradenton, 3 Sep. 1898, *Combs 1296* (holotype, US 2808982).

P. wilmingtontense Ashe, J. Elisha Mitchell Sci. Soc. 16: 86. 1900. TYPE: United States. North Carolina: New Hanover County, near Wilmington, 17 May 1899, *Ashe s.n.* (holotype, NCU not seen; isotype, US).

P. pauciciliatum Ashe, J. Elisha Mitchell Sci. Soc. 16: 87. 1900. TYPE: United States. North Carolina: New Hanover County, near Wilmington, 20 May 1899, *Ashe s.n.* (lectotype, NCU not seen; isotype, US).

Caespitose perennials, with a basal rosette of broader leaves present or absent. *Culms* decumbent to erect, 4–30 cm tall, freely branching at the upper nodes, internodes cylindrical, greenish to purplish, hollow, shortly and densely pilose; nodes shortly pilose. *Sheaths* striate, greenish to purplish, shortly pilose, the margins ciliate. *Ligules* membranous-ciliate, 0.3–0.7 mm long. *Blades* lanceolate, 1–5 cm long, 0.2–0.6 cm wide, flat, subcordate, the apex acuminate, greenish or occasionally purplish, shortly and densely or sparsely pilose on both surfaces, the lower margins long-ciliate or completely ciliate. *Inflorescences* terminal, exserted or partially included in the upper leaves, peduncles cylindrical, shortly pilose, to 4 cm long; *panicles* lax, few to multiflowered, 1–4 cm long; *main axis* flexuous, shortly pilose, first-order branches alternate or subopposite, divergent, the axis of the branches and pedicels shortly pilose. Axillary panicles similar to the terminal one. *Spikelets* solitary, obovoid, 1.6–2.4 mm long, 1–1.3 mm wide, shortly hispid, the upper glume and lower lemma subequal, or the upper glume shorter and not covering the upper anthercium. *Lower glume* 0.7–1.1 mm long, $\frac{1}{3}$ or more the length of the spikelet, ovate, obtuse to truncate or acute, 1–3-nerved. *Upper glume* 7–9-nerved, obtuse. *Lower lemma* 7-nerved, obtuse. *Lower palea* lanceolate, 0.6–0.8 mm long, 0.4 mm wide, hyaline, glabrous; lower flower absent. *Upper anthercium* obovoid, 1.2–1.5 mm long, 0.6–0.8 mm wide, pale, smooth, shiny, indurate, with simple papillae, the lemma 7-nerved, shortly apiculate, pilose at the apex. *Caryopsis* obovoid, 0.7–1.3 mm long, 0.5–1 mm wide; hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: United States, Mexico to Belize and the West Indies, in moist sandy pinelands, to 1,400 m.

Additional specimens examined. BELIZE. Pine Ridge N of aviation field, *Bartlett 11225* (US). CUBA. ISLA DE LA JUVENTUD: vicinity of Siguatepeque, *Britton et al. 15379* (US). ORIENTE: Sierra Maestra, La Gran Piedra, 1,200

m, *Ekman 8151* (US); Sierra de Nipe, in pineland, between Woodfred and Loma Mensura, *Ekman 15290* (G). PINAR DEL RÍO: Arroyo Mántua, Damují, in white sand at Rincón del Prado, *Ekman 11022* (US); Sábalo, in pineland on white sand, *Ekman 11427* (G, US); sandy Sabana de los Remates, *León & Victorin 18702* (US). DOMINICAN REPUBLIC. LA VEGA: La Vega, Cordillera Central, Constanza, Loma del Medio, *Ekman 14094* (G, US); prope Constanza, *von Tuerckheim 3321* (G, US); Montecristi, Lagunas de Cenobí, *Valeur 4* (US). PUERTO RICO. San Juan, Isla Verde, *McKee 10588* (P); track from Manatí to Vega Baja, *Underwood & Griggs 955* (US); Santurce, *Heller 6442* (MO, US); vicinity of San Juan, between Cataño and Guainabo, *Chase 6631* (US); Laguna Tortuguero, *Britton et al. 3853* (MO, US); W end of Laguna Tortuguero, white sand, *Britton & Chardon 6831* (US). UNITED STATES. FLORIDA: Lake County, Eustis, *Nash 1337, 2076* (P).

24. *Panicum pycnocladus* Tutin, J. Bot. 72: 340. 1934. TYPE: Guyana. Kaieteur savanna, Potaro River, 1,100 ft., 20 Aug. 1933, *Tutin 508* (holotype, BM not seen; isotypes, K, US). Figures 11, 28, 34.

Panicum albociliatum Swallen, Brittonia 3: 149. 1939. TYPE: Venezuela. Bolívar: Mount Auyan-tepui, 2,200 m, *Tate 1286* (holotype, US 1723625; fragment, VEN 222501; isotype, NY).

Panicum tiricaense Swallen, Mem. New York Bot. Gard. 9: 400. 1957. TYPE: Venezuela. Bolívar: upper falls of Río Tirica above summit camp, alt. 1,940–1,950 m, central section, Chimantá Massif, 7 Feb. 1955, *Steyermark & Wurdack 535* (holotype, US 2182126; isotypes, F 1480635, K, NY).

Panicum tiricaoides Swallen, Mem. New York Bot. Gard. 9: 401. 1957. TYPE: Venezuela. Bolívar: frequent in thickets along Río Tirica, below summit camp, central section, Chimantá Massif, 1,925 m, 5 Feb. 1955, *Steyermark & Wurdack 475* (holotype, US 2182124; isotypes, G, K, NY).

Perennial. Culms leaning on vegetation, decumbent, rooting and branching at the lower nodes, then ascending to erect, freely branching at the upper nodes, 12–60 cm tall; internodes 3–15 cm long, terete, hollow, glabrous or hirsute, nodes compressed, pubescent with retrorse hairs. Sheaths 2–5 cm long, glabrous or hirsute, delicate, the margins long-ciliate. Ligules membranous at the base and short to long-ciliate at the apex, (0.2–0.3–)1–1.5 mm long; collar pilose with whitish hairs. Blades lanceolate or ovate-lanceolate, 2–4.5(–12) cm long, 0.5–1.8 cm wide, herbaceous, flat, divergent, glabrous or sparsely pilose to densely hispid, cordate, the base amplexicaulous and asymmetric, the apex acute, the margins scabrous, the lower margins long-pilose. Inflorescences terminal, exserted, peduncle hispid to glabrous, 6–20 cm long; panicle lax, 3–6(–10) cm long, 1.5–6 cm wide; main axis glabrous or hirsute with long papillose-pilose hairs, eglandular, the pulvini pilose or glabrous, first-

order branches flexuous, ascending, alternate or subopposite, occasionally whorled toward the base, glabrescent, eglandular; pedicels pilose toward the distal portion or glabrous, smooth. Spikelets ellipsoid, 2.2–3(–3.3) mm long, 0.8–0.9 mm wide, glabrous or pilose, acute and attenuate at the base, with a stipe between the lower and upper glume, upper glume and lower lemma subequal. Lower glume ovate-acuminate, (0.7–)1.2–1.8 mm long, ½–¾ the length of the spikelet, 3(–5)-nerved, embracing the upper glume. Upper glume 1.9–2.7 mm long, 9-nerved, not covering the apex of the upper antheridium. Lower lemma glumiform, 7–9-nerved. Lower palea linear-lanceolate, 1.5–1.8 mm long, 0.3 mm wide, hyaline, glabrous; lower flower absent. Upper antheridium ellipsoid, 1.8–2.1 mm long, 0.8 mm wide, indurate, pale, lemma slightly crested at the apex, scabrous and pilose; stamens 3, anthers 0.8 mm long. Caryopsis ellipsoid, 1.5 mm long, 0.8 mm wide, hilum punctiform, embryo ½ the length of the caryopsis.

Distribution and ecology: Ecuador, Peru, Venezuela, Guyana, Surinam, and Brazil, on forest edges, often leaning on vegetation, or in open places, between 500 and 2,600 m.

Additional specimens examined. BRAZIL. BAHIA: Rui Barbosa, *Almeida 22* (US); Serra do Tombador, NW of Jacobina, on BR-234 to Ouro Branco, 950 m, *Harley et al. 16634* (K); Serra do Sincorá, Lagoa Encantada, 19 km NE of Ibicoara, *Harley et al. 15783* (CEPEC, K, US). CEARA: Campo Grande, *Swallen 4531* (US). RORAIMA: without locality, *Rondón s.n.* (RB 110790). ECUADOR. LOJA: between La Toma and Loja, 1,800–2,600 m, *Hitchcock 21420* (US). GUYANA. Kaieteur Plateau, *Maguire & Fanshawe 23446* (K, NY); vicinity of Kaieteur Falls and along W rim of Potaro Gorge, ca. 1,400 ft., *Cowan & Soderstrom 1891* (K, NY, P). PERU. CAJAMARCA: Cutervo, a 7 km sobre la carretera Cutervo–Socota, *Sánchez-Vega 2295* (SI). SURINAM. 5 km E of Lucie Rivier, *Irwin et al. 55684* (K, SI, US); 14 km N of Lucie Rivier, *Maguire et al. 54280* (US). VENEZUELA. AMAZONAS: Dpto. Atabapo, Cerro Huachamacari, base of main wall and slope below it, E side, 800–1,300 m, forest, 3°49'N, 65°43'W, *Liesner 25867* (MO). ANZOATEGUI: Distr. Freites, burro trail between San Durnal and Los Pajaritos, *Davidse & González 19792* (VEN); Cerro Peonia, above Los Pajaritos, 31 km NE of Bergantín and N of Mundo Nuevo, Serranía de Turimiquire, 1,400–1,700 m, *Davidse & González 19850* (MO, VEN), *19914A* (MO, VEN); Distr. Libertad, ridges and tops of Montañas Negras, along the Sucre and Anzoátegui border, 20 airline km NE of Bergantín, NE of Buenos Aires, Serranía de Turimiquire, 2,000 m, *Davidse & González 19563* (MO). BOLIVAR: Gran Sabana, formación Roraima, a lo largo del Río Aponguao, cerca del km 146 al S de El Dorado, 1,350–1,400 m, *Steyermark et al. 104200* (COL, US); la Gran Sabana, 49 km W of the intersection of the main road to Santa Elena and road to Cabanayén, 1,360 m, *Davidse et al. 4749* (MO, US, VEN), *4783a* (MO, SI, VEN); la Gran Sabana, ca. km 167, S of El Dorado along Hwy. to Santa Elena, 24 km S of La

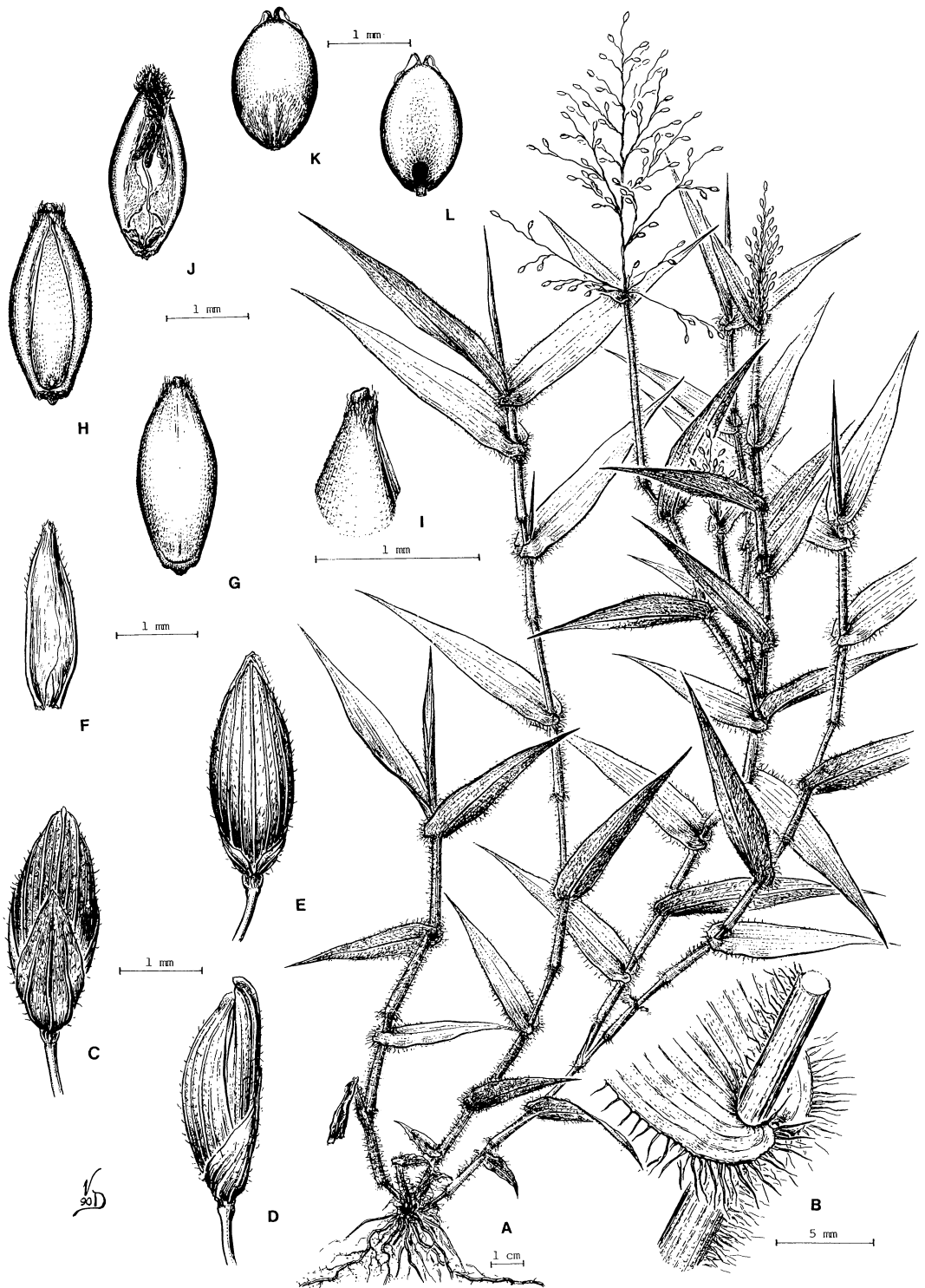


FIGURE 34. *Panicum pycnocladus*.—A. Habit.—B. Detail of clasping base of the blade.—C. Spikelet, lower glume view.—D. Spikelet, lateral view.—E. Spikelet, upper glume view.—F. Lower palea.—G. Upper antherium, lemma view.—H. Upper antherium, palea view.—I. Detail of apex of the lemma.—J. Upper palea with lodicules, anthers, and stigma.—K. Caryopsis, embryo view.—L. Caryopsis, hilum view. (All based on *Steyermark* 87974.)

Ciudadela, *Davidse* 4763 (MO, SI, VEN); a 12 km al N de La Ciudadela, Gran Sabana, 1,400 m, 5°50'N, 61°27'W, *Zuloaga et al.* 4474 (MO, SI, VEN); entre Piedra de la Virgen y la parte alta de la Escalera, carretera a la Gran Sabana, 500–1,400 m, 6°0'N, 61°25'W, *Zuloaga et al.* 4404* (MO, SI, VEN); Distr. Piar, Chimantá Massif, 1,600–1,700 m, *Steyermark* 75642 (NY, US), 128196 (SI); Sierra Imataca, Río Toro, between Río La Reforma and Puerto Rico, N of El Palmar, 200 m, *Steyermark* 87974 (NY, US, VEN); Meseta del Jaua, Cerro Jaua, cumbre, 4°48'N, 64°34'W, *Steyermark et al.* 109377 (NY); Jaua, sector centro-meridional, cabeceras del Río Marajano, 4°48'N, 64°32'W, *Huber* 13043, 13046 (MO).

Zuloaga & Judziewicz (1991) mentioned that the specimen *Tutin* 651 is marked as type of *P. pycnocladus* in BM.

This is one of the species of *Panicum* found at higher elevations, being present in Ecuador to 2,600 m.

Swallen (1939, 1957) described three species from Venezuela: *P. albociliatum*, *P. tiricaense*, and *P. tiricaoides*. No morphological differences were observed between these species and *P. pycnocladus*.

Panicum pycnocladus is characterized by having asymmetrical, lanceolate or ovate-lanceolate leaves and spikelets 2.2–3(–3.3) mm long with a conspicuous internode between the lower and upper glume. While most of the specimens of *P. pycnocladus* examined have glabrous spikelets, some populations have spikelets with short hairs.

Panicum pycnocladus shows close affinities to *P. stipiflorum*, and the latter species may represent a variant of *P. pycnocladus*. *Panicum pycnocladus* has spikelets with the lower glume $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet, and blades with only the lower margins pilose. *Panicum stipiflorum* has spikelets with the lower glume usually $\frac{1}{2}$ the length of the spikelet and blades with long-ciliate margins.

Anatomically, the specimen studied has a definite keel that is structurally distinguishable from the other first-order vascular bundles due to the presence of additional sclerenchyma tissue in the form of adaxial and abaxial girders (Fig. 11A). The cushion-based macrohairs of *P. pycnocladus* are of interest, as this hair type is not common in the section. The hair bases are clearly sunken between numerous raised and modified epidermal cells which form the cushion (Fig. 11B). The hairs themselves are also much thicker than the needlelike hairs that occur on other species such as *P. cumbucana* (Fig. 6C), *P. hebotos* (Fig. 9A–D), and *P. peristypum* (Fig. 10C, D). The thick, cushion-based macrohair type is best developed in *P. pycnocladus*, although similar hairs do occur in *P. viscidellum* (Fig. 19), some specimens of *P. acumi-*

natum (Fig. 3E, F), and near the leaf blade margin in *P. davidsei* and *P. sabulorum* (Fig. 12A).

25. *Panicum sabulorum* Lam., *Encycl.* 4: 744. 1798. *Dichantherium sabulorum* (Lam.) Gould & Clark, *Ann. Missouri Bot. Gard.* 65: 1112. 1978. TYPE: Uruguay. Montevideo: Montevideo, *Commerson s.n.* (holotype, P; fragment, BAA; isotypes, R, US). Figure 12.

Short-rhizomatous perennials, with two different kinds of culms: young culms simple, erect, with broad, cordate, lanceolate leaves; older culms erect to decumbent, occasionally rooting and profusely branching at the lower and upper nodes, to 1 m long, with leaves smaller than those of the primary culms; internodes hollow, cylindrical, hirsute, nodes densely pilose to glabrous, dark. *Sheaths* 2.5–6 cm long, hirsute to glabrous, the margins ciliate, glands present or absent, more conspicuous toward the distal portion. *Ligules* membranous-ciliate, 0.4–1.1 mm long. *Leaves* lanceolate, 1–9(–15) cm long, 0.2–1.4(–2) cm wide, flat, the base subcordate or cordate, amplexicaulous, the apex acuminate, rigid to herbaceous, hispid, with short, stiff hairs or with papillose-pilose hairs, or glabrous, the lower margins long-ciliate, otherwise scabrous, the midnerve inconspicuous. Primary *inflorescences* lax, diffuse, few- to multiflowered, *panicles* 2–10 cm long, 2–8 cm wide; *main axis* hirsute or glabrous, glandular or eglandular, first-order branches alternate, divergent, the axis of the branches long-hirsute to scabrous and glandular or eglandular; pedicels claviform, hirsute, glandular or eglandular; axillary panicles similar to the terminal one, smaller. *Spikelets* obovoid, biconvex, 1.9–3 mm long, 0.9–1.4 mm wide, paired or solitary, shortly stipitate, greenish and tinged with purple, hirsute to glabrous, glumes and lower lemma with manifest nerves. *Lower glume* $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet, 3–5-nerved, the nerves anastomosing toward the apex, ovate, obtuse to acute and embracing the upper glume on its base. *Upper glume* 7–9-nerved, obtuse, not covering the apex of the upper anthercium. *Lower lemma* glumiform, 7–9-nerved. *Lower palea* ovate, 1.6 mm long, 0.8 mm wide, hyaline, the margins short-ciliate; lower flower male or absent. *Upper anthercium* broadly ellipsoid, 1.8–2.5 mm long, 0.7–1.2 mm wide, stramineous, shiny, shortly apiculate, with simple papillae in regular rows; lemma 5-nerved. *Caryopsis* broadly ellipsoid, 1.5 mm long, 1 mm wide; hilum punctiform, embryo less than half the length of the caryopsis.

KEY TO THE VARIETIES

1. Leaf blades clasping the culm 25c. var. *cordatum*
1. Leaf blades not clasping the culm 2

2. Spikelets (2.2-)2.4-3 mm long, pilose; blades pilose; plants growing in open, dry places 25a. var. *sabulorum*
2. Spikelets 1.9-2.3(-2.6) mm long, glabrous or sparsely pilose; blades glabrous; plants growing on forest edges in humid places 25b. var. *polycladum*

25a. *Panicum sabulorum* var. *sabulorum*.

Figure 32.

P. acutatum Steudel, Syn. Pl. Glumac. 1: 86. 1853. TYPE: Chile. Concepción: Concepción, *D'Urville s.n.* (holotype, P; fragments BAA, US 80445).

Panicum latiglume Doell in C. Martius, Fl. Bras. 2(2): 257. 1877. *Panicum latiglume* var. *villosum* Doell in C. Martius, Fl. Bras. 2(2): 257. 1877. *Panicum latiglume* Doell f. *villosum* (Doell) E. Ekman, Ark. Bot. 13(10): 28. 1913. *Panicum latiglume* Doell f. *genuinum* (Doell) E. Ekman, Ark. Bot. 13(10): 28. 1913, nom. illeg. TYPE: Brazil. Santa Catarina: Isla de Santa Catarina, *Gaudichaud 90* (isotype, P; fragment, US 80869).

Panicum latiglume Doell var. *decalvatum* Doell in C. Martius, Fl. Bras. 2(2): 257. 1877. *Panicum latiglume* Doell f. *decalvatum* (Doell) E. Ekman, Ark. Bot. 13(10): 28. 1913. TYPE: Brazil. Santa Catarina: Isla de Santa Catarina, *Gaudichaud 91* (fragment, US 80869).

Panicum fultum Hackel, Repert Spec. Nov. Regni Veg. 6: 342. 1909. SYNTYPES: Uruguay. Montevideo: Montevideo, arenas de la Barra de Santa Lucía, *Arechavaleta s.n.* (syntypes, W, G, BAA). Paraguay. Cordillera: in campis prope Caraguatay, *Hassler 3124* (syntypes, G, NY, W, fragment, BAA).

Distribution and ecology: southern Brazil, Argentina, Paraguay, and Chile; found in open places on sandy soils.

Selected specimens cited. ARGENTINA. BUENOS AIRES: Balcarce, *Hunziker 2166* (SI). CORRIENTES: La Cruz, *Burkart 7943* (SI), *Parodi 12364* (US); ruta nac. 12, 20 km E de Ituzaingó, *Zuloaga et al. 3231* (SI). ENTRE RIOS: arroyo El Palmar, *Burkart & Crespo 22927* (SI), *Zuloaga & Morrone 3857* (MO, SI); Colonia Ayuí, *Zuloaga & Morrone 3852* (MO, SI); Colón, Palmar, *Burkart et al. 23267* (SI); ruta 12, desvío a Holt, arroyo El Cuartillo, *Zuloaga 3864* (MO, SI). CHACO: Isla del Cerrito, *Krapovickas & Cristóbal 20048* (CTES). BRAZIL. PARANA: Colônia Orleans, Curitiba, *Dombrowski 1958* (CTES); Mun. 4 Barras, Rio Taquari, próx. Estr. Graciosa, *Hatschbach 35525* (K). RIO DE JANEIRO: Petrópolis, Carangola, *Góes & Dionisio 417* (US). RIO GRANDE DO SUL: Taimbesinho, prope São Francisco de Paula, *Rambo 54532* (US); Rio Grande, *Swallen 9252* (US); entre São Lourenço e Camaqua, *Pereira 6811* (RB); Bagé, Hulha Negra, *Allem & Vieira 1809* (ICN, SI); Sta. Maria, Est. Experimental, 23 Nov. 1955, *Camargo s.n.* (SI); Osório, estrada Pasinhos a Osório, 7 km antes do entroncamento com a BR-101, margem da Lagoa dos Barros, *Valls et al. 2308* (CTES); Lages, *Swallen 8140* (US). SANTA CATARINA: Sombrio, *Reitz 1978* (NY); Serra dos Ilheos, *Smith & Klein 15464* (NY, SI); Ubatuba, *Hans 317* (SI); without locality, *D'Urville s.n.* (W). SÃO PAULO: Cananeia, Ilha do Cardoso, Praia do Marujá, *da Silva 249* (MO); São Paulo, Parque do Estado, *Sendulsky 768* (SI), *842* (SI,

SP); Santos, *Sendulsky 739* (SI, SP). CHILE. CONCEPCION: Concepción, *D'Urville 1821* (P), *Gay s.n.* (P). MAULE: without locality, *Fuentes s.n.*, Dec. 1911 (W). PARAGUAY. PARAGUARI: Paraguari, *Balansa 8*, (G, K, P); Cordillera de Piribebuy, au desus de Mbatobí, 1 Nov. 1883, *Balansa 4202* (P). URUGUAY. CANELONES: Ruta Interbalnearia Km 51, Arroyo Solís Chico, *Dubcovsky 834, 835, 836, 837* (all SI); Carrasco, *Burkart 19982* (SI), *Osten 6917* (W), *Herter 324* (G, MO, NY, SI). MONTEVIDEO: Montevideo, *Arechavaleta 144* (W), *Montoro 2667* (P); prés Montevideo, *D'Orbigny 8* (W). ROCHA: La Paloma, *Zuloaga & Deginani 1081* (SI). SALTO: Granja Catáneo, *Rosen-gurt B-6217* (SI). TACUAREMBO: Camino a Ribera, a 32 km de Tacuarembó, *Cabrera & Zuloaga 32424, 32425* (SI).

In this variety the spikelets are pilose, (2.2-)2.4-3 mm long, the axis of the inflorescence is hirsute, and the blades are rigid and hirsute.

25b. *Panicum sabulorum* var. *polycladum*

(E. Ekman) Palacios, in *Burkart*, Fl. Ilustr. Entre Rios, Colec. Cient. INTA 6(2): 316. 1969. *Panicum polycladum* E. Ekman, Ark. Bot. 11(4): 24. 1912. TYPE: Argentina. Misiones: Bonpland, 27 Jan. 1908, *Ekman 651* (holotype, S; fragment, US 80923; isotype, CORD). Figure 32.

Panicum demissum Trin., Spec. Gram. 3: pl. 319. 1832. TYPE: Brazil. Rio de Janeiro: Rio de Janeiro, *Martius s.n.* (holotype, LE; fragment, US 557430).

Panicum ramosissimum Trin., Mem. Acad. St. Petersb. VI. Sci. Nat. 1: 312. 1834. TYPE: Brazil. Without locality, *Sellow s.n.* (holotype, LE; fragment, US 974731).

Panicum pencanum Philippi, Anal. Univ. Chile 93: 713. 1896. TYPE: Chile. Concepción: Concepción, 1888, *Philippi s.n.* (isotype, CORD; fragment, BAA, US).

Panicum deltae L. Parodi ex *Burkart*, Bol. Soc. Argent. Bot. 12: 291. 1968. TYPE: Argentina. Buenos Aires: Delta del Paraná inferior bonaerense, arroyo Chaná Miní, 14 Jan. 1923, *Parodi 4928* (holotype, SI; isotypes, BAA, US 1160950).

Distribution and ecology: found from the states of Minas Gerais and Rio de Janeiro to southern Brazil; also in Paraguay, Uruguay, Argentina, Bolivia, and Chile. Plants grow in shady and wet areas, on forest edges, to 1,500 m.

Selected specimens cited. ARGENTINA. BUENOS AIRES: Punta Lara, *Zuloaga & Deginani 1891, 3085* (SI), *3859, 3861* (SI); Cerro La Peregrina, 20 km N of Mar del Plata, *Eyerdam et al. 23678* (MO, SI, US); Escobar, Paraná de Las Palmas, *Zuloaga & Morrone 3079, 3860* (SI), *4543, 4544* (MO, SI). CORDOBA: W of Tanti at Rancho Alegre, *Renvoize 3743* (SI); between Cerro Blanco and La Hollada, ruta nac. 20, km 767, *Solomon 4091* (MO). CORRIENTES: Puente Pesoa, *Quarín 1744* (CTES, SI); ruta nac. 12, 20 km E de Ituzaingó, *Zuloaga et al. 3228* (SI); Cuay Grande, *Zuloaga & Deginani 554* (SI); Estancia Santa Teresa, *Pedersen 2997* (P). ENTRE RIOS: Nueva Escocia, *Bacigalupo et al. 871* (SI); ruta 14 y Río Gualaguaychú, 4 km al N, *Bacigalupo et al. 579*

(SI); San José de Feliciano, Arroyo Feliciano, *Bacigalupo et al.* 696 (SI). FORMOSA: without locality, *Kermes* 346 (SI). JUJUY: Sierra de Zapla, Mina 9 de Octubre, *Cabrera et al.* 32004 (SI); Santa Bárbara, *Venturi* 9545 (SI, US, W), 9691 (US). MISIONES: Villa Venecia, *Renvoize et al.* 3034 (P, SI); casa de Horacio Quiroga, *Zuloaga et al.* 3191 (MO, SI); La Granja, Posadas, *Ekman* 645 (G, US); 15 km de San Javier, *Zuloaga et al.* 1972* (SI); entre San Pedro y Puerto Piray, km 76, *Zuloaga et al.* 2060* (SI); San Antonio, *Zuloaga et al.* 2128* (SI). SALTA: Cerro Pelado Chiquito, Parque Nac. El Rey, *Malmierca* 2006 (SI); Depto. Rosario de Lerma, Campo Quijano, *Venturi* 8428 (US). BOLIVIA. COCHABAMBA: Comarapa to Cochabamba, *Renvoize & Cope* 4072 (K, US). SANTA CRUZ: entre Comarapa y Pojo, *Zuloaga et al.* 1579 (SI). BRAZIL. ESPIRITO SANTO: Serra do Caparaó, *Chase* 9680 (MO), 9730 (US), 9731 (US, W). MINAS GERAIS: Serra do Itabirito, ca. 50 km SE of Belo Horizonte, *Irwin et al.* 19715 (MO, NY, US); Barbacena, Serra Mantiqueira, *Chase* 8646 (NY, US), 8674 (NY, US); Mun. Itamonte, Parque Nacional de Itatiaia, *Zuloaga et al.* 2380* (SI). PARANA: Passa Vinte, *Clayton* 4269 (K, NY, US); Mun. Jaguariava, Fazenda Samambaia, *Hatschbach* 35451 (K); 2 km E of Cascavel along highway BR-277 to Curitiba, *Davidse et al.* 11255 (MO, SI, US). RIO GRANDE DO SUL: Santa Vitoria do Palmar, *Swallen* 7406 (US); Tenente Portela, *Valls et al.* 1780 (CTES, US); Nova Petrópolis, km 100 da BR-116, ao N da ponte sobre o Rio Caí, *Valls et al.* 1664 (CEN, ICN, SI), 1665 (ICN, SI). RIO DE JANEIRO: Corcovado, *Chase* 8159 (MO, NY); Patí do Alferes, *Sucre et al.* 9087 (RB); Parque Nacional Itatiaia, picada Macieiras, *Zuloaga et al.* 2352* (RB, SI, US), *Chase* 8267 (RB, US), 8268 (US); Parque Nac. Itatiaia, Rio Campo Belho, *Zuloaga et al.* 2361* (RB, SI, US); Serra dos Orgãos, 16 km S of Itaipara, *Davidse et al.* 11422 (MO). SANTA CATARINA: 4 km S of Xanxerê, *Smith & Klein* 13066 (K, NY, SI); W of Chapecó on road to Guatambú, *Smith & Reitz* 12534 (K, R, US); Mun. Ponte Serrada, 2 km S of Paraná line, fazenda, *Smith et al.* 15680 (US); Mun. São Joaquim, Rio Lava Tudo, *Smith & Klein* 15896 (K, SI, US); 10 km S of São Joaquim, *Smith & Reitz* 14305 (K, NY, SI, US). SÃO PAULO: Campos do Jordao, Serra Mantiqueira, *Chase* 9894 (US); city of São Paulo, Agua Funda, *Eiten & Eiten* 6236 (MO). CHILE. Taleamavida, *Barros* 291 (SI). MAULE: ad rivulos pr. Constitución, *Reiche* s.n. (W). PARAGUAY. Encarnación, *Pavetti & Rojas* 10855 (US). CAAGUAZU: in vicinias Caaguazú, *Balansa* 4a (K, P), *Hassler* 9212 (G, K, NY, US). CORDILLERA: Eusebio Ayala, *Schinini* 2423 (CTES), 2583 (CTES, SI). GUAIRA: Villa Rica, *Balansa* 5 (G), 5a (P). URUGUAY. CANELONES: Toledo, *Osten* 20083 (US). FLORIDA: Río Yí y Arroyo Mansavillagra, *Rosengurt B-739* (US); La Palma, *Herter* 1153 (US). MALDONADO: Cerro Pan de Azúcar, *Rosengurt B-2722* (US). MONTEVIDEO: Montevideo, Barra del Santa Lucía, *Archavaleta* 267 (US); Montevideo, balneario Carrasco, *Osten* 6511 (SI). ROCHA: Parque San Miguel, *Rosengurt & Del Puerto* 9253 (US). SAN JOSE: Río Santa Lucía, próximo al pueblo "25 de Agosto," *Rosengurt B-247* (US). SORIANO: Isla Redonda, *Berrio* 6350 (W). TACUAREMBO: Gruta de los Cuervos, *Cabrera & Zuloaga* 32393 (SI).

Panicum sabulorum var. *polycladum* usually grows in humid and shady places, on forest edges or streams. It differs from variety *sabulorum* by having smaller spikelets (1.9–2.3(–2.6) mm long)

that are glabrous or with scattered hairs toward the apex; herbaceous and usually glabrous blades; and panicles with the main axis and branches commonly glandular.

Glaziou 4305, from Rio de Janeiro, Brazil, was cited by Doell (1877) as *P. nodiflorum* Lam. (= *P. dichotomum* L. var. *dichotomum*).

25c. *Panicum sabulorum* var. *cordatum* Zuloaga & Morrone, *Novon* 1: 117. 1991. TYPE: Brazil. Paraná: Carvalho, *Dusén* 13336 (holotype, US; isotype, W). Figure 32.

Additional specimens examined. BRAZIL. PARANA: Serrinha, *Jönson* 1076a (US), *Dusén* 15596 (NY, SI, US); Trancheira, *Jönson* 1099a (US). SANTA CATARINA: Pilões, 200 m, *Reitz & Klein* 3225 (NY, US); Mun. Praia Grande, *Valls* 10087 (CEN, SI).

In this variety the spikelets are glabrous, 2–2.2 mm long; manifest glands are present on the glabrous sheaths and axis of the inflorescences; and the leaf blades are amplexicaulous, cordate, asymmetrical at base, glabrous and up to 15 cm long and to 2 cm wide.

26. *Panicum sciurotis* Trin., *Gram. Panic.* 228. 1826. *Dichantherium sciurotis* (Trin.) Davidse, *Novon* 2: 104. 1992. TYPE: Brazil: "V. sp. Brasil," *Chamisso* s.n. (holotype, LE). Figure 28.

Panicum rostellatum Trin., *Mém. Acad. Imp. Sci. Saint-Petersbourg, Sér. 6, Sci. Math., Seconde Pt. Sci. Nat.* 3(2): 288. 1834. TYPE: Brazil. Bahia: "In arenosis prope Ilheos (Brasil) Sep. 1821," without collector, 232 (holotype, LE; fragment, US 974732).

P. cordifolium Steudel, *Syn. Pl. Glumac.* 1: 85. 1853, non Desv. 1831. *Panicum sciurotis* Trin. var. *breviglume* Doell in C. Martius, *Fl. Bras.* 2(2): 250. 1877. TYPE: Paraguay. Without locality, *Rengger* s.n. (holotype, P).

P. trichoptium Steudel, *Syn. Pl. Glumac.* 1: 85. 1853. TYPE: Brazil. Bahia: without locality, *Salzmann* s.n. (lectotype, P; fragment, US 2903508).

P. diffusulum Salzm. ex Steudel, *Syn. Pl. Glumac.* 1: 89. 1853. TYPE: Brazil. Bahia: without locality, in sabulosis umbrosis, *Salzmann* 684 (holotype, P; fragments, US 967933, 974705, 2903510; isotypes, G, K, MO, P, W).

P. sciurotis Trin. var. *molliusculum* Doell in C. Martius, *Fl. Bras.* 2(2): 250. 1877. TYPE: Brazil. "In Insula S. Catharinae," *Chamisso* s.n. (lectotype, here designated, LE).

Annual. Culms geniculate, decumbent, rooting and branching at the lower nodes, then becoming erect, 5–25 cm tall; internodes hollow, compressed, hirsute, 2–8 cm long; nodes dark, densely pilose with retrorse whitish hairs. Sheaths striate, 1–5 cm long, hirsute, with long whitish hairs, the margins ciliate. Ligules membranous-ciliate, ca. 0.4 mm long; collar pilose, brownish. Blades ovate-

lanceolate, 1.5–9 cm long, 0.8–2.8 cm wide, herbaceous, flat, hirsute, papillose-pilose with short, rigid hairs, the base amplexicaulous, the margins ciliate, the midnerve inconspicuous. *Inflorescence* terminal, exserted; peduncle 5–7.5 cm long, flexuous, hirsute; *panicles* lax, diffuse, 2–7 cm long, 1–5 cm wide; *main axis* flexuous, papillose-pilose with long hairs; pulvini pilose; first-order branches divergent, alternate or opposite, the axis of the branches flexuous, smooth, glabrous or with scattered long hairs; pedicels smooth, glabrous; axillary panicles present, similar to the terminal one. *Spikelets* solitary, ellipsoid, 1.5–1.7 mm long, 0.7–0.8 mm wide, hirsute, with short hairs, the upper glume and lower lemma subequal or the upper glume shorter, the nerves inconspicuous. *Lower glume* 0.3–0.4 mm long, $\frac{1}{4}$ or less the length of the spikelet, nerveless, truncate, not embracing the upper glume at the base. *Upper glume* obtuse, not covering the apex of the antherium, 5(–7)-nerved, the nerves anastomosing, obtuse. *Lower lemma* glumiform, obtuse, slightly inflated at the base, 5-nerved, the nerves anastomosing toward the distal portion. *Lower palea* lanceolate, 0.9 mm long, 0.2 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 1.4–1.5 mm long, 0.5–0.7 mm wide, glabrous, smooth and shiny, short-apiculate, with simple papillae all over its surface. *Caryopsis* obovoid; hilum punctiform; embryo $\frac{1}{3}$ the length of the caryopsis.

Distribution and ecology: restricted to northeastern Brazil, where it grows in sandy soils, in open places or forest edges.

Additional specimens examined. BRAZIL. BAHIA: Bahia, *Chase 7901* (F, RB, SI, US, W); Cruz das Almas, *Pinto 941* (US). CEARA: Campo Grande, *Swallen 4539* (RB, SI, SP, US); Campo Salles to Crato, *Swallen 4303* (K, R, SP); Serra do Araripé, *Luetzelburg 26101* (M, US); Serra do Araripé, Novo Exú, *Luetzelburg 26141* (M). PERNAMBUCO: Carvarú, *Tenorio 66-197* (US); Garanhuns, *Chase 7791* (US); vicinity of Recife, *Chase 7732 1/2* (US); Recife, *Tavares 788* (US). RIO GRANDE DO NORTE: Natal, *Swallen 4677* (SP, US); Nova Cruz to Montanhas, *Swallen 4823* (RB, SP, US); entre Parnamirim e São Jose de Mipibú, *Emygdio 1663* (R, US); without locality, *Riedel s.n.* (K, M, P, US 974737).

The type locality of the species, Santa Catarina, Brazil, is probably erroneous, since *P. sciurotis* has only been found in northeastern Brazil, in Ceará, Pernambuco, Bahia, and Rio Grande do Norte. The same is probably true for the type material of one of its synonyms, *P. cordifolium*, which was originally cited from Paraguay.

Panicum sciurotis differs from *P. sciurotoides* in having spikelets with the lower glume nerveless and truncate; upper glume and lower lemma 5(–

7)-nerved with the nerves not manifest; upper antherium inserted laterally in relation to the axis of the rachilla; and lower lemma inflated at the base.

Panicum litigosum Steudel, a species often associated with *P. sciurotis*, is a synonym of *P. brevifolium* L., an African species in Bahia, Brazil.

27. *Panicum sciurotoides* Zuloaga & Morrone, *Novon* 1: 1. 1991. *Dichantherium sciurotoides* (Zuloaga & Morrone) Davide, *Novon* 2: 104. 1992. TYPE: Brazil. Minas Gerais: Distr. Diamantina, Christais, near Corrigan Duas Pontes, 1,160 m, 13 May 1931, *Mexia 5819* (holotype, MO; isotypes, G, K, M, P, R). Figures 14, 28.

Annual. *Culms* decumbent, geniculate, rooting and branching at the lower nodes, erect portion 10–85 cm tall, branching at the upper nodes; internodes 2.5–11.5 cm long, terete, hollow, hispid to glabrous; nodes dark, compressed, densely pilose with retrorse whitish hairs. *Sheaths* striate, 3–6.5 cm long, sparsely papillose-pilose to glabrous, the margins ciliate or one margin ciliate and the other one membranous. *Ligules* membranous-ciliate, small, surmounted by long hairs at the base of the blade; collar pilose. *Blades* ovate-lanceolate, 3–10 cm long, 0.8–2 cm wide, flat, the base cordate, clasping and asymmetric, either densely hirsute with short to long appressed tuberculate hairs or short-hispid on the abaxial surface, or glabrous, the margins ciliate toward the base, otherwise scabrous. *Inflorescence* terminal, lax, diffuse, pyramidal, 2.5–9 cm long, 1.5–8.5 cm wide; *main axis* flexuous, hirsute, with long papillose-pilose hairs; branches alternate, flexuous, the axis of the branches smooth, glabrous; pedicels glabrous. *Spikelets* solitary, narrowly ellipsoid, 1.5–1.9 mm long, 0.5–0.7 mm wide, greenish, short-hispid, the upper glume and lower lemma subequal. *Lower glume* ovate, 0.4–0.9 mm long, usually $\frac{1}{3}$ – $\frac{1}{2}$ or more the length of the spikelet, acute to truncate, 1–3(–7)-nerved. *Upper glume* 7–9(–11)-nerved, not embracing the lower lemma. *Lower lemma* glumiform, 7–9-nerved, acute, not inflated at the base. *Lower palea* lanceolate to truncate, 0.7–1 mm long, 0.2–0.3 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 1.2–1.7 mm long, 0.4–0.6 mm wide, smooth, shiny, short-apiculate, with simple papillae over its entire surface. *Caryopsis* 1.1 mm long, 0.7 mm wide.

Distribution and ecology: widely distributed from Belize and Panama to Bolivia and Brazil; common on forest edges, with the culms straggling in low vegetation, often in disturbed and open places in sandy soils; from 100 to 1,400 m.

Selected specimens cited. BELIZE. EL CAYO: ca. 3 mi. S of Grano de Oro on road between Millionario and La Flor, *Croat 23391, 23398A* (MO). BOLIVIA. LA PAZ: Hacienda Canana, sobre el camino a Tipuani, *Buchtien 7115* (BAA, G, US), *7116* (MO); Hacienda Simaco sobre el camino a Tipuani, *Buchtien 5319* (M, MO, US). BRAZIL. ALAGOAS: Porto de Pedras, Fazenda Canada, *Campelo 1444* (CTES). BAHIA: Bom Jesus, *Luetzelburg 135a* (M); São Bento das Lages, *Luetzelburg 133* (K, M); 12 km N of Cachoeira, 225 m, *Chase 8082* (MO, US); Serra do Tombador, NW of Jacobina, on BR 234 highway to Ouro Branco, *Harley et al. 16636* (CEPEC, K, US); Serra da Agua de Rega, ca. 27 km N of Seabra, road to Agua de Rega, 1,000 m, *Irwin et al. 31023* (MO). CEARA: Barra do Cocó, *Black 55-18336* (IAN); Praia Náutica de Fortaleza, *Black 55-18347* (IAN). ESPIRITO SANTO: Alfredo Chaves, Vila São Bento de Uranio, *Zuloaga et al. 2409* (RB, SI, US); Santa Teresa, Reserva Biológica de Nova Lombardia, Picada da Cachoeira, *Zuloaga et al. 2427* (RB, SI, US). MINAS GERAIS: Diamantina, Serra de San Antonio, *Chase 10373* (US); ca. 1 km S of São Pedro do Suaçui along Hwy. MG-3, 520 m, *Davidse et al. 11495* (MO); Juiz de Fora, Morro do Imperador, *Chase 8571* (US); abandoned diamond mines, steep slopes of Rio Jequitú, ca. 15 km E of Diamantina, *Irwin et al. 27933* (MO, P); ca. 15 km N of São Joao da Chapada, *Irwin et al. 28151* (F, K, MO, UB, US); Serra do Espinhaço, ca. 8 km E of Diamantina, *Irwin et al. 27666* (K, MO, UB, US). PARANA: Paranaguá, *Dombrowski 277* (K, US); Pinheirinho, Mun. Antonina, *Hatschbach 14758* (K, US). PERNAMBUCO: Dois Irmaos, vicinity of Pernambuco, *Chase 7732* (MO, US); SW of Garanhuns, 300–400 m, *Chase 7828* (MO). RIO DE JANEIRO: Monte Serrat, Serra da Itatiaia, *Chase 8246* (IAN, MO, US); Parque Nac. Itatiaia, Picada Macieiras, *Zuloaga et al. 2349** (MO, RB, SI, US), *2354** (RB, SI, US). SANTA CATARINA: Vila Velha, arredores, *Paciornik 117* (K); without locality, *D'Urville s.n.* (P), *Schenck 229* (W). SÃO PAULO: Cananeia Island, 1 km NE of city along E shore of island, *Clayton & Eiten 4743* (K). ECUADOR. EL ORO: between La Chonta and Portovelo, *Hitchcock 21211* (US). TUNGURAHUA: Baños, *Pachano 228* (US). GUYANA. Forest along Potaro River, 4 mi. above Kaieteur Falls, *Cowan & Soderstrom 2109* (K, NY, P, US). FRENCH GUIANA: Galbao Mt., 650 m, *de Granville et al. 8966* (CAY, P, US). PANAMA. COCLE: along continental divide near sawmill above El Copé, *Knapp 3822* (SI). VENEZUELA. BOLIVAR: 12 km al N de La Ciudadela, Gran Sabana, 5°50'N, 61°27'W, *Zuloaga et al. 4475** (MO, SI, VEN); Salto El Dante, 35 km N of La Ciudadela on way down from La Gran Sabana, along highway to El Dorado, *Davidse 4951* (MO, SI, VEN); entre Piedra de la Virgen y la parte alta de la Escalera, carretera a la Gran Sabana, 60°01'N, 61°25'W, *Zuloaga et al. 4399* (MO, SI, VEN). FALCON: cerca de Maraparari, *Lasser & Foldats 3005* (VEN). YARACUY: 7.5 km N of Salom, cloud forest, 10°15'N, 68°29'W, *Liesner & Steyermark 12373* (MO); 5 km N of Salom, transition between savanna and forest, *Davidse et al. 20674* (MO).

Panicum sciurotoides is related to *P. sciurotis* Trin., from which it differs in having the lower glume $\frac{1}{3}$ – $\frac{1}{2}$ or more the length of the spikelet and 1–3(–7)-nerved; the upper glume 7–9(–11)-nerved; the lower lemma 7–9-nerved and not inflated at base; and the upper antherium inserted basally.

Panicum viscidellum differs from *Panicum sciurotoides* in its pseudogligule composed of long hairs.

Anatomically, all specimens examined are very similar in leaf anatomy (Fig. 14). The keel of this species is distinctive, containing only a single vascular bundle (Fig. 14A). The asymmetrical, S-like nature of the lamina on either side of the keel is of particular interest, as this structure does not occur in any other taxon of section *Dichantherium*, yet is common in section *Cordovensia*, also of subgenus *Dichantherium*.

Large-spikelet form of *P. sciurotoides*: BRAZIL. RIO DE JANEIRO: between Alta Boa Vista and Silvestre, vicinity of Rio de Janeiro, 450–520 m, 23 Jan. 1925, *Chase 8374* (F, NY, US); camino Dos Macacos, Jardim Botânico to Alta Boa Vista, vicinity of Rio de Janeiro, 100–200 m, 12 Feb. 1925, *Chase 8446* (US); Corcovado, Sep. 1920, *Kuhlmann & Duke 16233* (SI); Corcovado, vicinity of Rio de Janeiro, 700 m, 11 Jan. 1925, *Chase 8169* (F, GH, MO, NY); Corcovado, 6 Mar. 1924, *Bailey & Bailey 742* (US); Tijuca, 1,000 m, 28 Apr. 1930, *Chase 12158* (US).

These specimens, included provisionally in *P. sciurotoides*, have spikelets 1.9–2.2 mm long and panicles 3.5–8 cm long. They were collected in Rio de Janeiro, Brazil, in mountains of the Serra do Mar, scandent on the forest margins.

28. *Panicum scoparium* Lam., *Encycl.* 4: 744. 1798. *Dichantherium scoparium* (Lam.) Gould, *Brittonia* 26: 60. 1974. TYPE: United States. South Carolina: without locality, *Mitchaux s.n.* (holotype, P-MICH; photo and fragment, US 2808935). Figure 28.

Plants perennial with a rosette of winter leaves. *Culms* ascending, slightly decumbent at the base, to erect, to 1.6 m tall, simple and then freely branching at the upper nodes; internodes cylindrical, hollow, villous, covered with appressed whitish hairs, purplish to greenish, nodes densely pilose, covered with retrorse whitish hairs, with a glandular zone below. *Sheaths* striate, densely papillose-pilose and covered with conspicuous glands, the margins shortly pilose. *Ligules* membranous-ciliate, 1.5–2.5 mm long, membranous portion inconspicuous or to 0.5 mm long. *Blades* lanceolate, (2–)10–19 cm long, (0.3–)1.5–1.8 cm wide, flat, the base subcordate, the apex attenuate, hispid on both surfaces, the margins shortly pilose, the midnerve conspicuous. *Inflorescences* terminal and axillary from the uppermost nodes, terminal inflorescence exserted, peduncle hispid, ca. 25 cm long; *panicles* lax, open, diffuse, 10–18 cm long; *main axis* flexuous, hispid and covered with conspicuous glands, the branches alternate to opposite, divergent, the

axis of the branches hispid toward the base, otherwise glabrous, glandular; pedicels solitary, 1–15 mm long, glabrous and covered with glands; terminal panicles with chasmogamous flowers; axillary panicles ca. 4 cm long, similar to the terminal one. *Spikelets* solitary, obovoid, 2.5–2.8 mm long, 1.3–1.6 mm wide, greenish to purplish. *Lower glume* truncate to ovate, 0.4–0.8(–1.5) mm long, $\frac{1}{7}$ – $\frac{1}{4}$ or occasionally slightly longer than $\frac{1}{2}$ the length of the spikelet, nerveless to 1-nerved. *Upper glume and lower lemma* subequal or the upper glume shorter and not covering the upper antherium, obtuse, 9-nerved. *Lower palea* lanceolate, hyaline, 1.3 mm long, 0.6 mm wide; lower flower absent. *Upper antherium* ellipsoid, 2–2.2 mm long, 0.9–1.4 mm wide, smooth, shining, pale, glabrous, papillose, shortly apiculate. *Caryopsis* obovoid, 1.5 mm long, 1.2 mm wide, olivaceous and with dark spots; hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: southeastern United States, Mexico, and the West Indies, in marshes, moist pinewoods, and roadsides.

Selected specimens cited. CUBA. ORIENTE: Chanascal de la Cueva, Sierra de Nipe, *León 19856* (MO); crest of Sierra Nipe, *Morton & Acuña 3082* (US); pine woods, iron mine, S of Guaro, *Hitchcock 23414* (US). DOMINICAN REPUBLIC. Cordillera Central, near La Cumbre, *Ekman 11432* (G, US). LA VEGA: vicinity of Constanza, 1,000–1,600 m, *Allard 17485* (US); 16 km E of El Río along hwy., 1,220 m, *Davidse 2657* (MO); 18 km S of Jarabacoa along the highway, 1,160 m, *Davidse 2651* (MO). MONTE CRISTI: Lagunas de Cenobí, *Ekman 12943* (US). SAN JUAN: Piedra del Aguacate to Río del Oro, *Howard & Howard 9331* (US). SANTIAGO: declives del Pico de Igua, *Jiménez 1236* (US). HAITI. Massif des Matheux, Grand-Bois, *Ekman 5688* (US); Montagnes Noires, Pet. Riv. de l'Artibonite, between Pérodin and Ingram, *Ekman 3431* (US). PUERTO RICO. Sierra de Naguabo, Río Icaca, *Shafer 3481* (US). UNITED STATES. ARKANSAS: Miller County, collected near Texarkana, *A.A. & E. Geller 4236* (P). DISTRICT OF COLUMBIA: Brookland, *Holm s.n.* (P). SOUTH CAROLINA: Orangeburg, moist sandy soil, *Hitchcock s.n.*, *Amer. Gr. Hb. 178* (P). VIRGINIA: Cape Henry, moist sand along bank of ditch, *Chase s.n.*, *Amer. Gr. Hb. 177* (P).

29. *Panicum sphaerocarpon* Elliott, Sketch Bot. S. Carolina 1: 125. 1816. *Dichantheium sphaerocarpon* (Elliott) Gould, Brittonia 26: 60. 1974. *Panicum dichotomum* L. var. *sphaerocarpon* (Elliott) Alph. Wood, Class-Book Bot., ed. 1861: 786. 1861. *Panicum microcarpon* Muhlenb. var. *sphaerocarpon* (Elliott) Vasey, Grass. U.S.: 12. 1883. TYPE: United States. Georgia: without locality, *Baldwin s.n.* (holotype, CHARL not seen; photo and fragment, US 81121).

Caespitose perennial, with or without a basal rosette of short, broad leaves. *Culms* decumbent and geniculate, branching at the base, to erect, branching at the upper nodes, 15–40(–60) cm tall; internodes short toward the base, compressed, hollow, glabrous; nodes short-pilose or glabrous. *Sheaths* striate, greenish to purplish, shortly ciliate on the margins, glabrous in the rest of the surface. *Ligules* absent or to 0.8 mm long, short-membranous at base, then long-ciliate, or absent; collar brownish, glabrous. *Blades* lanceolate to ovate-lanceolate, 2.5–9 cm long, 0.5–1.5 cm wide, flat, rigid, glabrous, the base subcordate to cordate, the apex acuminate, the margins scabrous, short-ciliate to ciliate toward the base. *Inflorescences* terminal, exserted, peduncles 6–25 cm long, glabrous; *panicles* lax, diffuse to contracted, (2–)5–11 cm long, 3.5–7 cm wide; *main axis* flexuous, glabrous, glandular; first-order branches alternate, divergent or appressed, distant, the axis of the branches smooth, glabrous, glandular; pedicels long, greenish to purplish, glabrous, smooth, glandular; axillary panicles similar to the terminal one. *Spikelets* solitary, obovoid to broadly ellipsoid, 1.1–1.8 mm long, 0.9–1 mm wide, short-hirsute, the upper glume and lower lemma subequal. *Lower glume* broadly ovate, obtuse, 0.2–0.4(–0.9) mm long, $\frac{1}{5}$ the length of the spikelet, nerveless or 1(–3)-nerved separated from the upper glume by a short stipe. *Upper glume* 1.3–1.7 mm long, obtuse, shiny on the inner surface, short-hirsute, 7-nerved, the nerves anastomosing toward the base. *Lower lemma* glumiform, 1.2–1.7 mm long, 7-nerved, the nerves anastomosing toward the apex. *Lower palea* ovate-lanceolate, 0.6 mm long, 0.3 mm wide, hyaline, the margins sparsely pilose or glabrous, lower flower absent. *Upper antherium* broadly ellipsoid, 1–1.3 mm long, 0.6–0.9 mm wide, glabrous, smooth, shiny, indurate, papillose with simple papillae; cleistogamous flowers present or absent. *Caryopsis* obovoid, 0.7 mm long, 0.5 mm wide, brownish; hilum punctiform, embryo $\frac{1}{3}$ the length of the caryopsis.

Panicum sphaerocarpon is a species with a distinctive anatomy. The absence of differentiation between the spongy and palisade mesophyll separates this species from all others in the section. The chlorenchyma cells are also characteristic in that their cytoplasm is centrally concentrated and adaxial air spaces are present (Fig. 15B, D). In addition, the adaxial bulliform cells are in discrete fans consisting of only 3–4 cells.

KEY TO THE VARIETIES

1. Spikelets 1.1–1.4 mm long var. *floridanum*
1. Spikelets 1.4–1.8 mm long var. *sphaerocarpon*

29a. *Panicum sphaerocarpon* var. *sphaerocarpon*

Panicum inflatum Scribner & Smith, U.S.D.A. Div. Agrostol. Circ. 16: 5. 1899. *Panicum sphaerocarpon* Elliott var. *inflatum* (Scribner & Smith) A. Hitchc., in A. Hitchc. & Chase, Contr. U.S. Natl. Herb. 15: 253. 1910. TYPE: United States, Mississippi: Harrison County, Biloxi, *Tracy* 4622 (holotype, US).

Panicum vicarium Fourn., Mex. Pl. 2: 20. 1886. TYPE: Mexico. Veracruz: Córdoba, *Schaffner* 285 (holotype, P).

Panicum auburne Ashe, North Carolina Agric. Exp. Sta. Bull. 175: 115. 1900. TYPE: United States. Alabama: Lee County, Auburn, 1898, *Earle & Baker* 1527 (isotype, NY; fragment, US 2383621).

Distribution and ecology: United States, Mexico, Mesoamerica, and northern South America (Colombia and Venezuela). Grows in forest edges, gravelly banks, or in open sites, in partially disturbed areas, between 600 and 2,700 m.

Selected specimens cited. BELIZE. BELIZE: 4 km of Hattieville along the western hwy. to Belmopan, 810 m, *Davidse & Brant* 32994 (MO, SI). COLOMBIA. CAUCA: de El Estrecho a Balboa, a 18 km de El Estrecho, 1,280 m, *Zuloaga & Londoño* 4249* (COL, SI). ANTIOQUIA: Río Negro, 2,110 m, *Archer* 240 (US); Santa Elena, 1,500–2,000 m, *Archer* 1167 (US). CUNDINAMARCA: Subida a Alto del Tigre, *Zuloaga* 4035* (COL, SI). COSTA RICA. CARTAGO: 3 km S of Agua Caliente, 1,400 m, *Pohl & Davidse* 11377 (US). HEREDIA: Volcán Barba, Cordillera Central, *Pohl & Davidse* 10535 (MO). SAN JOSE: ca. 2 km SE of Tarbaca on road to San Gabriel, 1,600 m, *Pohl & Davidse* 11046 (US). ECUADOR. TUNGURAHUA: Baños al Topo, *Acosta-Solís* 20832 (US). EL SALVADOR. CHALATENANGO: E slope of Los Esemiles, *Tucker* 1056 (P). SANTA ANA: summit of Cerro Monte Cristo, juncture of Salvador, Honduras, and Guatemala, *Pohl* 12572 (MO). GUATEMALA. BAJA VERAPAZ: 6 km N of El Chol, *Harmon & Dwyer* 3165 (MO). EL QUICHE: NE of Nebaj, *Metzler* 6 (MO). SAN MARCOS: Finca Armenia, San Rafael, pie de la Cuesta, *Dwyer* 15207 (MO). HONDURAS. EL PARAISO: Monserrat mountain, *Molina & Molina* 27489 (MO). INTIBUCA: Cerro San Cristóbal, La Esperanza, *Ordoñez* 85 (MO). FRANCISCO MORAZAN: 2.5 km N of Zambrano, on road to San Francisco de Soroguera, *Pohl & Davidse* 12131 (MO). OCOTEPEQUE: common in pine forest and rocky hillsides of Machuca, Honduras and Guatemala border, *Molina & Molina* 27870 (MO). OLANCHO: Río El Salto, 5 km al W, Campamento, *Amador* 89 (MO); Montaña Los Zapotes, 10 km W de Campamento, *Galeano* 98 (MO). MEXICO. CHIAPAS: Mun. Teopisca, marsh near Teopisca, *Breedlove & Davidse* 54814 (MO); Mun. La Trinitaria, 9 km S of Comitán on Mexican Hwy. 190, *Breedlove & Davidse* 54954 (MO). GUERRERO: 3.5 km al N de Zoyotepec, brecha maderera, *Martínez-Salas & Torres* 2562 (MO). JALISCO: E of San Sebastián, Hacienda del Ototal, *Mexía* 1812 (MO). MICHOACAN: ca. 10 mi. W of Ciudad Hidalgo, near km Post 160 on Hwy. 15 to Morelia, *Davidse & Davidse* 9842 (MO). VERACRUZ: Orizaba, *Hitchcock s.n.*, Amer. Gr. Hb. 155 (MO, P); sand bluffs near Jalapa, 4,000 ft., *Pringle* 8344 (MO, P). NICARAGUA. ESTELI: along new road from Hwy. 1 (at km 135.5 and ca. 10.6 km W of bridge at La Trinidad

to San Nicolás, *Stevens* 14802, 18000 (MO). PANAMA. CHIRIQUI: E slope of Volcán de Chiriquí (Barú), WNW of Boquete, *Davidse & D'Arcy* 10153 (MO). VENEZUELA. ARAGUA: Distr. Ricaurte, ca. Colonia Tovar, a 600 m del desvío al Jarillo, vía Colonia Tovar, 2,170 m, *Zuloaga & Ortíz* 4280* (MO, SI, VEN). DISTRITO FEDERAL: mountainside between El Junquito and Colonia Tovar, 6,000 ft., *Soderstrom* 960 (VEN); ca. 2.5 km down road to Carayaca as measured from intersection with main road between El Junquito and Colonia Tovar, *Davidse & Tillett* 4079 (MO).

29b. *Panicum sphaerocarpon* var. *floridanum* Vasey, U.S.D.A. Div. Agrost. Bot. Bull. 8: 33. 1889. *Panicum floridanum* (Vasey) Chapman, Fl. South U.S., ed. 3: 585. 1897, non Trin., 1835. *Panicum erectifolium* Nash, Bull. Torrey Bot. Club 23: 148. 1896. *Dichantherium erectifolium* (Nash) Gould & Clark, Ann. Missouri Bot. Gard. 65: 1105. 1978. *Dichantherium sphaerocarpon* (Elliott) Gould var. *floridanum* (Vasey) Davidse, Novon 2: 104. 1992. TYPE: United States. Florida: "Moist pine barrens, Mosquito Inlet," May 1879, *Curtiss* 3599 (lectotype, US 81122; isotype, MO). Figure 29.

Distribution and ecology: open white-sand savannas and moist pine woods of southeastern United States, Belize, and Cuba, 0–100 m.

Additional specimens examined. BELIZE. BELIZE: 12.5 mi. NW of Belize along Northern Hwy., *Croat* 23259 (MO), *Dwyer* 10716 (MO); savanna near Ridge Lagoon Plantation, 11 mi. from Belize on Northern Hwy., *Gentry* 7860 (MO). CUBA. ISLA DE LA JUVENTUD: about 5 km S of Santa Bárbara, *Blanco s.n.* (US 2183813), *Killip* 44825 (US); along road to San Francisco de las Piedras, *Killip* 43723, 44193 (US). ORIENTE: Moa, champ d'aviation, *Victorin et al.* 21448 (US). PINAR DEL RIO: Herradura, at a small laguna, *Ekman* 11599 (US); La Grifa, in open places, *Ekman* 11242 (US); between Guane and Remates, near sea level, edge of Laguna de Cebo, *Killip* 32328a (US). SANTA CLARA: Motembo, *León et al.* 8615 (US).

Variety *floridanum* differs from variety *sphaerocarpon* by its smaller spikelets 1–1.5 mm long, erect leaves that are appressed to the culms, glabrous nodes, and ligules 0.3–0.4 mm long.

30. *Panicum stigmatosum* Trin., Gram. Panic. 194. 1826. TYPE: Brazil. Minas Gerais: "ad rip. rivuli Pibanha, in Serra dos Orgaos, 1. mis. mense Aprili *Riedel*" (holotype, LE not seen; photo of the type, K, fragment, US 974621). Figures 16, 29.

P. mollicomum Kunth, Revis. Gramin. 1: Suppl. 9. 1830. *P. lanuginosum* J. S. Presl, Reliq. Haenk. 1: 306. 1830, non Elliott, 1816. TYPE: "Peru," without locality, *Haenke s.n.* (PR, holotype not seen; fragment of the type, US 974627).

Perennial, (30–)50–100 cm tall. *Culms* decumbent, branching and rooting at the lower nodes, then ascendent, leaning on vegetation, branching at the upper nodes; internodes 4–19 cm long, compressed, glabrous, with glands toward the distal portion; nodes compressed, brownish, pilose or glabrous. *Sheaths* 3–11 cm long, shorter than the internodes, hispid or glabrous, glandular, one margin ciliate, the other one ciliate toward the apex but otherwise glabrous. *Ligules* (0.3–)1–1.6 mm long, shortly membranous at the base, then ciliate; collar villous or puberulous, brownish. *Blades* linear-lanceolate, 10–22 cm long, 1–2.2 cm wide, the base subcordate or cordate, slightly asymmetrical, the apex attenuate, sparsely pilose or glabrous on the adaxial surface or hispid on both surfaces, the margins shortly ciliate, scabrous, the abaxial surface glandular or eglandular. *Inflorescences* exerted, peduncle (6–)9–34 cm long, cylindrical, glabrous or sparsely pilose, glandular; panicles lax, diffuse, 9–21 cm long, 6–15 cm wide; *main axis* flexuous, glabrous or sparsely pilose, glandular, the pulvini pilose, first-order branches divergent, alternate or subopposite, flexuous, the axis of the branches flexuous, scaberulous, glandular; pedicels claviform, shortly hirsute or scabrous. *Spikelets* ellipsoid or obovoid, (1.9–)2.4–3.2 mm long, (0.9–)1.1–1.3 mm wide, greenish to purplish, glabrous, shortly stipitate, the upper glume and lower lemma subequal. *Lower glume* ovate, 1.1–1.8 mm long, $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet, embracing the upper glume, (1–)3-nerved, glabrous. *Upper glume* (1.6–)2–2.4 mm long, not covering the apex of the upper antherium, glabrous, 7–9-nerved, the nerves manifest. *Lower lemma* glumiform, (1.6–)2–2.4 mm long, 7–9-nerved. *Lower palea* lanceolate, (1.6–)1.8–2.1 mm long, 0.6–0.7 mm wide, hyaline, glabrous, the margins ciliate; lower flower present or absent, male when present; stamens 3, anthers to 0.9 mm long. *Upper antherium* ellipsoid, 1.9–2.1 mm long, 0.9–1 mm wide, acuminate, stramineous, indurate, with simple papillae all over its surface; lodicules ca. 0.3 mm long; stamens 3, the anthers 0.7 mm long. *Caryopsis* ellipsoid, 1.3 mm long, 1 mm wide; hilum punctiform, embryo $\frac{1}{3}$ the length of the caryopsis.

Distribution and ecology: Brazil, in the states of Espírito Santo, Minas Gerais, Rio de Janeiro, Santa Catarina, and São Paulo, on forest edges in tangled colonies, 1,000–2,200 m.

Additional specimens examined. BRAZIL, ESPÍRITO SANTO: Serra do Caparaó, *Chase 10106*, *10112* (US). MINAS GERAIS: Parque Nac. Itatiaia, camino para las Agulhas Negras, *Zuloaga et al. 2382* (RB, SI, US); Serra da Gramma, 1,100 m, *Chase 9543* (US), 1,700 m, *Chase*

9556 (NY); Serra do Caparaó, 2,100–2,200 m, *Chase 9662* (F, NY, US); Itacolumí, E of Ouro Preto, *Chase 9381* (NY, US), *9421* (US). RIO DE JANEIRO: Floresta Regime de Preservação Permanente do IBDF, entre Vale dos Princesas y Rocío, 1,000–1,200 m, *Zuloaga et al. 2389* (SI); Macieiras, Serra de Itatiaia, *Chase 8261* (F, NY, US), *8322* (US), *Zuloaga et al. 2351**, *2358** (SI), Rio Campo Belo, *Zuloaga et al. 2363* (RB, SI); Petrópolis, Rio Itamaraby, *Glaziou 17946* (US, W); below Macieiras, Serra de Itatiaia, 1,200–1,800 m, *Chase 8322* (US); Rio de Janeiro, *Glaziou 18629* (US, W). SANTA CATARINA: 41 km S of Campo Alegre, on the road to Jaraguá do Sul, *Smith & Klein 7334* (US). SÃO PAULO: Salesópolis, Estação Biológica de Boracéia, *Mattos & Mattos 14248* (P, US). Without state and locality, *Riedel 226* (G).

Panicum stigmatosum is closely related and perhaps conspecific with *P. sabulorum*, differing only in: the plants being bigger, scandent; foliar dimorphism is absent; the inflorescence is bigger ((6–)9–34 cm long); and leaf blades and axis of the inflorescence are glandular. There are several intermediate specimens between both species, however, such as *Zuloaga et al. 2351*, *2382*, *Glaziou 17946*, *18629*, *Chase 9361*, *9381*, *9421*, and *Mattos & Mattos 14248*.

Macrohairs are lacking in the two specimens examined in the anatomical study (Fig. 16D, E). The mesophyll is characteristically very diffuse with large intercellular air spaces.

Panicum stigmatosum var. *parviflorum* Doell is a dubious name. Doell included in his original diagnosis two specimens: *Sellow 4906* and *Regnell III-1360*. There is a fragment of the latter specimen at US which is *P. pantrichum* Hackel (sect. *Cordovensia*).

Small-spikelet form of *P. stigmatosum*: BRAZIL, ESPÍRITO SANTO: Serra do Caparaó, *Chase 10105* (MO, US). MINAS GERAIS: Serra da Gramma, E of Araponga, 1,200 m, *Chase 9531* (F, GH, MO, NY, US). RIO DE JANEIRO: Serra de Itatiaia, Macieiras, 1,700–1,800 m, *Chase 8321* (GH, NY, US).

These specimens have spikelets 1.9–2.1 mm long, but are otherwise similar in all characters to other material *P. stigmatosum*. The rachilla is prolonged as a short mucro above the upper antherium in *Chase 10105*.

31. *Panicum stipiflorum* Renvoize, Kew Bull.

37: 329. 1982. TYPE: Brazil. Bahia: 16 km NW of Lagoinha, which is 5.5 km SW of Delfino on side road to Minas do Mimoso, 950–1,000 m, 8 Mar. 1974, *Harley, Renvoize, Erskine, Brighton & Pinheiro 17019* (holotype, CEPEC; isotypes, K, NY, US 2955108). Figure 29.

Annual? Culms decumbent at the base, then ascending, 20–30(–80) cm tall, freely branching at the upper nodes, many-noded, internodes terete, hollow, short-pilose, nodes compressed, densely pilose with short, appressed, whitish hairs. *Sheaths* striate, sparsely or densely hirsute with short hairs, or long-pilose in the upper portion, the margins long-ciliate, more so in the upper portion. *Ligules* 0.3 mm long, membranous-ciliate. *Blades* ovate-lanceolate, 2–6 cm long, 0.6–1.5 cm wide, cordate, amplexicaulous, sparsely to densely hirsute with short, rigid hairs, or glabrescent, the margins cartilaginous, scabrous and long-ciliate with papillose-pilose hairs. *Inflorescences* terminal, exserted, peduncles to 20 cm long, cylindrical, shortly hirsute; *panicles* lax, diffuse, 3–8 cm long, 2–5 cm wide; *main axis* flexuous, hirsute; pulvini densely pilose; first-order branches alternate, divergent, the axis of the branches hirsute, smooth, eglandular; pedicels hirsute, 0.6–2 mm long. *Spikelets* paired or solitary, ellipsoid, 2.2–2.6 mm long, 0.9 mm wide, sparsely hirsute with short hairs on the glumes and lower lemma, greenish or tinged with purple. *Lower glume* acute, ½ or less the length of the spikelet, occasionally larger, not embracing the upper glume at its base, 3–5-nerved, separated from the upper glume by a conspicuous stipe. *Upper glume* 1.8–2.1 mm long, occasionally a little smaller and not covering the apex of the upper antherium, 7–9-nerved, the nerves anastomosing. *Lower lemma* glumiform, 7-nerved, the nerves anastomosing toward the apex. *Lower palea* elliptical, 1.5 mm long, 0.3 mm wide, hyaline, glabrous; lower flower absent. *Upper antherium* ellipsoid, 1.7–1.8 mm long, 0.7 mm wide, indurate, smooth, shiny, papillose with simple papillae regularly distributed all over its entire surface; lemma 5-nerved, shortly apiculate and pilose toward the apex. *Caryopsis* ellipsoid, 1.5 mm long, 0.9 mm wide; hilum punctiform, embryo ⅓ the length of the caryopsis.

Distribution and ecology: Bahia, Brazil, in cerrados in rocky, sandy soils, between 900 and 1,100 m, in flower between February and April.

Additional specimens examined. BRAZIL. BAHIA: 34 km E of Morro do Chapéu along Hwy. BA-052, Chapada da Diamantina, *Davidse et al.* 11888 (K, MO, NY, SI, SP); Chapada da Diamantina, along waterfall of the Rio Ferro Doudo, ca. 21 km E of morro do Chapéu, *Davidse et al.* 11950 (MO, SP); 16 km NW of Lagoinha on side road to Minas de Mimoso, 950–1,000 m, *Harley et al.* 17004 (paratypes, K, NY, US); Fazenda Mundo Novo, Botafogo, *Zehntner* 248, 263 (RB); Serra do Tombador, ca. 18 km E of Morro de Chapéu, *Irwin et al.* 30702 (MO, UB); Serra Tinguá, *Zehntner* 2017 (M); Sentacé, *Zehntner* 2048 (M).

Panicum stipiflorum is characterized by its cordate, amplexicaulous leaves with conspicuous ciliate margins, spikelets with a stipe between the lower and upper glume, and lower glume usually less than ½ the length of the spikelet.

32. *Panicum strigosum* Muhlenb. in Elliott, *Sketch Bot. S. Carolina* 1: 126. 1816. *Dichantherium strigosum* (Muhlenb.) Freckmann, *Brittonia* 33: 457. 1981. TYPE: United States. “Hab. in humidis. Car. & Georg.,” *Elliott Herb. s.n.* (lectotype, CHARL not seen; isolectotype, US; photo and fragment, US 2808953). Figure 29.

Panicum ciliatum Elliott, *Sketch Bot. S. Carolina* 1: 126. 1816, non *Panicum ciliatum* Maercklin, 1792.

Panicum dichotomum L. var. *glabrescens* Griseb., *Fl. Brit. W.I.* 553. 1864. *Dichantherium leucoblepharis* (Trin.) Gould & Clark var. *glabrescens* (Griseb.) Gould & Clark, *Ann. Missouri Bot. Gard.* 65: 1100. 1978. *Dichantherium strigosum* (Muhlenb.) Freckmann var. *glabrescens* (Griseb.) Freckmann, *Brittonia* 33: 457. 1981. TYPE: Jamaica. Without locality, *Purdie s.n.* (holotype, K).

Panicum laxiflorum Lam. var. *pubescens* Vasey, *Contr. U.S. Natl. Herb.* 3: 30. 1892. *Dichantherium leucoblepharis* (Trin.) Gould & Clark var. *pubescens* (Vasey) Gould & Clark, *Ann. Missouri Bot. Gard.* 65: 1101. 1978. *Panicum ciliatum* Elliott var. *pubescens* (Vasey) Freckmann ex R. W. Pohl, *Fieldiana, Bot., n.s.* 4: 356. 1980. *Panicum leucoblepharis* Trin. var. *pubescens* (Vasey) Beetle, *Phytologia* 48: 192. 1981. TYPE: United States. Florida: Duval County, without locality, *Curtiss s.n.* (lectotype, US).

P. polycaulon Nash, *Bull. Torrey Bot. Club* 24: 200. 1897. TYPE: United States. Florida: Hillsborough County, Tampa, 20 Aug. 1895, *Nash 2420a* (holotype, NY; isotype, US).

P. longipedunculatum Scribner, *Tennessee Agric. Exp. Sta. Bull.* 7: 53. 1894. TYPE: United States. Tennessee: White Cliff Springs, July 1890, *Scribner s.n.* (lectotype, US 742594).

Short-rhizomatous perennials, caespitose and with many fasciculate culms. *Culms* erect, 3–20 cm tall, few-noded, unbranched below the inflorescence; internodes short, cylindrical, hollow, short-pilose or glabrous; nodes pilose, compressed. *Sheaths* 1 cm long, longer than the internodes, striate, glabrous, one margin ciliate, the other membranous. *Ligules* 0.2–0.4 mm long, membranous-ciliate; collar glabrous. *Blades* lanceolate, 1–5(–7) cm long, 0.3–0.5(–0.7) cm wide, flat, glabrous or with long sparse hairs, the base narrowed or subcordate, the apex acute, the margins long-ciliate with rigid papillose-pilose hairs or occasionally glabrous. *Inflorescences* terminal, exserted, peduncle 1–14 cm long, flexuous, glabrous or sometimes hirsute near the junction with the panicle; *panicles* lax, diffuse, few-flowered, 2–5 cm

long, 1.5–4.5 cm wide; *main axis* flexuous, densely hirsute with long whitish hairs, occasionally glabrous, glandular, the pulvini pilose; first-order branches alternate, the axis of the branches hirsute, flexuous and glandular; pedicels glabrous, claviform, glandular; axillary inflorescences present, similar to the terminal one. *Spikelets* solitary, obovoid or ellipsoid, 1–1.7 mm long, 0.6–0.9 mm wide, puberulous or glabrous, greenish to purplish, the upper glume and lower lemma subequal. *Lower glume* ovate, 0.5–0.8 mm long, $\frac{1}{3}$ – $\frac{2}{5}$ the length of the spikelet, nerveless or 1-nerved, embracing the upper glume at its base, acute or truncate, with a small internode between the lower and upper glume. *Upper glume* obtuse, 7-nerved. *Lower lemma* 7-nerved, glumiform, obtuse. *Lower palea* 0.3–0.7 mm long, 0.1–0.2 mm wide, hyaline, glabrous; lower flower absent. *Upper antheridium* ovoid, 1–1.2 mm long, 0.6–0.9 mm wide, biconvex, whitish, indurate, smooth, glabrous, papillose; lemma shortly apiculate; stamens 3, the anthers 0.5 mm long. *Caryopsis* unknown.

Distribution and ecology: southern United States, Mexico, Mesoamerica, and the West Indies, in South America in Colombia and Venezuela. Commonly found in wet meadows or swampy areas and savannas, between sea level and 2,100 m.

Selected specimens cited. BELIZE. BELIZE: 4 km W of Hattieville along the western hwy. to Belmopan, 80 m, *Davidse & Brant 32982* (MO, SI). EL CAYO: Mountain Pine Ridge, along Coona Cairn Road, *Davidse & Brant 33037A* (MO). ORANGE WALK: savanna ca. 5 km N of August Pine Ridge on the road to Trinidad, *Davidse & Brant 32810* (MO). STANN CREEK: in pine ridge, Mullins River Pine Ridge, *Gentle 8550* (NY). TOLEDO: Swasey Branch, Monkey River, *Gentle 3748* (MO). COLOMBIA. CAUCA: Cuatro Esquinas, 1,700–1,800 m, *Pennell & Killip 6362* (NY, US); Munchique, 2,100 m, *Alston 8205* (COL, US). MAGDALENA: Santa Marta, *Smith 163* (MO, NY, P, US). COSTA RICA. GUANACASTE: región del Volcán Cacao, Cerro Pelado, *Chacon 2266* (MO). CUBA. ISLA DE LA JUVENTUD: near Nueva Gerona, *Palmer & Riley 990* (US); between San Francisco de Las Piedras and Cerro La Cañada, moist soil along stream, *Killip 44614* (US). ORIENTE: Sierra de Nipe, in pineland savannas at foot of Loma Mensura, 725 m, *Ekman 9704* (US). PINAR DEL RIO: NW of Pinar del Río, *Hitchcock 23299* (US); Mántua, *Ekman 11088* (G); Sierra de los Organos, Grupo del Rosario, Pinar de Lechuzá, *Ekman 12969* (G, NY, US). DOMINICAN REPUBLIC. Llano costero, Cuenca, *Ekman 11068* (G, US); sabana de Santa Rosa, 190 m, *Allard 15870* (US). GUATEMALA. ALTA VERAPAZ: vicinity of Secanquim, 550 m, *Pittier 257* (US). PETEN: Tikal National Park, Bajo de Santa Fé, in pinal, *Contreras 528* (US). HAITI. Massif du Nord, Marmelade, *Ekman 8206* (G, US). HONDURAS. GRACIAS A DIOS: Tuas, campamento maderero al W de Brus Laguna, *Nelson & Hernández 1005* (MO). OLANCHO: Vaguada del Río de la población de Culmi, *Nelson & Romero 4708* (MO). JAMAICA. Halliss Savanna, Upper Clarendon, *Harris 12225* (MO, US);

James Hills, Savanna, *Harris 12852* (MO, US); Bull Head Mountain and vicinity, *Hitchcock 9550, 9551* (US). MEXICO. CHIAPAS: Municipio de Palenque, 8–12 km N of Palenque on road to Catazaja, *Breedlove 55356* (MO). NICARAGUA. ZELAYA: ca. 3 km S of Bilwaskarma, *Pohl & Davidse 12262* (MO); along Río Tuapi from bridge (on road between Puerto Cabezas and Tuapi) to coast, *Stevens 7816* (MO). PANAMA. BOCAS DEL TORO: Santa Catalina, *Blackwell et al. 2696* (MO). COCLE: Caribbean side of divide at El Copé, *Hamilton & Davidse 2634* (MO). HERRERA: 10 km W of Las Minas on road to El Toro, roadside and cafetal, *Sytsma & D'Arcy 3221* (MO). PANAMA: Distrito Capira, Cerro Campana, *van der Werff & Herrera 6167* (MO); hills NE of Hacienda La Joya, *Dodge et al. 16884* (MO). VERAGUAS: along beach, Concepción, *Hammel 5237* (MO). PUERTO RICO. Monte Mesa, vicinity of Mayagüez, *Chase 6276* (US); Campo Alegre, between Manatí and Laguna del Tortuguero, *Chase 6621* (US).

33. *Panicum superatum* Hackel, Oesterr. Bot. Z. 51: 427. 1901. TYPE: Brazil. Rio de Janeiro: Serra dos Orgãos, 7 Mar. 1889, *Glaziou 17904* (holotype, W; isotype, P, fragment, P, fragments US 1280065, 1715312). Figures 17, 31, 35.

Caespitose, short-rhizomatous perennial. *Culms* erect to ascendent, (0.1–)0.2–1.2 m tall, branching at the base or from the upper nodes; internodes 4–6 cm long, hispid or glabrous, terete, hollow; nodes compressed, long-pilose, or glabrous. *Sheaths* 4–10 cm long, striate, glabrous or hirsute with long papillose-pilose hairs, one margin long-ciliate, the other membranous. *Ligules* membranous-ciliate, 0.6–1.5 mm long; collar glabrous or densely pilose. *Blades* lanceolate to linear-lanceolate, 4.5–16 cm long, 0.6–1.5(–2.5) cm wide, hispid or glabrous, densely pilose on the adaxial surface near the subcordate or cordate base, the apex attenuate, the margins ciliate. *Inflorescence* terminal, exserted, peduncle hispid; *panicles* contracted to slightly open, 5–8(–17) cm long, 0.8–5(–10) cm wide; *main axis* hispid, the pulvini pilose; first-order branches appressed or slightly divergent from the main axis, alternate or subopposite, the axis of the branches hispid or short-pubescent and eglandular; pedicels flexuous, scabrous, hispid with long hairs. *Spikelets* congested, obovoid, (2.1–)2.4–3.3 mm long, 0.9–1.2 mm wide, sparsely pilose or glabrous, the upper glume and lower lemma subequal, shortly stipitate. *Lower glume* ovate-lanceolate, 1.6–2.4 mm long, $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet, clasping, 3–5-nerved, with a short stipe between the lower and upper glume. *Upper glume* (1.8–)2.4–2.5 mm long, (7–)9–11-nerved, not covering the apex of the upper antheridium. *Lower lemma* (1.9–)2.2–2.5 mm long, 7–9-nerved. *Low-*

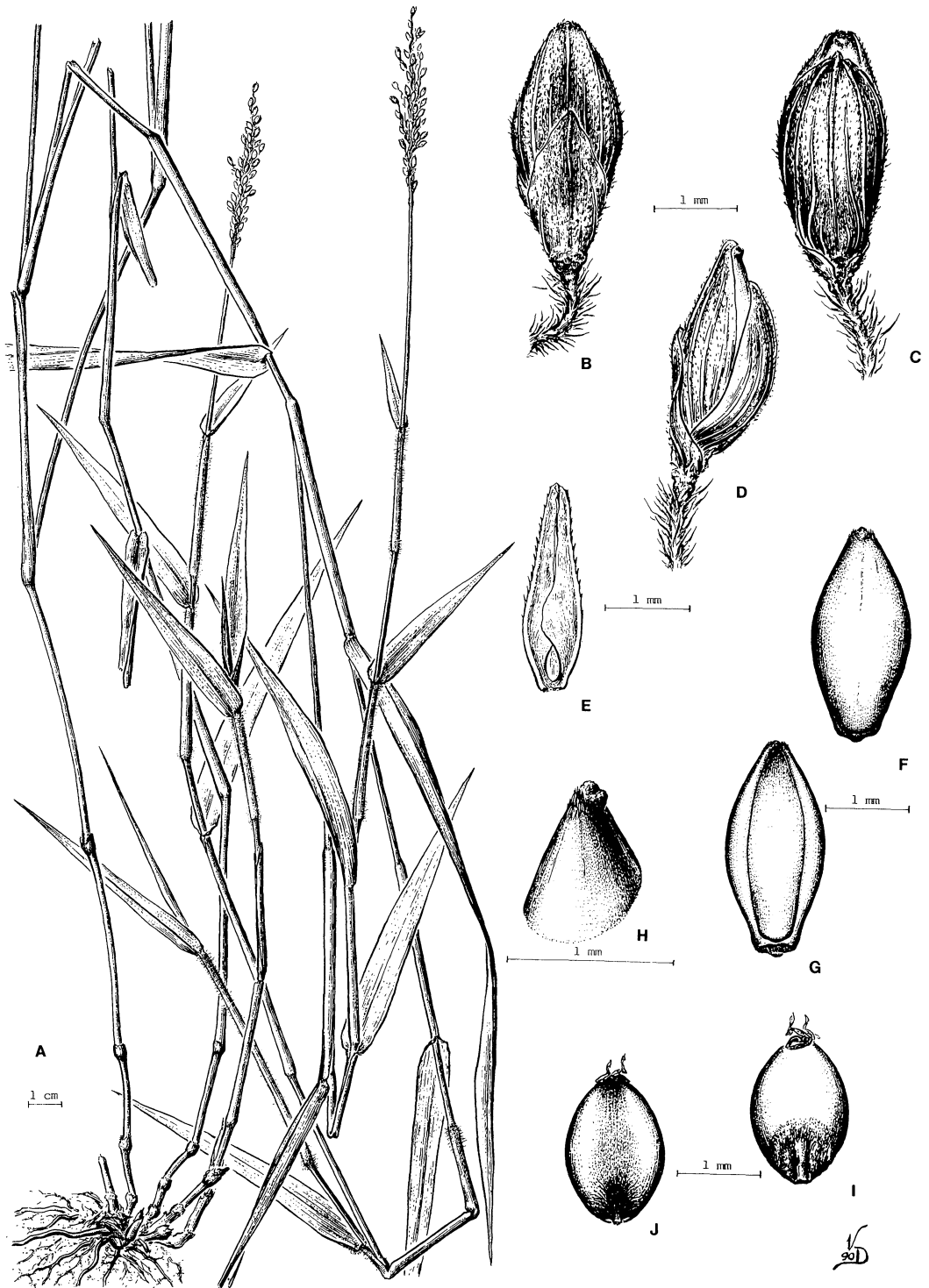


FIGURE 35. *Panicum superatum*.—A. Habit.—B. Spikelet, lower glume view.—C. Spikelet, upper glume view.—D. Spikelet, lateral view.—E. Lower palea.—F. Upper antherium, lemma view.—G. Upper antherium, palea view.—H. Detail of apex of the lemma.—I. Caryopsis, embryo view.—J. Caryopsis, hilum view. (All based on Chase 9350.)

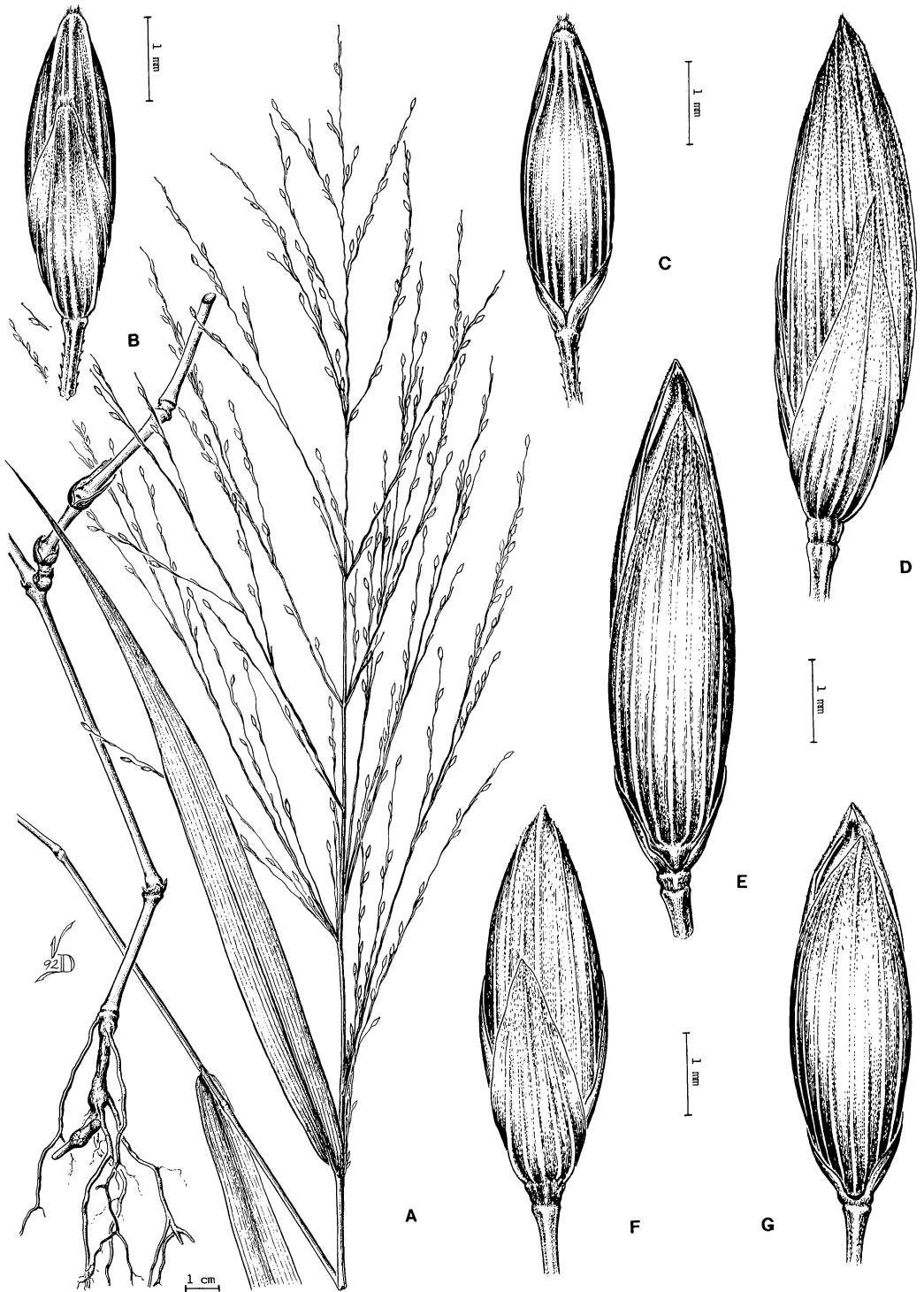


FIGURE 36. A-C. *Panicum penicillatum*. —A. Habit.—B. Spikelet, lower glume view.—C. Spikelet, upper glume view. D, E. *Panicum caparaoense*. —D. Spikelet, lower glume view.—E. Spikelet, upper glume view. F, G. *Panicum itatiaiae*. —F. Spikelet, lower glume view.—G. Spikelet, upper glume view. (A-C, based on *Alvarenga & Oliveira* 525; D, E, based on *Hatschbach & Guimaraes* 45170; F, G, based on *Chase* 8327.)

er palea lanceolate, (1.5–)2.1 mm long, 0.6 mm wide, membranous, the margins ciliate; lower flower absent or present, male when present, with 3 anthers each 1 mm long. *Upper antherium* ellipsoid, 1.9–2.5 mm long, 0.9–1.2 mm wide, indurate, smooth, the apex of the lemma apiculate, scaberulous; stamens 3, the anthers 0.3–1 mm long. *Caryopsis* ellipsoid, 1.7 mm long, 1 mm wide; hilum punctiform, embryo $\frac{1}{3}$ the length of the caryopsis.

Distribution and ecology: Brazil, on mountain slopes from Espírito Santo to Rio Grande do Sul, 900–2,650 m.

Additional specimens examined. BRAZIL. ESPÍRITO SANTO: Serra do Caparaó, rocky open campo, 2,650 m, *Mexía 4014* (NY, P, US); Serra do Caparaó, 2,280–2,400 m, *Chase 10084* (IAN, RB, US). MINAS GERAIS: Barbacena, Serra Mantiqueira, *Chase 8667* (F, US); Ouro Preto, Villa Rica, 1,100 m, *Chase 9350* (F, GH, MO, NY, US); cerrado on middle slopes of Pico de Itacolúmi, ca. 3 km S of Ouro Preto, 1,750 m, *Irwin et al. 29483* (MO, UB); Mun. Itamonte, Parque Nacional de Itatiaia, camino para las Agulhas Negras, 1,550–1,800 m, *Zuloaga et al. 2374** (MO, RB, SI, US). PARANA: 4 km E of Guarapuava along highway BR-277 to Curitiba, 1,050 m, *Davidse et al. 11319* (MO); Bocaiuva do Sul, *Clayton 4285* (K). RIO DE JANEIRO: Alto de Itatiaia, 2,200–2,400 m, *Chase 8299* (NY, US, W); Teresópolis, Posse, morro das Antenas de Televisao, *Sucre 2317* (SI); Tijuca, in open spot at summit, *Chase 12161* (US). RIO GRANDE DO SUL: Cambará do Sul-Itaimbezinho-Bela Vista, *Valls et al. 1870, 2903* (CEN); Serra da Rocinha, prope Bom Jesus, in dumetosis, *Rambo 53841* (US). SANTA CATARINA: Mun. Caçador, 9 km W of Caçador, *Smith & Klein 10899* (NY, US); Mun. Bom Jardim da Serra, Alto, 20 km S of Bom Jardim, *Smith & Klein 15809* (HB, NY, P, US); 5 km S of Ponte Alta along highway BR-116 to Lajes, *Davidse et al. 11104* (MO, SP); Ponte Serrado, 94 km W of Joaçaba, 700–900 m, *Smith & Klein 14008* (HB, K, SI); Mun. Urubici, 19 km N of Perico, *Smith & Klein 15889* (HB, US); Mun. Lajes, Serra do Ilhéos, *Smith & Klein 15456* (K, US). SÃO PAULO: Jardim Botânico e Parque do Estado, *Sendulsky 1063* (SI); Campos do Jordão, Serra Mantiqueira, sandy campo, 1,600 m, *Chase 9822* (NY, US).

Related to *Panicum sabulorum* and *P. stigmatosum*, *P. superatum* can be distinguished by its contracted panicles and appressed spikelets.

There are two indurate florets in *Chase 9403*. *Sendulsky 1063* has anthers only 0.3 mm long.

34. *Panicum surrectum* Chase ex Zuloaga & Morrone, Novon 1: 111. 1991. TYPE: Brazil. Minas Gerais: Barbacena, long and tangled in moist brushy base of higher slope, *Chase 8664* (holotype, US; isotypes, F, NY). Figures 24D, 30.

Short-rhizomatous perennial. *Culms* decumbent to geniculate, then erect, branching at the upper

nodes, scandent, 45–120 cm tall; internodes compressed or cylindrical, 7–13 cm long, glabrous; nodes compressed, glabrous, brownish. *Sheaths* 4–10.5 cm long, shorter than the internodes, glabrous to papillose-pilose toward the base, shiny, one margin ciliate, the other one ciliate toward the base, otherwise glabrous. *Ligules* 0.2 mm long, membranous-ciliate; collar pilose. *Blades* linear-lanceolate, 5–12 cm long, 0.6–1 cm wide, glabrous to short-hispid, attenuate at the base and apex, the margins scabrous, long-ciliate toward the base; midnerve conspicuous. *Inflorescences* terminal, exerted; *panicles* lax, diffuse, 3.5–15 cm long, 3–10 cm wide; *main axis* glandular or eglandular, flexuous, glabrous, the pulvini glabrous; first-order branches ascendent, whorled toward the base, then subopposite or alternate, the axis of the branches glabrous, flexuous, glandular or eglandular; pedicels triquetrous, glabrous, glandular or eglandular. *Spikelets* narrowly ellipsoid, 1.8–2.2 mm long, 0.8 mm wide, glabrous, greenish, nonstipitate, the upper glume and lower lemma subequal, the nerves manifest. *Lower glume* ovate, 0.9–1.3 mm long, $\frac{2}{5}$ – $\frac{1}{2}$ (– $\frac{3}{4}$) the length of the spikelet, not embracing the upper glume, (1–)3-nerved, the lateral nerves inconspicuous. *Upper glume* 1.6–2 mm long, not covering the apex of the upper antherium, 9-nerved. *Lower lemma* glumiform, 1.8–2.1 mm long, 9-nerved. *Lower palea* lanceolate, 1.5–1.8 mm long, 0.4 mm wide, shortly pilose near the apex, otherwise glabrous, hyaline; lower flower male or sterile, stamens 3, the anthers 1 mm long. *Upper antherium* ellipsoid, 1.6–1.8 mm long, 0.7 mm wide, pale, indurate, papillose, the apex of the lemma shortly crested and pilose; stamens 3, the anthers 1.2 mm long, purplish. *Caryopsis* ovoid, 1.3 mm long, 0.7 mm wide; hilum punctiform, embryo less than $\frac{3}{4}$ the length of the caryopsis.

Distribution and ecology: Brazil, occasionally present in Paraguay, found at forest edges, between 600 and 1,800 m.

Additional specimens examined. BRAZIL. DISTRITO FEDERAL: ca. 35 km E of Brasília, *Irwin & Soderstrom 5419* (NY, UB, US). GOIAS: Luziania, 15 km ao S da cidade, *Heringer 18124* (IBGE, RB). MATO GROSSO DO SUL: Dourados, *Chase 11023* (IAN). MINAS GERAIS: 19 km NE of the intersection of Hwys. 381 and 459, ca. 12 km SW of São Gonçalo do Sapucaí, 870 m, *Davidse & Ramamoorthy 10602* (MO, SI); Itacolúmi, E of Ouro Preto, 1,400 m, *Chase 9380* (NY, US), *9407* (US); Juiz de Fora, *Krieger SVD 1227* (RB, US); Poços de Caldas, 1,100–1,500 m, *Chase 10677* (NY, SP, US); Serra da Gramma, 1,700 m, slope above jungle, *Chase 9555* (F, GH, NY, US). PARANA: Mun. Gral. Carneiro, Rio Lageado, *Hatschbach et al. 13731* (K); Trés Barras, *Dusén 17531* (F, G, GH, NY, US). RIO DE JANEIRO: below Macieiras, Serra de Itatiaia, 1,700–1,800 m, *Chase 8324* (GH, NY,

US). RIO GRANDE DO SUL: Taimbezinho, pântano, *Boechat s.n.* (ICN 41067). SANTA CATARINA: Rio Capinzal, *Dusén 17876* (US); Santa Cecilia, 1,100 m, *Reitz & Klein 11358* (US). SÃO PAULO: Serra Mantiqueira, Campos do Jordao, 1,580 m, open sandy campo, *Chase 9815* (F, NY, US) 9839 (NY, US), *Holway 1737* (US), *Leite 3510* (GH). PARAGUAY. CAAGUAZU: Caaguazú, *Balansa 7* (G).

Panicum surrectum shows affinities with *P. sabulorum*, *P. stigmatum*, and *P. superatum*. *Panicum surrectum* is characterized by its long-ellipsoid spikelets, and smaller lower glume, not embracing the upper glume. *Panicum stigmatum*, *P. sabulorum*, and *P. superatum* have a lower glume $\frac{1}{2}$ – $\frac{3}{4}$ the length of the spikelet, covering the base of the upper glume, and ellipsoid to obovoid, globose spikelets. Additionally, in *P. superatum* the panicles are contracted, with the spikelets congested on the branches, and *P. stigmatum* has bigger spikelets, (2–)2.4–3.2 mm long, and leaves 10–22 cm long.

Panicum surrectum has, as other species of subgenus *Dichantherium* (Morrone & Zuloaga, 1991), conspicuous glands on the axis and pedicels of some specimens.

Cleistogamous flowers were observed in *Chase 9815*, with anthers 0.6 mm long.

35. *Panicum telmatum* Swallen, *Phytologia* 14: 81. 1966. TYPE: Frontier between Roraima, Brazil and Bolívar, Venezuela, Serra do Sol, 28 Dec. 1954, 2,100 m, *Maguire & Maguire 40400* (holotype, US 2182190; isotype, NY). Figure 31.

Tufted perennial. *Culms* elongated, arching, branching, internodes cylindrical, hollow, densely hispid with appressed hairs; nodes pilose. *Sheaths* papillose-pilose to short-pilose, the margins long-ciliate. *Ligules* membranous-ciliate, membranous portion 0.2 mm long, cilia 0.8–1 mm long, collar pilose with whitish hairs. *Blades* lanceolate, 3.5–5.5 cm long, 4–9 mm wide, flat, the base rounded, the apex acuminate, the adaxial surface sparingly hispid and with long, whitish hairs near the ligule, the abaxial surface scabrous, the margins long-ciliate. *Inflorescence* with base included in uppermost sheath or short-exserted, 3–5 cm long, pyramidal, few-branched, the branches divergent from the axis; *main axis*, the branches and pedicels hirsute with whitish hairs. *Spikelets* solitary, ellipsoid, 3–3.2 mm long, 1.2–1.4 mm wide, minutely appressed-puberulent; lower glume separated from the upper glume by a short internode. *Lower glume* 2–2.3 mm long, broadly ovate, blunt, 3–5-nerved, about $\frac{3}{4}$ the length of the spikelet, the nerves

anastomosing. *Upper glume and lower lemma* as long as spikelet, broadly rounded on back, 7–9-nerved, the nerves anastomosing toward the apex. *Lower palea* ovate, 2 mm long, 0.6–0.8 mm wide, ca. $\frac{2}{3}$ as long as the lemma, hyaline, glabrous, the margins short-ciliate, the lower flower absent. *Upper antheridium* ellipsoid, 2.3–2.5 mm long, 1.1 mm wide, nearly as long as spikelet, glabrous, short-pilose at the apex of the lemma; lemma 7-nerved, with simple papillae over its entire surface. *Caryopsis* unknown.

Distribution and ecology: endemic to Uei-tepui (Cerro del Sol), Venezuela, about 25 km SE of Mt. Roraima, where growing in “burnt part of boggy central area.”

Additional specimens examined. VENEZUELA. BOLIVAR: Distr. Roscío, altiplanicie que rodea la cumbre del Uei-tepui (Cerro del Sol), sector occidental por encima del valle del Río Arabopo, *Huber 10008* (MO, MYF, SI).

Panicum telmatum is related to *P. sabulorum*; the latter species has smaller, biconvex obovoid spikelets 1.9–3 mm long and is known from central and southern Brazil, Paraguay, Uruguay, Bolivia, Chile, and Argentina.

36. *Panicum umbonulatum* Swallen, *Contr. U.S. Natl. Herb.* 29: 420. 1950. *Dichantherium umbonulatum* (Swallen) Davidse, *Novon* 2: 105. 1992. TYPE: Guatemala. Zacapa: upper slopes of Sierra de Las Minas, along Río Repollal, 2,100–2,400 m, 12–13 Jan. 1942, *Steyermark 42469* (holotype, US 1935002; isotypes, F, NY). Figure 31.

Panicum alcobense Swallen, *Contr. U.S. Natl. Herb.* 29: 423. 1950. TYPE: Guatemala. Jalapa: collected in oak wood around top of Cerro Alcoba, just E of Jalapa, 1,700 m, 2 Dec. 1939, *Steyermark 32515* (holotype, F 1040005; fragment and photo, US 2236474).

Panicum ramiparum Swallen, *Contr. U.S. Natl. Herb.* 29: 423. 1950. TYPE: Guatemala. Quezaltenango: collected in mountains near Santa María, S of Quezaltenango, 25 Mar. 1932, *Weatherwax 160* (holotype, US 1914983).

Perennial without a basal rosette of broader leaves. *Culms* decumbent, rooting and branching at the lower nodes and trailing, to erect, 40–100 cm tall, internodes terete, hispid, greenish to purplish; nodes compressed, purplish, densely papillose-pilose with whitish retrorse hairs. *Sheaths* striate, papillose-pilose with deciduous tuberculate hairs, the margins ciliate. *Ligules* membranous-ciliate, 0.6–1 mm long; pseudoligule present, with long hairs at the adaxial surface of the blade; collar

densely pilose. *Blades* lanceolate, 5–12 cm long, 0.4–1.4 cm wide, flat, the base cordate to subcordate, the apex acuminate, short-hispid on the adaxial surface or glabrous and long-pilose toward the base, the lower margins ciliate, otherwise glabrous. *Inflorescences* terminal, exserted, peduncle terete, ca. 20 cm long, hispid, densely pilose toward the distal portion near the junction with the panicle; *panicles* lax, diffuse, multiflowered, 4–12 cm long, 3.5–10 cm wide; *main axis* flexuous, hispid, the pulvini pilose; first-order branches alternate, divergent, the axis of the branches triquetrous, greenish to purplish, scabrous and sparsely hispid, spikelets solitary on second- or third-order branches; pedicels triquetrous, scabrous. *Spikelets* ellipsoid, (2.2–)2.4–2.8 mm long, 1–1.1 mm wide, greenish to purplish, plano-convex, sparsely hispid or glabrous, the upper glume and lower lemma subequal, as long as or shorter than the upper anthercium. *Lower glume* 1.2–1.4 mm long, $\frac{1}{3}$ – $\frac{1}{2}$ the length of the spikelet, obtuse, 1-nerved, not embracing the upper glume. *Upper glume* 7–9-nerved. *Lower lemma* glumiform, 7-nerved. *Lower palea* lanceolate, 1.5 mm long, 0.4 mm wide, hyaline, glabrous; lower flower absent. *Upper anthercium* narrowly ellipsoid, 2.4–2.5 mm long, 0.9–1.1 mm wide, whitish, smooth, shiny, indurate, papillose, apiculate and short-pilose and with a green spot on the apex of the lemma. *Caryopsis* ellipsoid, 1.6 mm long, 1 mm wide; hilum punctiform, embryo less than $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: Mexico to El Salvador, and Ecuador, on forest edges, in moist places, between 550 and 2,400 m.

Additional specimens examined. ECUADOR. LOJA: Argelia, 2,300 m, *Espinosa 547* (US). EL SALVADOR. SANTA ANA: Hacienda San José, *Rohweder 2111* (MO). GUATEMALA. ALTA VERAPAZ: along route ca. 14 mi. between Cobán and Tactic, 6 mi. S of Cobán, 13 mi. N of Tactic, *Croat 41422* (MO). BAJA VERAPAZ: along highway ca. 14 to Cobán, about 1 mi. S of turnoff to Salama, *Croat 41154* (MO). HUEHUETENANGO: pine-oak forest in canyon of Río Chixoy near Malacatanquito about 20 km SW of Huehuetenango, 1,600 m, *Williams et al. 22170* (US), *22171* (F). QUEZALTENANGO: Chiquival, 2,360 m, *de Koninck 117* (US). HONDURAS. 17 km NE of Nueva Ocotepeque, *Harmon & Dwyer 3771* (MO). COMAYAGUA: 75 km E de Comayagua, *Hernández 198* (MO). EL PARAISO: 31 km S of El Zamorano, on road between Guinope and Mandasta, *Pohl & Davidse 12152* (MO); edge of bog in mixed oak-pine forest near Piedra Herrada, 1,500 m, *Williams 15983* (US). FRANCISCO MORAZAN: Universidad, Campo abierto, *Lainez 91* (MO); W slope of Cerro de Uyuca, along trail from Las Flores toward Tatumbla, 1,600 m, *Standley 22813, 23466* (US); SW of San Juancito, *Pohl & Davidse 11984* (MO); Jutiapa,

ca. 7 km NE of Tegucigalpa, *Pohl & Davidse 11977* (MO); La Tigra, 35 km NE de Tegucigalpa, *Ordoñez 42* (MO). OCOTEPEQUE: alrededores de Belén Gualcho, *Nelson et al. 4026* (MO). MEXICO. CHIAPAS: Mun. Siltepec, on the ridge above Siltepec on the road to Huixtla, *Breedlove & Almeda 58273* (MO). OAXACA: 56 km de Tlaxiaco rumbo a Putla, *Beetle M-4807* (MO).

This species is related to *P. viscidellum*, differing in its larger spikelets (2.2–)2.4–2.8 mm long. It is also related to *P. divergens*; the latter species lacks a conspicuous pseudoligule and usually has sparsely hispid spikelets.

37. *Panicum viscidellum* Scribner, U.S.D.A. Div. Agrost. Circ. 19: 2. 1900. *Dichantherium viscidellum* (Scribner) Gould, Brittonia 32(3): 357. 1980. TYPE: Mexico. Veracruz: near Jalapa, 1,250 m, 1899, *Pringle 8089* (lectotype, US 354526; isolectotypes, M, MO, P). Figures 18, 19, 20, 30.

Panicum tremulosum Mez, Notizbl. Bot. Gart. Berlin-Dahlem 7: 76. 1917. TYPE: Venezuela. Distrito Federal: prope Caracas, *Moritz s.n.* (holotype, B; fragment, US).

Panicum longiculme Swallen, J. Wash. Acad. Sci. 21: 15. 1931. TYPE: Colombia. Antioquia: Quebrada del Alto, in mountains above Bello, 17 June 1930, *Archer 160* (holotype, US 1445529).

Panicum blakei Swallen, Contr. U.S. Natl. Herb. 29: 422. 1950. TYPE: Guatemala. Izabal: along trail from Los Amates to Izabal, Cerro de Las Minas, 31 May 1919, *Blake 7817* (holotype, US 1163068).

Panicum furtivum Swallen, Contr. U.S. Natl. Herb. 29: 421. 1950. TYPE: Guatemala. Huehuetenango: between Quetzal and Barillas, Sierra de los Cuchumatanes, 1,600–2,000 m, 18 July 1942, *Steyermark 49123* (holotype, US 1935043).

Short-rhizomatous perennial. *Culms* decumbent, rooting and branching at the lower nodes, then erect, branching at the upper nodes, 15–100 cm tall; internodes 3.5–18 cm long, hollow, striate, compressed, hispid, with long, rigid hairs; nodes compressed, densely pilose with whitish, retrorse hairs. *Sheaths* 2.5–13.5 cm long, papillose-pilose with tuberculate, caducous hairs, the margins ciliate. *Ligules* short-membranous at the base, then long-ciliate, 0.3–1(–2) mm long, with a conspicuous pseudoligule with hairs 2–3 mm long; collar pilose. *Blades* ovate-lanceolate to lanceolate, 3–14 cm long, 0.4–2 cm wide, glabrous or short-pilose on both surfaces, the base cordate and clasping, the apex acute, the margins long-ciliate and scabrous. *Inflorescences* terminal, exserted or partially included within the upper leaves, peduncle flexuous, 10–23 cm long, glabrous or sparsely or densely hispid; *panicles* diffuse, 3–12 cm long, 2–

10 cm wide; *main axis* glabrous or densely hirsute; pulvini pilose and scaberulous, first-order branches alternate to subopposite, ascendent and divergent, the axis of the branches glabrous or hispid, eglandular. *Spikelets* solitary, ellipsoid, (1.5–)1.8–2(–2.2) mm long, 0.7 mm wide, sparsely pilose, occasionally glabrous, the upper glume and lower lemma subequal, the stipe absent. *Lower glume* ovate, 0.6–1 mm long, $\frac{1}{3}$ – $\frac{1}{2}$ the length of the spikelet, sparsely pilose, acute, nerveless to 1–3-nerved, not embracing the upper glume. *Upper glume* 1.4–1.8 mm long, 7–9-nerved. *Lower lemma* glumiform, 7-nerved. *Lower palea* 0.7 mm long, 0.2 mm wide, hyaline, glabrous; lower flower absent. *Upper antheridium* ellipsoid, 1.5–1.8 mm long, 0.6 mm wide, indurate, papillose, shortly apiculate, apicule puberulous; stamens 3, the anthers 0.8 mm long. *Caryopsis* ellipsoid, 1.2 mm long, 0.6 mm wide, hilum punctiform, embryo $\frac{1}{2}$ the length of the caryopsis.

Distribution and ecology: from Mexico and the West Indies to northern South America, in Colombia, Ecuador, and Venezuela. Commonly found on forest edges, roadsides, and riverbanks, in moist places among shrubs, between 100 and 2,800 m.

Selected specimens cited. BELIZE. BELIZE: Ridge Lagoon Plantation ca. 12 mi. NW of Belize, *Croat 24077A* (MO). EL CAYO: Mountain Pine Ridge, along Coona Cairn Road, *Davidse & Brant 33022* (MO). STANN CREEK: Pine Ridge, *Gentle 8491* (US). TOLEDO: lower part of Richardson Creek, affluent of Bladen Branch, 100–250 m, *Davidse & Brant 32336** (MO, SI). COLOMBIA. ANTIOQUIA: Mun. Salgar, km 15 of road Salgar–El Dauro, 5°59'N, 76°07'W, *Zarucchi et al. 5957* (MO). BOYACA: Reserva Acueducto Villa de Leyva, 2,100 m, *Wood 4426* (COL, K); entre Chinavita y Tibaná, 1,700 m, *Zuloaga 4117* (MO, SI, VEN). CAUCA: La Esmeralda, near Jamundí, *Pittier 940* (US); El Tambo, *von Sneidern 1305* (G); without locality, *Zuloaga & Londoño 4203** (SI). CUNDINAMARCA: subida al Alto del Tigre, 1,700 m, *Zuloaga 4027* (COL, MO, SI); Quetame, *Zuloaga 3962* (COL, MO, SI). EL VALLE: Monte Frío, Yanaconas, 1,700–1,850 m, *Killip & García 33718* (COL, US). MAGDALENA: Sierra Nevada de Santa Marta, región del Campano, 1,300 m, *Barkley & Gutiérrez 1918* (COL, US). NARIÑO: Mun. Junín, 1,100 m, *Pinto et al. 1889* (COL); La Florida, *Archer 3314* (COL); Reserva La Planada, Quebrada El Mar–La Calladita, *Olga de Benavides 9533* (MO). NORTE DE SANTANDER: road from Pamplona to Toledo, crossing the divide between Río La Teja and Río Mesme, 2,500–2,800 m, *Killip & Smith 19812* (MO, US). SANTANDER: Mesa de los Santos, 1,500 m, *Killip & Smith 15106* (US). TOLIMA: “La Trinidad,” Libano, *Pennell 3323* (US). VALLE DEL CAUCA: La Cumbre, 1,600 m, *Pennell & Killip 5671* (NY), *Pennell 5020* (NY). COSTA RICA. ALAJUELA: 15 km NNW of San Ramón by road, 2.5 km N of Balsa on road to San Lorenzo, *Liesner & Judziewicz 14878* (MO, SI). CARTAGO: ca. 8 km S of Cartago by air, Finca El Chaparral, 4.5 km S of bridge

on Agua Caliente at Lourdes, *Liesner & Judziewicz 14619* (MO); 3 km S of Agua Caliente, 1,400 m, *Pohl & Davidse 11376* (US). GUANACASTE: Parque Nacional Rincón de la Vieja, SSE slopes of Volcán Santa María above Hacienda Santa María, 900–1,200 m, *Davidse et al. 23439* (MO, SI). PUNTARENAS: Las Alturas along Río Coton, *Davidse 24132* (MO, SI). SAN JOSE: Cordillera de Talamanca, 14 km S of División along the Interamerican highway, 1,500 m, *Pohl & Davidse 11618* (US). CUBA. ISLA DE LA JUVENTUD: Columbia, *Ekman 12406* (US). ECUADOR. TUNGURAHUA: valley of Pastaza River, between Caños and Cashurco, 8 hr. E of Baños, 1,300–1,800 m, *Hitchcock 21809* (US); valley of Río Pastaza, Hacienda Río Verde Grande, *Asplund 7839* (G, K, US); Agoyán, *Asplund 7627* (MO). EL SALVADOR. CHALATENANGO: pass on Hwy. 4, 7 km SSE of La Palma, *Pohl & Davidse 11889* (MO). GUATEMALA. ALTA VERAPAZ: Cobán, 1,350 m, *von Tuerckheim 3836* (M); savanna on S side of Cerro Chinaja, between Sachaj and Sacacac, 150–180 m, *Steyermark 45168* (US). BAJA VERAPAZ: Biotopo del Quetzal, WNW of Purulha, *Stevens et al. 25420** (MO); 4 km N of El Chol, *Harmon & Dwyer 3127* (MO). HONDURAS. ATLANTIDA: valley of Río Cangrejil, 17 km SSE of La Ceiba, *Pohl & Davidse 12084* (MO). COMAYAGUA: 14 km SE of Taulabe by road, *Pohl & Davidse 12112* (MO). EL PARAISO: Cerro Monserrat, cerca de Yuscarán, *Nelson & Romero 4267, 4279* (MO); 32 km W of Danli along Hwy. 4, *Pohl & Davidse 11928* (MO). GRACIAS A DIOS: Caserío de Rus-Rus, vanguardia del Río Rus-Rus, *Nelson & Romero 4097* (MO). LA PAZ: Agua Blanca River, between Chinacla and Planes de Mulle, *Molina & Molina 24346* (MO). FRANCISCO MORAZAN: Río del Gallo, near El Jicarito, 2 km from El Zamorano, *Swallen 10992* (MO); 2.5 km N of Zambrano on road to San Francisco de Soroguara, *Pohl & Davidse 12136* (MO); 14 km S of El Zamorano on road to Guinope, *Pohl & Davidse 12147* (MO). OLANCHO: Montaña Los Zapotes, 10 km noroeste campamento, *Martínez 37* (MO). SANTA BARBARA: Trinidad, Finca Las Colmenas, *Salguero 15* (MO). JAMAICA. Banana Ground, *Adams 10098* (MO). MEXICO. CHIAPAS: Lago Pojoj, Lagos de Montebello National Park, *Breedlove & Davidse 55022* (MO); Mun. La Trinitaria, Lago Tzisco, Lagos de Montebello National Park, *Breedlove & Davidse 55031* (MO). OAXACA: Mun. San Pedro Yaneri, Distr. Ixtlán, 17.3 km S of La Esperanza and 40.3 km SE of Valle Nacional, 1,900 m, *Davidse et al. 30257* (MO). VERACRUZ: about 7 mi. SSE of Jalapa in area of rolling hills, *Reeder & Reeder 6000* (MO); Orizaba, *Hitchcock s.n.*, Amer. Gr. Hb. 179 (MO). NICARAGUA. ESTELI: Cerro Tisey, faldas del lado S, 1,300–1,400 m, *Moreno 9670* (MO, SI). GRANADA: Volcán Mombacho, lado N, arriba de Finca El Progreso, *Neill 868* (MO). JINOTEGA: along Hwy. 3 ca. 1.9 km NW of Aranjuez road entrance, *Stevens 5576, 5591* (MO). MATAGALPA: Santa María de Ostuma, Cordillera Central de Nicaragua, between Matagalpa and Jinotega, 1,300–1,500 m, *Williams et al. 23591* (F, US). NUEVA SEGOVIA: El Cincho, a 8 km al NE de El Jicaro, *Moreno 19510* (MO). RIVAS: Isla Ometepe, Volcán Concepción, costado NW del volcán, punto de referencia a “Los Hatillos,” *Robledo 214* (MO). ZELAYA: near Tala Has and Puente Mango (over Río Kisalaya), *Stevens 7650* (MO). PANAMA. CHIRIQUE: Foothills, vicinity of El Boquete, *Hitchcock 8178* (SI). PANAMA: top of Cerro Jefe, 2.3 km N of Panamerican highway, *Folsom et al. 2534* (MO). VENEZUELA. ANZOATEGUI: Distr. Freites, Cerro Peonia, above Los Pajaritos, 31 airline km NE of Bergantín and

N of Mundo Nuevo, Serranía de Turimiquire, 1,400–1,700 m, *Davidse & González 19914* (MO, VEN). ARACUA: Distr. Ricaurte, cerca de Colonia Tovar, a 0.6 km del desvío al Jarillo vía Colonia Tovar, *Zuloaga & Ortíz 4279**, *4281* (MO, SI, VEN); Parque Nacional Henry Pittier, *Zuloaga & Ortíz 4530**, *4532**, *4537** (MO, SI, VEN); Distr. Ricaurte, 0.5 km del desvío a Buenos Aires, *Zuloaga et al. 4288* (MO, SI, VEN). COJEDES: Cerro Azul, Fila La Blanquera, al NE de La Sierra, 1,100–1,300 m, *Delascio 7535* (VEN). DISTRITO FEDERAL: Cordillera Costanera, El Junquito, *Chase 12427* (K, VEN), *12428* (US), *12431*, *12440* (US, VEN), *12441* (US); Piso de El Avila, *Alston 5561a* (MO); Parque Nacional El Avila, ridgetop in vicinity of Lagunazo, between Pico El Avila and Pico Occidental, 2,200 m, *Nee & Whalen 16805* (F, VEN). FALCON: Sierra de San Luis, entre Curimagua y San Luis, 1,300–1,400 m, *Steyermark 99143* (M, US, VEN). LARA: Distr. Iribarren, El Cortijo, *Burandt Jr. V0570* (MO, US). MERIDA: Capellanía (Bailadores), 1,600 m, *Tamayo 2362* (VEN). MIRANDA: 34 km NW of Santa Lucía by road, *Davidse 2912* (MO). TACHIRA: between Las Delicias and Paraguita, bordering Río Táchira, *Steyermark 57148* (US).

Panicum viscidellum is a common species with some degree of variation in the size of leaves and pilosity, characters that were used for describing *P. tremulosum*, *P. blakei*, and *P. furtivum*. *Panicum viscidellum* is related to *P. sciurotooides* and *P. umbonulatum*, differing from the first species by the presence of a conspicuous pseudoligule and its usually larger spikelets, and from *P. umbonulatum* by its smaller spikelets.

Pohl (1980) noted that the correct name for this species might be *Panicum reflexopilum* Steudel, Syn. Pl. Glumac. 1: 84. 1853 (described from Oaxaca, Mexico). However, neither he nor we could find the type specimen of *P. reflexopilum*, so the name remains dubious.

All specimens examined for anatomical purposes have a leaf anatomy typical of section *Dichantherium*, including numerous macrohairs, either cushion-based (Fig. 18D) or with few modified epidermal cells associated with the hair bases (Fig. 19A–D). Several of the specimens exhibit an unusual silicification of the basal cells associated with the macrohairs (Fig. 20). The hairs themselves may be lost but the modified, swollen basal cells are then clearly seen to contain opaline silica deposits (Fig. 20F).

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INDEX TO CITED SPECIMENS. Each specimen is listed by the first collector, even when other collectors participated in the collecting. Vouchers utilized for anatomical studies are marked with an asterisk.

Acosta Solís 12834 (2a); 20832 (29a). Ahumada 4829 (25b). Alain 2108 (2b); 8796 (28). Adams 8258 (32); 10098 (37). Allard 14508 (2a); 14509a (12a); 14893 (1a); 14910 (18); 15870 (32); 15873 (1a); 16029 (1a); 16089 (1a); 16408 (28); 16494 (1a); 17402 (18); 17407 (28); 17485 (28); 17490 (18); 17516 (28). Allen 772 (32); 1809 (25a); 1868 (25a). Almeida 22 (24). Alston 5561a (37); 7978 (37); 8205 (32). Alvarado 72 (18). Alvarenga 525 (20). Amador 89 (29a). *Amer. Gr. Hb.* 84 (18); 88 (1a); 133 (2a); 134 (2a); 155 (29a); 177 (28); 178 (28); 179 (37); 193 (13); 225 (13); 226 (13). Anderson 35542 (27); 35583; (33) 35729 (27); 36114 (33); 36155 (20); 36397 (34). Andino 76 (18). Antonio 2194 (27). Archer 240 (29a); 1077 (2a); 1167 (29a); 1182 (2a); 1306 (2); 3228 (37); 3314 (37); 3318 (2a); 4440 (25b). Arechavaleta 144 (25a); 267 (25b). Arnason 17200 (37). Asplund 7627 (37); 7839 (37). Atwood 2941 (2a).
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- Caballero 124 (2a). Cabrera 23574 (25b); 28547 (25b); 28777 (25b); 28898 (25b); 32004 (25b); 32393 (25b); 32424 (25a); 32425 (25a). Calderón 23 (37); 2414 (10); 2425* (10). Camargo s.n. (25a); 7281 (2a). Campelo 1444 (27). Canisio 365 (25a). Capanema 5396 (25b). Carauta 2340 (25b). Castellanos 25628 (16). Cerrato 148 (29a). Chacon 2266 (32). Chardon 151 (1a). Chase 6249 (2a); 6273 (1a); 6276 (32); 6475 (2a); 6621 (32); 6624 (1a); 6631 (23); 6752 (2a); 7389 (18); 7732 1/2 (26); 7732 (27); 7791 (26); 7828 (27); 7901 (26); 8082 (27); 8159 (25b); 8182 (15); 8246 (27); 8261 (30); 8267 (25b); 8268 (25b); 8274 (33); 8299 (33); 8312 (33); 8322 (30); 8324 (34); 8478 (30); 8484 (15); 8571 (27); 8573 (15); 8579 (20); 8646 (25b); 8667 (33); 8674 (25b); 8716 (20); 8958 (27); 9288 (20); 9350 (33); 9361 (30); 9380 (34); 9381 (30); 9403 (33); 9407 (34); 9408 (15); 9421 (30); 9465 (20); 9479 (20); 9543 (30); 9555 (34); 9556 (30); 9608 (20); 9640 (15); 9641 (20); 9662 (30); 9680 (25b); 9690 (33); 9730 (25b); 9731 (25b); 9745 (15); 9752 (20); 9769 (25b); 9794 (15); 9815 (34); 9822 (33); 9839 (34); 9894 (25b); 10081 (15); 10084 (33); 10106 (30); 10112 (30); 10187 (27); 10200 (20); 10217 (20); 10251 (27); 10253 (25b); 10289 (16); 10297 (20); 10354 (16); 10373 (27); 10387 (34); 10677 (34); 11023 (34); 12161 (33); 12162 (15); 12165 (15); 12170 (15); 12427 (37); 12428 (37); 12431 (37); 12436 (1a); 12440 (37); 12441 (37); 12458 (37). Chiang 9452 (19). Claussen 228 (20). Clayton 4190 (15); 4240 (25b); 4269 (25b); 4280 (25b); 4285 (33); 4305 (34); 4371 (25b); 4711 (25b); 4741 (15); 4743 (27). Conçalves 2211 (33). Conrad 3270 (18). Contreras 528 (32); 2922 (2a). Cook 37 (2a). Coradin 6530 (4). Costa Sacco 182 (25b); 202 (25b); 364 (25a). Cowan 1891 (24); 2109 (27). Croat 12066 (37); 21272 (1a); 21315A (37); 21521 (37); 23398A (27); 23259 (29b); 23391 (27); 24077A (37); 24777A (29b); 41154 (36); 41422 (36); 46634 (18); 54243 (27); 63947 (37); 64018 (18); 65910 (18); 71502 (15). Cruz 70 (18); 173 (18); 175 (36). Cuatrecasas 18559 (2a). Curtiss 307 (2a); 406 (1b). da Silva 172 (15); 180 (15); 249 (25a); 284 (27). Daniel 237 (2a). Davidse 972 (2a); 2049 (29a); 2650 (18); 2651 (28); 2657 (28); 2694 (28); 2699 (18); 2893 (37); 2893A (37); 2912 (37); 3089 (37); 3201 (2a); 3481 (2a); 3495 (2a); 3532 (2a); 3572 (2a); 4017 (37); 4070 (1a); 4074 (37); 4079 (29a); 4749 (24); 4762 (4); 4763 (24); 4783A (24); 4795 (24); 4951 (27); 9368 (2a); 9461 (18); 9688 (2c); 9842 (29a); 10153 (29a); 10308 (2a); 10441 (25b); 10446 (15); 10602 (34); 10620 (25b); 10704 (34); 10933 (15); 10949 (15); 11020A (25b); 11104 (33); 11255 (25b); 11315 (25b); 11319 (33); 11411 (15); 11422 (25b); 11495 (27); 11888 (31); 11950 (31); 19537 (2b); 19563 (24); 19611 (2b); 19792 (24); 19850 (24); 19914 (37); 19914A (24); 20554 (2b); 20561 (2b); 20674 (27); 20799 (27); 20904 (15); 23439 (37); 23657 (27); 24132 (37); 28878 (37); 29621 (18); 29625 (12a); 29630 (13); 29845 (2a); 30257 (37); 30807* (2a); 30825* (2a); 32336* (37); 32452 (2b); 32802 (37); 32806 (1b); 32810 (32); 32839 (37); 32844 (2b); 32911 (2a); 32927 (1a); 32981 (2b); 32982 (32); 32994 (29a); 33022 (37); 33037 (12b); 33037A (32); 33054 (2a); 33069 (2b); 33115 (2b). Davidson 766 (2a). Davis s.n. (27). Dayton 3058 (18). de Koninck 117 (36). del Mazo s.n. (25b). Delascio 7535 (37). Demaree 66629 (2a). Diogo 599 (15). Dionisio 891 (20). Díaz 983 (1a). Díaz-Piedrahita 1077 (37); 3815 (37). Dodge 16884 (32). Dombrowski 277 (27); 1958 (25a); 2200 (33); 3943 (15); 5835 (34). Dorsett 152b (20). dos Santos 33 (27); 3430 (27). Dubcovsky 834 (25a); 835 (25a); 836 (25a); 837 (25a). Duke 13626 (2a); 13683 (2a). Dusén 646 (25a); 1099a (15); 2039 (33); 3659 (33); 3661 (33); 14522 (27); 15565 (25b); 15596 (25c); 15766 (25b); 15767 (25b); 16127 (25b); 16390 (34); 17520 (25b); 17531 (34); 17876 (34). Dwyer 9110 (2a); 10082 (32); 10127 (32); 10716 (29b); 12711 (1b); 15016 (2a); 15207 (29a). D'Orbigny 8 (25a). D'Urville s.n. (25a); s.n. (27); 1821 (25a).
- Ebinger 908 (32). Edwards 438 (19). Eggers 2021 (2a). Egger 9 (13). Eiten 6236 (25b); 6929 (27). Ekman 645 (25b); 1095 (18); 1312 (1a); 1604 (18); 1946 (1a); 2647 (12a); 2908 (1a); 3201 (28); 3431 (28); 4743 (18); 5688 (28); 6189 (13); 6372 (1a); 6855 (1a); 6856 (2a); 6857 (32); 8117 (18); 8151 (23); 8206 (32); 9101b (28); 9701 (1b); 9704 (32); 10297 (13); 10329 (1b); 10330 (2a); 10705 (1b); 10802 (12b); 10803 (32); 10860 (18); 10937 (2b); 10994 (12b); 11022 (23); 11047 (14); 11058 (2b); 11068 (32); 11088 (32); 11138 (2b); 11182 (1a); 11215 (2b); 11242 (29b); 11261 (23); 11266 (2b); 11375 (1a); 11388 (1a); 11427 (23); 11430 (1a); 11432 (28); 11465 (14); 11586 (2b); 11599 (29b); 11630 (1a); 11651 (37); 11654 (1b); 11712 (37); 11713 (2b); 11855 (18); 11942 (12a); 11946 (1a); 11995 (1b); 11996 (1a); 12026 (23); 12098 (14); 12123 (32); 12152 (14); 12402 (1a); 12406 (37); 12581 (1a); 12697 (12a); 12794 (1a); 12943 (28); 12969 (32); 13808 (23); 13932 (12a); 14094 (23); 14674 (23); 15290 (23); 15636 (2b); 15896 (28); 16841 (2a); 17078 (1a); 17891 (1a); 18395 (1a). Emygdio 1663 (26). Enamorado 37 (18). Erazo 38 (36). Eskuche 1803 (25b). Espinosa 547 (36). Eugenio 285 (15); 2649 (15). Eyerdam 23132 (25b); 23678 (25b).

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- Kappel s.n. (25a). Kermes 346 (25b). Killip 4525a (2a); 4560 (2a); 5671 (37); 15106 (37); 15193 (2b); 19812 (37); 20046 (37); 20544 (37); 32328a (29b); 32376 (2b); 33718 (37); 42682 (2a); 42848 (37); 42942 (1a); 43723 (29b); 44058 (29b); 44193 (29b); 44614 (32); 44805 (12b); 44825 (29b); 44832 (1b); 44853 (12a); 44881 (2b). Klein 2646 (27); 5936 (25b); 11718 (27); 12031 (33). Knapp 3822 (27). Knoth 4007 (37). Koyama 7391 (4). Kral 69308 (32). Krapovickas 20048 (25a); 11627 (25b); 20360 (25b); 22801 (25b); 22848 (25a); 23817 (25b). Krieger SVD 1227 (34). Kuhlmann s.n. (20); 52 (30); 276 (27); 1942 (20); 1943 (15); 1948 (27); 2044 (25b); 15017 (25b). Kummrov 829 (25b); 2596 (33). Kuniyoshi 1612 (27).
- Láinez 91 (36). Lasser 3005 (27). Leavenworth 621 (13). Lehmann 974 (2a); 985 (37); 7000 (37). Leite 487 (25a); 3510 (34); 4262 (20). Leonard 3821 (2a); 3852 (18); 4331 (1a); 4346 (18); 4501 (18); 4701 (2a); 7838 (2a); 7920 (18); 8199 (2a); 14503 (18). León 3466 (12b); 3472 (2a); 4371 (2a); 4829 (32); 5177 (1a); 5840 (1b); 6152 (12a); 6422 (1a); 6457 (13); 6902 (2a); 7007 (1b); 7009 (12b); 7451 (1b); 8615 (29b); 9203 (12a); 9245 (1a); 14201 (13); 14821 (2a); 17885 (12b); 17979 (28); 18702 (23); 18789 (2b); 18882 (2a); 19193 (1a); 19414 (2b); 19474 (14); 19828 (12a); 19856 (28); 19981 (12a); 20007 (23). Liebmam 328 (18). Liesner 13514 (37); 12373 (27); 14466 (37); 14592 (37); 14619 (37); 14878 (37); 23580 (27); 25867 (24). Lindheimer 1265 (19). Liogier 10532 (1a); 11713 (18); 13365 (2a); 14162 (2a); 15872a (1a); 15974 (28); 16106 (28). Lourteig 2884 (25a). Lucas 35 (37). Lundell 6559 (32); 6561 (1b); 6563 (12b). Luteyn 8262 (37); 8294 (37). Lützelburg 133 (27); 135a (27); 6051 (20); 26101 (26); 26141 (26). Lyonnet 623 (13).
- Maas 5769 (4). Machado s.n. (25a); s.n. (25b). Magalhães s.n. (27); 15584 (27). Maguire 23446 (24); 42193 (4); 54280 (24). Malme 422 (25a); 435 (25a). Malmierca 2006 (25b). Manara s.n. (1a); s.n. (37). Marcano 4867 (18). Martinelli 814 (9). Martín 65 (37). Martínez 37 (37); 59 (2a); 16348 (2b). Martínez Salas 1494 (37); 2562 (29a). Mattos 11991 (25a); 12720 (33); 14248 (30). Maxon 594 (2a). Márquez 115 (29a). McDaniel 27158 (28). McKee 10588 (23); 11288 (29a); 11293 (2a); 11381 (1b); 11388 (1b); 11390 (12b). McVaugh 18881 (13); 19612 (13). Mendes Magalhaes s.n. (20). Metzler 6 (29a); 21 (2a). Mexía 1812 (29a); 4014 (33); 4738 (27); 5368 (20). Meyer 2663 (19). Miller 132 (1b). Molina 1272 (36); 7550 (37); 8034 (36); 14704 (1a); 24346 (37); 25283 (1b); 26112 (36); 27489 (29a); 27868 (1b); 27870 (29a). Montes 10815 (25b); 15262 (25b). Montoro 2667 (25a). Moreira-Filho 416 (27). Moreno 9473 (18); 9670 (37); 14360 (18); 17656 (18); 17694 (18); 18455 (18); 19510 (37). Mori 12698 (10); 14257 (4). Morillo 1433 (1a); 1445 (37); 1447 (1a); 8150 (27). Morton 3081 (1a); 3082 (28); 3100 (32); 3123 (12a). Mroginski 435 (25b); 437 (25b); 441 (25b). Mueller 408 (19); 414 (13); 2057 (19). Muñoz s.n. (27). Murillo 204 (2a).
- Nash 1243 (1a); 1337 (23); 2076 (23). Nee 10694 (37); 16805 (37); 23182 (29a); 26237 (18); 26325 (2a). Neill 868 (37). Nelson 634 (2a); 656 (2a); 1005 (32); 3618 (36); 3800 (13); 3842 (32); 4026 (36); 4097 (37); 4267 (37); 4279 (37); 4708 (32). Nicora 3067 (25a); 4170 (25a); 5903 (25b); 6027 (25b); 6530 (25b). Noll 2472 (27); 2735 (26); 2870 (10).
- Olga de Benavides 8680 (37); 8825 (37); 9213 (37); 9533 (37). Orcutt 5181 (2a). Ordoñez 42 (36); 84 (18); 85 (29a). Orth 5 (25a); 1938 (15). Osorto 44 (37). Osten 6511 (25b); 6917 (25a); 20083 (25b). O'Neill 8500 (14).
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- 8106 (1a). Pereira 1489 (33); 6732 (25b); 6811 (25a); 7056 (33). Peterson 7362 (2a). Pickel 5054 (25a). Pineda 82 (37). Pinto 117 (27); 941 (26); 1739 (2a); 1803 (37); 1889 (37). Pires 2844 (20). Pittier 93 (2a); 257 (32); 946 (2a); 982a (2a); 5889 (1a); 6042 (1a); 9382 (37); 9962 (2a); 13773 (2a); 13788 (37); 13792 (1a). Plowman 10045 (4); 10139 (25b). Pohl 12572 (29a); 12685 (32); 12749 (37); 12756 (36); 12839 (18); 10535 (29a); 11046 (29a); 11074 (18); 11249 (37); 11376 (37); 11377 (29a); 11379 (18); 11618 (37); 11676 (2a); 11677 (2a); 11889 (37); 11894 (2a); 11928 (37); 11977 (36); 11984 (36); 12084 (37); 12112 (37); 12131 (29a); 12136 (37); 12141 (2a); 12147 (37); 12152 (36); 12199 (2c); 12262 (32); 13123 (18). Ponte-Báez 22892 (37). Porter 4104 (37). Pringle 8083 (18); 8344 (29a); 13250 (18). Proctor 7334 (2a); 26565 (1a); 26567 (32). Purpus 7879 (2a). Paes s.n. (20).
- Quarín 1593 (25b); 1653 (25b); 1744 (25b); 2872 (25b); 3171 (25b); 3200 (25b); 3205 (25b).
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