

# THE NORTH AMERICAN SPECIES OF PENNISETUM.

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## INTRODUCTION.

The genus *Pennisetum* is one of that series of *Paniceae* in which sterile branches of the inflorescence are modified into an involucre subtending or surrounding the spikelets. This series falls into two groups, one in which these reduced branches or bristles remain on the common axis, the spikelets falling alone, the other in which the one or more free or coalesced bristles fall with the spikelets inclosed and aid more or less in the dispersal of the seed. The first group contains *Chaetochloa* and its allies, the second, *Chamaeraphis*, *Paratheria*, *Pennisetum*, *Plagiosetum*, *Odontelytrum*, and *Cenchrus*. The second group is but poorly represented in the Western Hemisphere. Only the monotypic genus *Paratheria* Griseb., about 20 species of *Pennisetum*, and 15 of *Cenchrus* are native to America.

One species of the genus, *Pennisetum glaucum*, pearl millet, has been cultivated since before the dawn of history and is unknown in the wild state. Its grain forms an important article of food in Africa and to a less extent in India. In our Southern States pearl millet is grown for forage. Another African species, *Pennisetum purpureum* Schumach., is being introduced as a fodder plant in the South under the name Napier grass. *Pennisetum ruppelii* Steud. and *P. macrostachyum* (Brongn.) Trin., with beautiful feathery panicles, are cultivated for ornament.

The American species of *Pennisetum* have been much confused. A recent work on the derivation of pearl millet,<sup>1</sup> by Paul Leeke, is devoted in part to the other species of the genus. A key to all the species is given and the numerous synonyms are referred to the species and varieties recognized. Except in the series *Penicillaria*, which includes "Negerhirse" (*Pennisetum glaucum*), no descriptions are given, save in new species and new varieties, and in a few other instances, and no specimens are cited. The American species were not well understood by Dr. Leeke, as shown by his referring the American *P. setosum* and the very different *P. multiflorum* Fourn., both perennials, to the East Indian annual, which he calls *P. indicum* [*P. polystachyum* (L.) Schult.].

<sup>1</sup> Untersuchungen über Abstammung und Heimat der Negerhirse [*Pennisetum americanum* (L.) Schum.] von Dr. Paul Leeke. Zeitschr. Naturw. 79: 1-108, with plates. 1907.

*Pennisetum* has been divided into various subgenera which appear to be fairly natural groups. Among our few species, however, are some that are intermediate or exceptional. *Pennisetum setosum*, with its densely plumose bristles, comes under subgenus *Eriochaeta*, but the obviously related *P. antillarum* has bristles not at all plumose. The introduced species belong in *Pennisetum* proper, with ciliate bristles and more than one spikelet in a fascicle. *Pennisetum karwinskyi* falls in this group, though in this the bristles are sometimes scarcely ciliate. The rest of our species, with bristles scabrous only, belong in subgenus *Gymnothrix*. The section *Beckeropsis* of the subgenus *Gymnothrix* is not represented in America, though the South American *P. exaltatum* and *P. mutilatum*, with few and reduced bristles, approach it. *Pennisetum glaucum* is placed in section *Penicillaria* by Stapf<sup>2</sup> and by Leake. The name *Penicillaria* refers to the minute brush of hairs at the tips of the anthers in this species.

An adequate revision of *Pennisetum* as a whole can be prepared only by someone having access to abundant material from Africa, its center of distribution. The present paper deals only with the species found in North America, 10 native and 4 introduced.

The text figures illustrate part of the inflorescence, two-thirds natural size.

## DESCRIPTION OF THE GENUS AND SPECIES.

### PENNISETUM L. Rich.

*Pennisetum* L. Rich. in Pers. Syn. Pl. 1: 72. 1805. Five species, *P. typhoideum*, *P. setosum*, *P. cenchroides*, *P. orientale*, and *P. violaceum* are included. All belong to the genus as at present limited. The first (which is the same as *P. glaucum*), agreeing with the generic characters given and being an important economic species, is taken as the type. The generic name refers to the plumose bristles, a character more pronounced in the other species included than in the type.

*Penicillaria* Willd. Enum. Pl. 1036. 1809. *Penicillaria spicata* Willd., based on *Holcus spicatus* L. (which is the same as *Pennisetum glaucum*), is taken as the type. In a footnote Willdenow explains that the genus was characterized by Swartz in Schrader's Neues Journal. The article referred to is one in which Swartz<sup>3</sup> discusses the genus *Holcus* and shows that *H. spicatus* L. does not belong in that genus, but rather in *Cenchrus* or in a distinct genus. He then gives a detailed description from a specimen grown in his garden, but does not propose a generic name. A second species, *P. ciliata*, based on *Alopecurus indicus* (*Pennisetum indicum* (Murray) Kuntze) is added. The name doubtless refers to the penicillate tips of the anthers, but neither Swartz nor Willdenow mentions this character.

*Gymnothrix* Beauv. Ess. Agrost. 59. pl. 13. f. 6. 1812. A single species, *G. thuarii* Beauv., from Ile-de-France [Mauritius] is included. The figure shows a fascicle with bristles not plumose. Beauvois divides *Pennisetum* into three genera: *Penicillaria*, containing the species with penicillate anthers ("apici villosis"); *Pennisetum*,

<sup>2</sup> In Thiselt. Dyer, Fl. Cap. 7: 431. 1898.

<sup>3</sup> Neu. Journ. Bot. Schrad. 2: 39-49. 1807.

containing the species with plumose bristles and 3 to 5 spikelets in a fascicle (among the species listed is *P. setosum* with solitary spikelets); and *Gymnotrix*, with glabrous bristles and solitary spikelets.

*Catatherophora* Steud. Flora 12: 465. 1829. A single species, *C. hordeiformis*, based on *Panicum hordeiforme* Thunb., is included. Steudel segregates it from *Gymnotrix* because the lower florets are undeveloped, that is, the sterile palea is wanting. *Panicum hordeiforme* Thunb. is composed of three varieties,  $\alpha$  and  $\beta$  being from the Cape of Good Hope, and  $\gamma$  from Japan. Steudel cites Ecklon's no. 973 from South Africa, showing that it is the African form upon which he bases his genus. This is *Pennisetum hordeiforme* (Thunb.) Spreng. In Steudel's Nomenclator<sup>4</sup> the name is spelled *Cataterophora*.

*Pentastachya* Hochst.; Steud. Nom. Bot. ed. 2. 2: 299. 1841. No description is given. A single species, *P. abyssinica* Hochst., nom. nud., is mentioned, this based on *Pennisetum pentastachyum* Hochst., not described until 1851. Here Richard<sup>5</sup> states that Hochstetter wished to propose the genus *Pentastachya* for this species, but that it could not be distinguished generically from other species having several spikelets in a fascicle.

*Beckeropsis* Fig. & DeNot. Agrost. Aegypt. Frag. 2: 49. pl. 28. 1853. (Mem. Accad. Sci. Torino 14: 365. 1854). Two species, *B. nubica*, based on *Beckera nubica* Hochst., and *B. petiolaris*, based on *Beckera petiolaris* Hochst., are included. The first is illustrated and is taken as the type. In this species the fascicle is reduced to a single long bristle below the solitary spikelet.

*Eriochaeta* Fig. & DeNot. Agrost. Aegypt. Frag. 2: 58. pl. 30, 31, 32. 1853. (Mem. Accad. Sci. Torino 14: 374. 1854). Three species, *E. secundiflora*, *E. densiflora*, and *E. reversa* are included. Each is illustrated. In these species the bristles are conspicuously plumose, and the spikelets are on plumose pedicels.

*Sericura* Hassk. in Steud. Syn. Pl. Glum. 1: 404. 1854. A single species, *S. elegans* Hassk., from Java, is included. Leake<sup>6</sup> refers this to *Pennisetum macrostachyum* (Brongn.) Trin. The description well applies to that species. The name *Sericura* was listed, with a few words of misleading description, in 1842.<sup>7</sup> Steudel obviously misunderstood this genus. Though the generic description applies perfectly to *Pennisetum*, he places it in *Andropogoneae* next to *Imperata*.

*Macrochaeta* Steud. in Zoll. Syst. Verz. Ind. Arch. Pfl. 60. 1854. The name *Macrochaeta sacchariformis* is mentioned without description in a note appended to *Sericura*. Steudel (see paragraph above) says that he had formerly used the name in letters.

*Amphochaeta* Anderss. Svensk. Vet. Akad. Handl. 1853: 136. 1855. A single species, *A. exaltata* Anderss., from the Galápagos Islands, is included. In this the bristles are reduced to 2 to 6, mostly shorter than the spikelet and more or less clustered at each side of it. Andersson emphasizes this character (hence the name).

#### DESCRIPTION.

Spikelets sessile or short-pedicel, one to several together, surrounded or subtended by an involucre, composed of a fascicle of reduced sterile branchlets, the fascicles sessile or short-peduncled and usually crowded on a common axis forming spike-like panicles, the fascicles falling entire with the spikelet inclosed; fascicles with few to numerous slender, antrorsely scabrous bristles, distinct throughout or, in two species, united at the very base into a minute disk, the outermost short, the inner longer, mostly unequal, the innermost (that is, the branchlet at the base of which the spikelet or the uppermost spikelet is borne) often stouter and longer than the others, sometimes conspicuously so; spikelets lanceolate, mostly acute; glumes unequal, 1 to 5-nerved,

<sup>4</sup> Nom. Bot. ed. 2. 1: 311. 1840.

<sup>5</sup> Zeitschr. Naturw. 79: 41. 1907.

<sup>6</sup> Tent. Fl. Abyss. 2: 387. 1851.

<sup>7</sup> Hassk. Flora 25<sup>2</sup>: Beibl. 2. 1842.

the first usually minute, rarely obsolete; sterile lemma few to several-nerved, inclosing a palea and often a staminate flower or empty; fruit subindurate, smooth, the lemma acuminate, mostly nerved toward the summit, its margins thin and usually flat; the palea of similar texture or a little thinner, its tip sometimes acuminate and free from the clasping lemma; stamens 3; stigmas plumose; grain usually oblong, dorsally compressed, with a punctiform hilum, free within the lemma and palea.

Annuals or perennials, mostly tall and robust, confined to the tropics and subtropics. There are probably 80 species or more, over half of them confined to Africa.

The spikelet of *Pennisetum glaucum*, presumably developed under cultivation, has assumed a form somewhat analogous to that of Indian corn. The fascicles are persistent on the axis, the glumes are much reduced, and the enlarged grain at maturity protrudes from the lemma and palea.

The simplest form of *Pennisetum* is found in the African species of the section *Beckeropsis*, in which there is a single bristle below the spikelet. In the South American *P. mutilatum* (Kuntze) Hack. the single bristle is usually shorter than the spikelet, or is sometimes obsolete. *Pennisetum exaltatum* (Anderss.) Leeke, of the Galápagos, connects these one-bristled forms with such few-bristled species as the North American *Pennisetum durum*. In *Hymenachne montana* Griseb., of Argentina, is found what suggests an approach to *Pennisetum*. In that the lower spikelets of the panicle are sometimes subtended by a bristle. The uppermost spikelet also is often thus subtended; that is, the spikelet-bearing branchlet is prolonged into a scabrous bristle. The subindurate fertile lemma and palea and the lanceolate spikelets of *Pennisetum* also suggest relationship to *Hymenachne*. At the other extreme, such species of *Pennisetum* as *P. karwinskyi* and *P. ciliare*, with bristles united at the very base and with several spikelets in a fascicle, approach such species of *Cenchrus* as *C. myosuroides*.

#### KEY TO THE SPECIES.

Bristles about 4 cm. long; panicles oval, feathery; spikelets 10 to 12 mm. long.

1. *P. villosum*.

Bristles rarely over 2 cm. long, most of them much shorter; panicles cylindrical or nearly so; spikelets not over 7 mm. long.

Grain at maturity subglobose, bursting through the lemma and palea; panicle solidly dense, 2 cm. or more thick; plants annual.....4. *P. glaucum*.

Grain permanently inclosed in the lemma and palea; panicles less than 2 cm. thick, not solid; plants perennial.

Fascicles, or most of them, with 2 or more spikelets.

Bristles free throughout, some of them plumose. Fascicles pedunculate; spikelets pedicellate.....2. *P. orientale triflorum*.

Bristles united at the base into a minute disk.

Inner bristles conspicuously plumose, much exceeding the spikelets.

3. *P. ciliare*.

Inner bristles sparsely (rarely not at all) ciliate, only the innermost much exceeding the spikelets.....5. *P. karwinskyi*.

Fascicles with but one spikelet.

Bristles conspicuously plumose.....6. *P. setosum*.

Bristles not plumose.

Panicles terminal on the primary culm and leafy branches only.

Blades involute, not over 5 cm. long.....10. *P. domingense*.

Blades flat or involute-pointed only, 10 cm. or more long.

Spikelets 2 to 2.5 mm. long; axis about 0.5 mm. thick. 7. *P. antillarum*.

Spikelets 4.5 mm. or more long; axis 1 to 3 mm. thick.

Bristles scant, most of them scarcely exceeding the spikelets or shorter; panicle stiff, densely flowered.....8. *P. crinitum*.

Bristles numerous, most of them about twice the length of the spikelet; panicle less dense.....9. *P. complanatum*.  
Panicles terminal and axillary, the latter on slender naked peduncles, 1 to several from a sheath.

Blades elongate, rarely over 12 mm. wide, tapering into a long setaceous-involute tip; spikelets 6 to 7 mm. long, the bristles mostly shorter.

11. *P. durum*.

Blades 15 to 40 mm. wide, if narrower not elongate, not setaceous-tipped; spikelets 4.5 to 6 mm. long, some of the bristles always longer.

Sterile lemma inclosing a well-developed palea and usually a staminate flower; panicles loosely flowered; most of the bristles about twice the length of the spikelet.....14. *P. bambusiforme*.

Sterile lemma empty; panicles rather densely flowered; most of the bristles not more than once and a half the length of the spikelets.

Panicles dull green; bristles scant, most of them not exceeding the spikelet, the innermost about twice as long.12. *P. distachyum*.

Panicles tawny; bristles numerous, most of them exceeding the spikelet, the innermost not conspicuously longer than the others.

13. *P. prolificum*.

### 1. *Pennisetum villosum* R. Br.

*Pennisetum villosum* R. Br. in Salt, Voy. Abyss. App. 62. 1814, nom. nud.; in Fres. Mus. Senckenb. Abh. 2: 134. 1837. Described from specimens collected in Abyssinia during the years 1805 to 1810 by Henry Salt. The type has not been examined.

*Pennisetum villosum* var. *humile* Hochst.; A. Rich. Tent. Fl. Abyss. 2: 387. 1851. "Prope Adoua [Abyssinia] (Schimper)." A specimen of Schimper's no. 316, collected at Adoua, Abyssinia, in September, 1837, in the National Herbarium, is a dwarfed plant like Chase's no. 5600 from Santa Barbara, California.

*Cenchrus villosus* Kuntze, Rev. Gen. Pl. 3<sup>2</sup>: 347. 1898. Based on *Pennisetum villosum* R. Br.

#### DESCRIPTION.

Plants perennial, rather pale, at length forming dense clumps from a knotted crown; culms ascending, 15 to 50 cm. tall, rarely 1 meter or more tall, commonly branching from the lower nodes, mostly flattened or angled in drying, the uppermost joint villous, at least below the inflorescence, otherwise glabrous; sheaths loose, mostly overlapping, pilose along the scarious margin and at the summit or glabrous; ligule a ring of fine hairs 1.5 to 2 mm. long; blades ascending or spreading, 3 to 6 mm. wide, mostly elongate, the upper often exceeding the inflorescence, but in dwarf plants sometimes only 8 to 10 cm. long, flat or folded, sparsely pilose on the upper surface or glabrous, the margins and sometimes the under surface scabrous; panicle grayish tawny, very dense, oval, 3 to 15 cm. long, 3 to 5 cm. wide including the bristles; fascicles short-peduncled, with a tuft of white hairs at the base of the peduncles; bristles slender, spreading, the longest 4 to 5 cm. long, the inner plumose below, the innermost not differentiated from the others; spikelets 1 to 4 in a fascicle, sessile, 10 to 12 mm. long, 1.7 to 2 mm. wide; glumes unequal, the first about 1 mm. long, one-nerved or nerveless, subacute, the second about one-third the length of the spikelet, one-nerved, acuminate; sterile lemma slightly shorter than the fertile one, long-acuminate, finely many-nerved, scabrous



FIG. 63.—*Pennisetum villosum*.  
\* From Eastwood 172, California.

except at the base, inclosing a well-developed palea and often a staminate flower; fruit but little indurate, long-acuminate, the lemma finely nerved and scabrous on the upper half, the margins thin and flat, the long brownish styles more or less persistent or caught in the feathery bristles.

This species is cultivated for ornament. In the trade it is commonly called *Pennisetum longistylum*. According to Hackel<sup>8</sup> and Leeke<sup>9</sup> this is not *P. longistylum* Hochst.<sup>10</sup> A specimen of the type collection of the latter, Schimper's no. 65, from Adoa, Abyssinia, in the National Herbarium, is very immature. It is much like dwarfed plants of *P. villosum*. The bristles are less plumose than are those of that species. It is clearly allied to *P. villosum* and does not belong in the section *Gymnothrix*, as stated by Hackel. Leeke places it next to *P. villosum*, differentiating it by the greater number of nerves in the sterile lemma.

## DISTRIBUTION.

Arid open ground, East Africa; sparingly escaped from cultivation in the United States, Mexico, and Jamaica.

MICHIGAN: Port Huron, *Dodge* 126.

TEXAS: Texarkana, *Plank* 23.

CALIFORNIA: Santa Barbara, *Eastwood* 172; *Chase* 5600; *Somes* C17. Ventura, *Parish* 11049.

SINALOA: Topolobampo, *Palmer* 231 in 1897.

JAMAICA: St. Andrew, *Harris* 12402.

*Pennisetum ruppelii* Steud.,<sup>11</sup> commonly called fountain-grass, is cultivated in parks and borders. It is a tufted perennial about 1 meter tall, with simple culms, narrow elongate scabrous blades, and beautiful feathery, purple or pinkish, nodding panicles, 15 to 35 cm. long, the fascicles pedunculate, not crowded, with one to three short-pedicelated spikelets, the bristles plumose toward the base, the longest 3 to 4 cm. long. *Pennisetum macrostachyum* (Brongn.) Trin.,<sup>12</sup> with broad blades and larger panicles with longer, more silky, not plumose bristles, is cultivated sparingly. A purple strain of this has been called "*P. macrophyllum atropurpureum*"<sup>13</sup> by seedsmen.

2. *Pennisetum orientale triflorum* (Nees) Stapf.

*Pennisetum triflorum* Nees in Steud. Syn. Pl. Glum. 1: 107. 1854. "(\* \* \* Royle Hrbr. nr. 59.) Nepal." The type has not been examined, but the description well applies to the East Indian plants identified as *P. orientale* var. *triflorum* by Stapf.

*Pennisetum orientale* var. *triflorum* Stapf in Hook. f. Fl. Brit. Ind. 7: 86. 1896. Based on *Pennisetum triflorum* Nees.

## DESCRIPTION.

Plants perennial, forming tough clumps from knotted crowns; culms erect from an ascending base, usually 1 meter or more tall, rather robust, simple or sparingly branching, pubescent or scabrous below the panicle, otherwise glabrous; nodes

<sup>8</sup> In Engl. & Prantl, Pflanzenfam. 2<sup>2</sup>: 38. 1887.

<sup>9</sup> Zeitschr. Naturw. 79: 23. 1907.

<sup>10</sup> A. Rich. Tent. Fl. Abyss. 2: 338. 1851.

<sup>11</sup> Nom. Bot. ed. 2. 2: 298. 1841, nom. nud.; Syn. Pl. Glum. 1: 107. 1854. "*P. macrostachyum* Fresen. Hochst. hrb. un. it. Abyss. no. 72." Described from Abyssinia.

<sup>12</sup> Mém. Acad. St. Pétersb. VI. 3<sup>2</sup>: 177. 1834. Originally described from the Moluccas.

<sup>13</sup> Henkel in Möllers Deutsch. Gärt. Zeit. 1906: 9. 1906.

appressed-pubescent, leaves numerous, the sheaths loose, mostly overlapping, ciliate on the margin, otherwise glabrous; ligule lacerate-ciliate, scarcely 1 mm. long; blades flat, lax, 5 to 10 mm. wide, elongate, sparsely hispid on the upper surface, scabrous beneath and sometimes with a few scattered hairs; panicles 12 to 20 cm. long, about 15 to 20 mm. thick, purplish, rather loose at least toward the base, nodding, the axis angled, densely pubescent; fascicles peduncled, spreading or reflexed; bristles slender, flexuous, unequal, the outer short, scabrous only, the inner mostly 1 to 1.5 cm. long, plumose below, the innermost one a little stronger and 2 to 2.5 cm. long; spikelets 1 to several in a fascicle, pedicellate, 5 to 7 mm. long, about 1.5 mm. wide, glabrous or scabrous; glumes acuminate-pointed, 1 to 3-nerved, the first one-fourth to one-third and the second about three-fourths the length of the spikelet; sterile and fertile lemmas subequal, acuminate-pointed, the tips usually spreading, 5-nerved, the sterile lemma inclosing a palea of equal length and a staminate flower, the fruit but slightly indurate, the tip of the palea free.



FIG. 64.—*Pennisetum orientale triflorum*.  
From *Amer. Gr. Nat. Herb.* 613, Jamaica.

#### DISTRIBUTION.

Native of India, introduced in the West Indies, where it is called Himalaya grass and is said to be a good forage grass; escaped from cultivation and found along trails and in open grassland (only American specimens are cited below).

JAMAICA: Cinchona, *Amer. Gr. Nat. Herb.* 613; *Hitchcock* 9700; *Harris* 11300, 11433.

TRINIDAD: Port of Spain, *Hitchcock* 10169.

### 3. *Pennisetum ciliare* (L.) Link.

*Cenchrus ciliaris* L. Mant. Pl. 302. 1771. "Habitat ad Cap. b. spei [Cape of Good Hope, Africa] \* \* \* Koenig." The description indicates the dwarfed form found in arid situations.

*Pennisetum ciliare* Link, Hort. Berol. 1: 213. 1827. Based on *Cenchrus ciliaris* L. The habitat is given as "Caribaeis, Cumana."

*Pennisetum cenchroides* L. Rich. in Pers. Syn. Pl. 1: 72. 1805. Based on *Cenchrus ciliaris* L.



FIG. 65.—*Pennisetum ciliare*. From *Drummond*, Punjab, India.

#### DESCRIPTION.

Plants perennial, tufted from a knotted crown; culms geniculate, slender, 10 to 50 cm. tall, sometimes taller, sparingly branching, scabrous at least on the uppermost joint; sheaths minutely scabrous and usually pilose along the margin; ligule ciliate, about 1 mm. long, sometimes minute; blades flat or folded, 2 to 10 cm. long (longer in plants in moist situations), 3 to 5 mm. wide, scabrous on the upper surface and long-pilose toward the base, glabrous or nearly so beneath; panicle 1.5 to 10 cm. long, not dense, purplish, mostly flexuous, the axis slender, angled, scabrous; fascicles subsessile, spreading; bristles united at the very base, flexuous, unequal, the outer short, slender, scabrous only, the inner thicker, flattened, about twice the length of the spikelet, ciliate, the innermost one a little longer than the rest; spikelets 1 to 5 in a fascicle, sessile, 4 to 5.5 mm. long, about 1.5 mm. wide, scaberulous; glumes thin, 1 to 3-nerved, acute or abruptly mucronate, the first one-fourth to more than one-third, the second two-thirds to three-fourths, the length of the spikelet; sterile lemma shorter than the

fruit, thin, 5 to 7-nerved, with a slender mucronate tip, inclosing a palea of equal length and a staminate flower; fruit but little indurate, the lemma 5-nerved, with an attenuate spreading tip.

Sometimes cultivated for ornament in the Southern States. An allied species, *Pennisetum holcoides* (Roxb.) Schult.,<sup>14</sup> has been cultivated under the name "*P. ciliare*," while true *P. ciliare* has been more generally known as "*P. cenchroides*." In *P. holcoides* the bristles are very plumose, making the panicles soft and downy.

#### DISTRIBUTION.

Arid open ground, tropics and subtropics of the Eastern Hemisphere; sparingly introduced in the American tropics (only American specimens cited below).

GUATEMALA: Zacapa, Pittier 1751.

PORRO RICO: Ponce, Britton, Cowell & Brown 5380.

#### 4. *Pennisetum glaucum* (L.) R. Br.

*Panicum glaucum* L. Sp. Pl. 56. 1753. "Habitat in Indiis." The first phrase name cited is "*Panicum spica tereti, involucellis bifloris fasciculato-pilosis. Fl. zeyl. 44.*" The Flora Zeylanica is Linnaeus's own work, and the exceptionally detailed description given<sup>15</sup> seems to show that it was drawn up from the plant which is still preserved in the British Museum.<sup>16</sup> The description given in the Species Plantarum, "Setae in spica longitudine flosculorum. Foliorum vaginae oris pilosae, Dum spica recens prodiit Flosculi in series dispositi observantur," also applies wholly to the Ceylon specimen, as does the name "*glaucum*" itself. But Linnaeus confused the matter by citing four phrase names, besides that from Flora Zeylanica. One refers to a Plukenet figure that probably represents *Elytrophorus articulatus*, one is a Tournefort phrase that is unidentifiable, and two, given as  $\beta$  and  $\gamma$ , are identifiable as green foxtail, *Chaetochloa viridis* (L.) Scribn., and yellow foxtail, *C. lutescens* (Weigel) Stuntz, respectively. The variety  $\gamma$  was taken by subsequent authors as the basis of *P. glaucum* L. and the names *Setaria glauca* and *Chaetochloa glauca* have been applied to yellow foxtail.

*Holcus spicatus* L. Syst. Nat. ed. 10. 2: 1305. 1759. A brief diagnosis, which applies to *P. glaucum* and fails to agree with the generic diagnosis of *Holcus* immediately above, is given, and "Pluk. t. 32. f. 4." is cited. Plukenet's figure<sup>17</sup> represents *P. glaucum*. No locality is mentioned, but Linnaeus later<sup>18</sup> gives "Habitat in India" for this species.

*Cenchrus spicatus* Cav. Descr. Pl. 304. 1802. Based on *Holcus spicatus* L. Kuntze (Rev. Gen. Pl. 3: 346. 1898) published this combination anew, based on "*Penicillaria spicata* Willd."

*Pennisetum typhoideum* L. Rich. in Pers. Syn. Pl. 1: 72. 1805. *Holcus spicatus* L. and Plukenet's figure, pl. 32, f. 4, are cited.

*Penicillaria spicata* Willd. Enum. Pl. 1037. 1809. Based on *Holcus spicatus* L.

*Pennisetum glaucum* R. Br. Prodr. Fl. Nov. Holl. 1: 195. 1810. The name is based on *Panicum glaucum* L., though the plant to which Brown applied it was evidently a species of *Chaetochloa*.

<sup>14</sup> Mant. 2: 148. 1824.

<sup>15</sup> Fl. Zeyl. 18. 1847. (The number 44 refers to the species, which is no. 44.)

<sup>16</sup> For the identity of this specimen see Trimen (Journ. Linn. Soc. Bot. 21: 136. 1896), and for the reasons for restoring this name to pearl millet see Stuntz, U. S. Dept. Agr. Bur. Pl. Ind. Inv. Seeds 31: 84. 1914; Hitchcock, Amer. Journ. Bot. 2: 299, 300. 1915. An analysis of the various Linnaean names that have been applied to pearl millet will appear in an early number of the American Journal of Botany.

<sup>17</sup> Phytogr. 1: pl. 32, f. 4. 1691.

<sup>18</sup> Sp. Pl. ed. 2. 2: 1483. 1763.

*Setaria glauca* Beauv. Ess. Agrost. 51, 178. 1812. The name is based on *Panicum glaucum* L., though Beauvois applied it to a species of *Chaetochloa*.

*Pennisetum spicatum* Roem. & Schult. Syst. Veg. 2: 499. 1817, as synonym of *Penicillaria spicata* Willd.; Koern. in Koern. & Wern. Handb. Getreid. 1: 284. 1885. Based on *Holcus spicatus* L.

*Panicum spicatum* Roxb. Fl. Ind. 1: 286. 1820. Based on *Holcus spicatus* L.

*Penicillaria plukeneti* Link, Hort. Berol. 1: 221. 1827. "P. Plukenetti Hort. Plukenet Alm. t. 32. f. 4. W[illdenow] E[numeratio] 1037." Both references are identifiable as *P. glaucum*.

*Chamaeraphis glauca* Kuntze, Rev. Gen. Pl. 2: 767. 1891. Based on "*Setaria glauca* Beauv.," that being based on *Panicum glaucum* L. Kuntze applied the name to a species of *Chaetochloa*.

*Ixophorus glaucus* Nash, Bull. Torrey Club 22: 423. 1895. Based on *Panicum glaucum* L., but the name applied to *Chaetochloa lutescens* (Weigel) Stuntz.

*Chaetochloa glauca* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897. Based on *Panicum glaucum* L., but the name applied to *Chaetochloa lutescens* (Weigel) Stuntz.

There has been great confusion as to the names referable to this

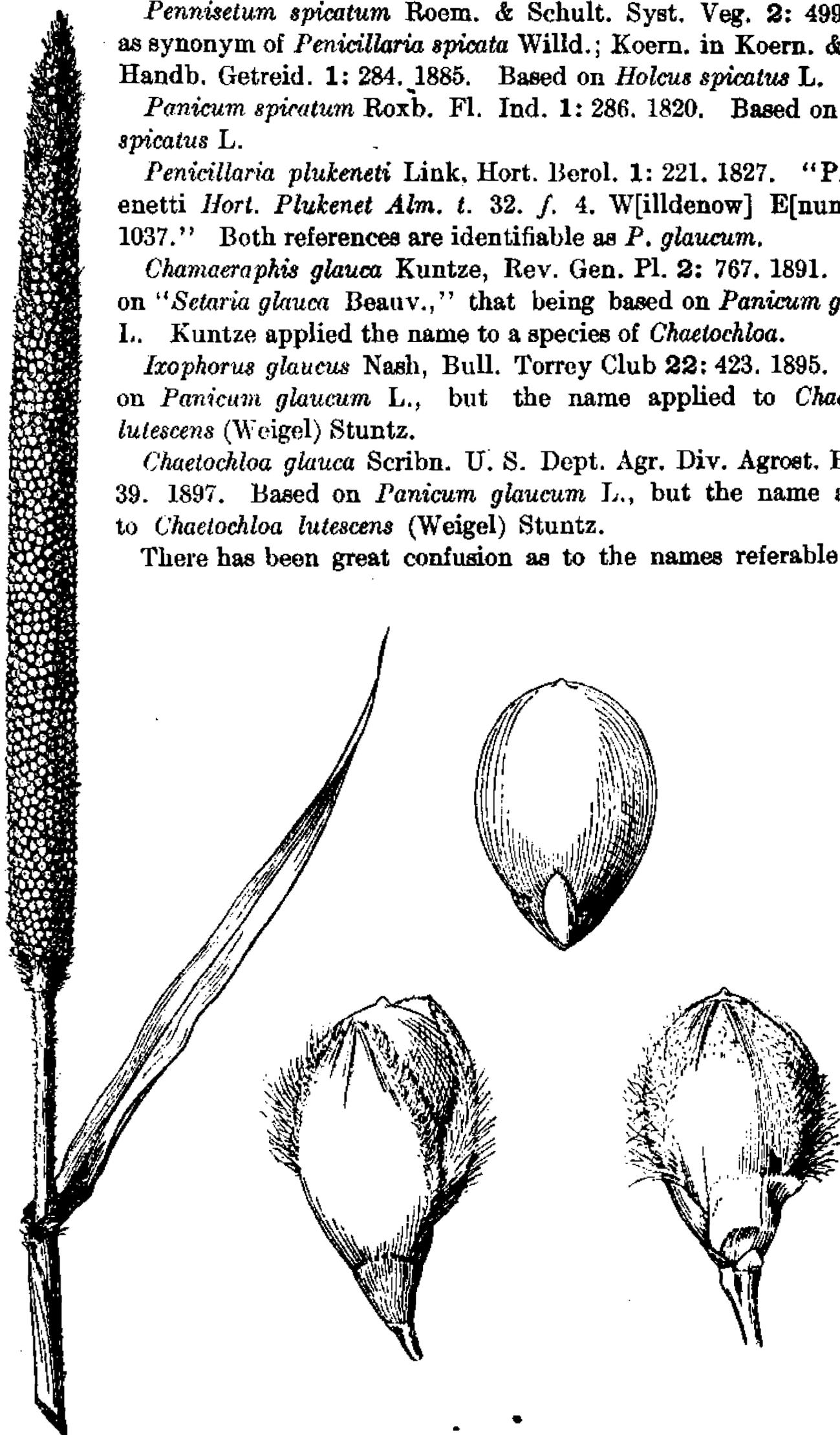


FIG. 66.—*Pennisetum glaucum*. From McCarthy, North Carolina.

species. As Hooker says, "The synonymy of the species is almost inextricable." The synonymy here given includes only those names that are based on Linnaean names.

Schumann<sup>19</sup> published the name *Pennisetum americanum*, based on *Panicum americanum* L., applying it to pearl millet. *Panicum americanum* L. is based on "Panicum americanum Clus. hist. 2, p. 215." Clusius's figure does not represent pearl millet, nor does his description apply to it. It is more like common millet (*Chae-tochloa italica*) but was probably based on a confusion of two or more species. Schumann's name was accepted by Leeke.<sup>20</sup>

#### DESCRIPTION.

Plants annual, branching at the base, robust, as much as 2 meters tall; culms simple or rarely branching, densely villous below the panicle, often minutely so below the nodes, otherwise glabrous; nodes usually appressed-pubescent; sheaths loose, mostly overlapping, commonly scabrous and usually densely hairy on the margins toward the summit and on the collar; ligule densely hairy, about 3 mm. long; blades flat, cordate at base, sometimes as much as 1 meter long and 5 cm. wide, scabrous on both surfaces, the midnerve prominent; panicles cylindrical, stiff, very dense, as much as 40 to 50 cm. long and 2 to 2.5 cm. thick, pale, bluish tinged, or sometimes tawny, the stout axis densely villous; fascicles on slender villous peduncles 2 to 5 cm. long, spreading; bristles unequal, the inner coarser, sparsely plumose below, about equaling the mature fruit; spikelets mostly 2 in a fascicle, short-pedicellate, at maturity 3.5 to 4.5 mm. long, obovate, turgid; glumes unequal, the first minute, the second one-fourth to half the length of the spikelet, ciliate; sterile lemma slightly shorter than the fertile one, firm, obscurely nerved, ciliate at the broad summit, inclosing a villous palea and sometimes a staminate flower; fertile lemma indurate, abruptly pointed, long-ciliate on the margins, except at the base and apex, the palea broad, thinner, villous on the margins and toward the summit, the subglobose or pyriform ripe caryopsis forcing open the lemma and palea and equaling them, bluish lead color or whitish; anthers with a minute tuft of hairs at the tips.

#### DISTRIBUTION.

Known only in cultivation. Leeke<sup>21</sup> considers it a composite species having a polyphyletic origin, arising in cultivation from *Pennisetum gymnothrix* (A. Br.) Schum., *P. perottetii* (Klotzsch) Schum., *P. mollissimum* Hochst., *P. violaceum* (Lam.) L. Rich, and *P. versicolor* Schrad. These species are all natives of Africa. *Pennisetum glaucum* has numerous varieties and forms. It is an important food plant in Africa<sup>22</sup> and is also cultivated for its grain in India, Arabia, and southern Europe. In our Southern States it is grown to a limited extent for forage. It is sometimes called Indian millet, African millet, and cat-tail millet.

*Pennisetum purpureum* Schumach.,<sup>23</sup> a tropical African species, is being introduced as a fodder plant in the Southern States under the name Napier grass. In Africa it is also called elephant grass. It is a robust leafy tufted branching perennial, 2 to 4 meters tall, with elongate blades 2 to 3 cm. wide, and dense, stiff, tawny or purplish panicles, the fascicles sessile, the sparsely plumose bristles exceeding the two or three unequally pediceled spikelets.

<sup>19</sup> In Engl. Pflanzenw. Ost-Afr. 5<sup>B</sup>: 51. 1895.

<sup>20</sup> Zeitschr. Naturw. 79: 52-96. 1907.

<sup>21</sup> Zeitschr. Naturw. 79: 55. 1907.

<sup>22</sup> For a full treatment of the varieties and their history see Koern. & Wern. Handb. Getreid. 1: 284. 1885; Schum. in Engl. Pflanzenw. Ost-Afr. 5<sup>B</sup>: 51-58. 1895; and Leeke, Zeitschr. Naturw. 79: 52-108. pl. 2. 3. 1907.

<sup>23</sup> Schumach. & Thonn. Beskr. Guin. Pl. 64. 1827. Described from Guinea, Africa.

5. *Pennisetum karwinskyi* Schrad.

*Pennisetum karwinskyi* Schrad. *Linnaea* 12: 431. 1838. "Habit. in Mexico (Karwinsky)." In the Schrader Herbarium, which is preserved in the herbarium of the Botanical Garden at Petrograd, there are two sheets bearing this name, but no data. On one sheet are leaves only; on the other is a culm with a single purplish panicle about 5 cm. long. The fascicles of this panicle are smaller than usual for the species and the inner bristles are only sparsely short-ciliate. The description and the specimen represent a rather dwarfed plant such as Rose, Standley & Russell's no. 12866, from Alamos, Sonora.

*Cenchrus multiflorus* Presl, *Rel. Haenk.* 1: 318. 1830. "Hab. in Mexico." The type specimen was examined by Professor Hitchcock in the herbarium of the German University at Prag. The fascicles are much like those of Pringle's no. 3849. Most of the bristles only slightly exceed the spikelets, the inner are more pilose than usual for the species, and one bristle is about twice as long as the rest, thicker, and stiffly flexuous.

*Pennisetum multiflorum* Fourn. *Mex. Pl.* 2: 49. 1886. No locality or specimen is cited. The description is as follows: "Spica imbricata, spiculis quinis in eodem involucre, quarum 1-2 abortientes; gluma inferiore tertiam partem spiculae aequante superiore inferiorem duplam aequante; involucri setis exterioribus brevibus scabris; interioribus crassioribus in dimidia tantum inferiore parte ciliatis, spiculas duplo superantibus, seta una multo longiore." In the Copenhagen Herbarium is a specimen of Liebmann's no. 463 which bears the name "*Pennisetum multiflorum* Fourn." in Fournier's handwriting. This consists of a single naked elongate terminal joint and, in an envelope, a fragment, 5 cm. long, of a panicle, the fascicles with exceptionally slender bristles, scarcely at all ciliate, the innermost one as much as 3.5 cm. long (as in Nelson's no. 3965); three fascicles with short subequal bristles, the inner sparsely ciliate (as in Pringle's no. 2044); and a single bur of *Cenchrus pilosus* H. B. K. (the only American species of *Cenchrus* known in which the bristles are antrorsely scabrous). Since only the inflorescence is described, it seems certain that Fournier's description was based on this fragmentary specimen. The allusion to the ciliate lower part of the thickened inner bristles must have been made from observation of the bur of the *Cenchrus*. Fournier does not base the name on *Cenchrus multiflorus* Presl, though he is naming the same species. He includes *Cenchrus multiflorus* Presl in *Cenchrus*. Liebmann's nos. 341 and 464, which he cites under it, are in the Copenhagen Herbarium; no. 464 bears the name *Cenchrus multiflorus* in Fournier's hand, the other is marked "determ: Fournier." Both are *Pennisetum karwinskyi*.

## DESCRIPTION.

Plants perennial, in loose clumps from hard knotted crowns, the culms produced from hard scaly bulblike buds bursting through the basal and underground sheaths; culms erect or ascending, simple or with leafy shoots from the lower nodes, mostly 1 to 1.5 meters tall, rarely only about 0.5 meter, very scabrous below the panicle, otherwise glabrous, the lower internodes compressed; sheaths keeled, mostly overlapping, pilose along the margin at least toward the summit, sometimes sparsely papillose-pilose, or rarely the lower densely pilose, throughout; ligule 1.5 to 2 mm. long, membranaceous-ciliate; blades usually rather firm, ascending or spreading, flat, 10 to 40 cm. long, 5 to 15 mm. wide, broadest at the base, tapering to a long, attenuate, very scabrous, usually involute tip, the upper surface scabrous and usually sparsely papillose-pilose, rarely densely so, sometimes scabrous only, the lower surface usually scabrous, sometimes smooth, the margins very scabrous; panicle rather stiff or slightly flexuous, 5 to 17 cm. long, mostly 10 to 12 mm wide, excluding the longest bristles, tawny or purplish or sometimes greenish, mostly dense except at the base, but sometimes the fascicles rather loosely arranged, the axis strongly angled, pubescent;

fascicles subsessile, ascending or spreading; bristles united at the very base, unequal, the outer short and slender, the inner stout, flattened and sparsely ciliate below (sometimes scabrous only but with some ciliate in the same fascicle, rarely none, ciliate), commonly erect or appressed with ascending tips, 5 to 8 mm. long, the innermost sometimes 15 to 25 cm. long, rarely longer, flexuous (this innermost bristle commonly elongate in the lower fascicles and not in the upper in the same panicle, but sometimes elongate in all and sometimes not in any); spikelets 1 to 5 in each fascicle, sessile, 5 to 6 mm. long, about 1.3 mm. wide, glabrous or scaberulous; glumes thin, acute, the first 1-nerved, one-third to half the length of the spikelet, the second 5 to 7-nerved, two-thirds to three-fourths the length of the spikelet, or the attenuate tip elongate; sterile lemma slightly shorter than the fertile one, 5 to 7-nerved, acuminate, inclosing a palea of about equal length and usually a staminate flower; fruit subindurate, the apex attenuate and spreading.

In this species the fascicles vary greatly in size. Specimens with few-flowered fascicles and short bristles appear distinct from those with fascicles of 4 or 5 spikelets and elongate innermost bristles, but in several specimens almost the entire range of variation in fascicles is found from base to summit of a single panicle. The type specimen of *Cenchrus multiflorus* and that of *Pennisetum multiflorum* represent about the extremes of inflorescence, the first with short, relatively thick, bristles, plentifully ciliate, the second with long, very slender bristles, very sparingly or not at all ciliate. Jiménez's no. 522 has an exceptionally large panicle, the innermost bristles of all fascicles elongate, a few of them 5 cm. long.

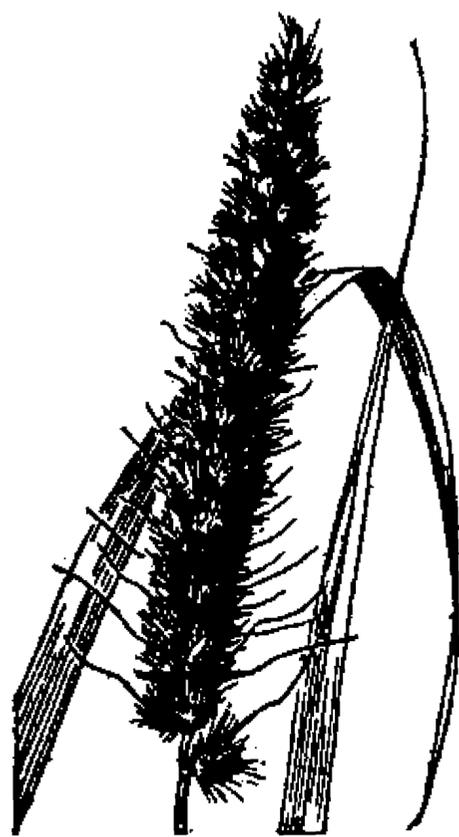


FIG. 67.—*Pennisetum karwinskyi*. From Pringle 3849, Mexico.

#### DISTRIBUTION.

Rocky, open, dry or moist slopes, mostly in the uplands, from Mexico to Costa Rica.

SONORA: Alamos, Rose, Standley & Russell 12866.

JALISCO: Guadalajara, Hitchcock 7342, 7364; Holway 3; Pringle 2044, 3849, 11327.

GUERRERO: Balsas, Hitchcock 6791. Acapulco, Palmer 75 in 1895.

OAXACA: San Agustín, Liebmann 341. Oaxaca, Galeotti 5880.

CHIAPAS: Between San Ricardo and Ocozocuantla, Nelson 2895. Ocuilapa, Nelson 3065.

COSTA RICA: Nuestro Amo, Jiménez 522.

#### 6. *Pennisetum setosum* (Swartz) L. Rich.

*Cenchrus setosus* Swartz, Prodr. Veg. Ind. Occ. 26. 1788. "India occidentalis." The type specimen in the Swartz Herbarium at Stockholm was examined by A. S. Hitchcock.

*Panicum cenchroides* L. Rich. Act. Soc. Hist. Nat Paris 1: 106. 1792. "E Cayenna missarum a Domino Le Blond." The type has not been examined. The description is insufficient for identification. The name is referred here on the authority of Doell.<sup>25</sup>

*Pennisetum setosum* L. Rich. in Pers. Syn. Pl. 1: 72. 1805. Based on *Cenchrus setosus* Swartz.

<sup>25</sup> In Mart. Fl. Bras. 2<sup>a</sup>: 306. 1877.

*Pennisetum purpurascens* H. B. K. Nov. Gen. & Sp. 1: 113. 1816. "Mexicani, Volcan de Jorullo." The type has not been examined, but the description applies well to the robust plants of Mexico. The blades are described as scabrous on the upper surface and on the margin and glabrous beneath, and the sterile floret as having a palea.

*Pennisetum uniflorum* H. B. K. Nov. Gen. & Sp. 1: 114. pl. 34. 1816. "Prov. Novae Andalusiae, juxta Cumanacoa," [Venezuela]. The description and plate identify the species. The sheaths are described as pubescent, the blades scabrous on the upper surface and margin, and glabrous beneath; the sterile lemma empty.

*Panicum densispica* Poir. in Lam. Encycl. Suppl. 4: 273. 1816. Based on "*Panicum cenchroides* Rich. non Lam."

*Panicum triticoides* Poir. in Lam. Encycl. Suppl. 4: 274. 1816. Described from a specimen in Desfontaines's herbarium, its source unknown. The type has not been examined. The description applies well to *Pennisetum setosum*, to which Doell<sup>26</sup> refers it. The sheaths are described as glabrous but pilose at the mouth, the blades as rough and sparsely pilose on both surfaces.

*Setaria cenchroides* Roem. & Schult. Syst. Veg. 2: 495. 1817. Based on *Panicum cenchroides* L. Rich.

*Pennisetum triticoides* Roem. & Schult. Syst. Veg. 2: 877. 1817. Based on *Panicum triticoides* Poir.

*Gymnothrix geniculata* Schult. Mant. 2: 284. 1824. "Setaria geniculata Sieb. Fl. Martini. \* \* In Martinica." The detailed description identifies the species. The sheaths are described as glabrous and the blades as scabrous on both surfaces.

*Pennisetum alopecuroides* Desv.; Hamilt. Prodr. Pl. Ind. Occ. 11. 1825. "India occidentali." The type has not been examined. The description of the "involucre" as pilose identifies the species. The sheaths are described as glabrous and the blades as subscabrous.

?*Pennisetum erubescens* Desv.; Hamilt. Prodr. Pl. Ind. Occ. 11. 1825. "St. Thomas." The brief diagnosis is insufficient for identification, but the species is probably *P. setosum*. The leaves are not described.

*Pennisetum richardi* Kunth, Rév. Gram. 1: 49. 1829. Based on *Panicum cenchroides* L. Rich.

*Pennisetum sieberi* Kunth, Rév. Gram. 1: 50. 1829. Based on "*Gymnothrix geniculata* Schult.—*Setaria geniculata* Sieb, herb. Mart."

*Pennisetum hirsutum* Nees, Agrost. Bras. 284. 1829. "In ripa fluminis S. Francisci ad Joazeiro provinciae Bahiensis et Pernambucensis; nec non in \* \* \* provinciae Piauiensis." The specimen collected by Martius in Bahia, which was examined by A. S. Hitchcock in the Munich Herbarium, is probably the type. The sheaths are described as tuberculate-pilose toward the summit and the lower blades as tuberculate-pilose on both surfaces, the upper blades as sparsely pilose.

*Pennisetum pallidum* Nees, Agrost. Bras. 285. 1829. "Habitat. \* \* \* ad latera montium de Mentanha et Itambé, districtus adamantini, provinciae Minarum." The type specimen, collected by Martius, was examined by A. S. Hitchcock in the Munich Herbarium. The sheaths and blades are described as tuberculate-hirsute.

*Pennisetum flavescens* Presl, Rel. Haenk. 1: 316. 1830. "Hab. in Mexico." The type specimen was examined by A. S. Hitchcock in the herbarium of the German University at Prag. The sheaths are described as smooth, the blades as nearly glabrous beneath and tuberculate-villous above.

*Pennisetum dasistachyum* Desv. Opusc. 76. 1831. "Habitat in Guyana." The type has not been examined. The description of the bristles identifies the species. Desvaux cites "*Panicum cenchroides* Rich. nec Lamk., densi-spica Poir." as synonyms. The sheaths and blades are described as glabrous, the sheaths bearded at the mouth.

<sup>26</sup> In Mart. Fl. Bras. 2<sup>2</sup>: 306. 1877.

*Pennisetum hamiltonii* Steud. Nom. Bot. ed. 2. 2: 297. 1841. Based on "*P. alopecuroides* Hamilt. (non Spr. nec. Steud.)."

*Pennisetum nicaraguense* Fourn. Bull. Soc. Bot. France II. 27: 293. 1880. "Circa Granada (n. 1304)," Nicaragua, the specimen collected by Paul Lévy. The type has not been examined. The description applies well to the robust plants with hirsute blades collected by A. S. Hitchcock in Nicaragua (nos. 8708, 8738).

*Pennisetum indicum* var. *purpurascens* Kuntze, Rev. Gen. Pl. 2: 787. 1891. Based on *Pennisetum purpurascens* H. B. K.

In Leeke's <sup>28</sup> revision *Pennisetum setosum* is included under *P. indicum* (Murray) Kuntze, and the American plants as well as those of India and Africa are referred to var. *typica*. The plant of India is an annual, much more freely branching than is *P. setosum*, and has more slender, less dense panicles. It was described by Linnaeus as *Panicum polystachion* <sup>29</sup> and transferred by Schultes <sup>30</sup> to *Pennisetum*. Linnaeus, following a brief diagnosis, cites "*Rumph. amb. 6. t. 7. f. 2. B.*" Merrill <sup>31</sup> identifies the Rumphian plant as *Setaria flava* (Nees) Kunth, and says that this "Rumphian reference is the whole basis" of *Panicum polystachion* L. Since Linnaeus gives a diagnosis of his own, however, (which does not agree with the Rumphian figure) I should take his own specimen as the basis of his species. Dr. Stapf states, in a letter, that in the Linnaean Herbarium there is a specimen of "the *Pennisetum setosum* of India" [that is, the species which has commonly been so called] "written up by Linnaeus himself *polystachyum*." If the name *Pennisetum indicum* (Murray) Kuntze <sup>32</sup> were properly referable to this species it would be antedated by *P. polystachyum* (L.) Schult. Dr. Stapf holds that *Alopecurus indicus* Murray (Syst. Veg. ed. 13. 92. 1774), upon which *Pennisetum indicum* Kuntze is based, was based on *Panicum alopecuroides* of Linnaeus's Mantissa. Murray cites "*Panicum alopecuroides* Spec. plant. 82," but his description is copied verbatim from the Mantissa (p. 322, 1771) and not from the second edition of the Species Plantarum, the page reference to which he gives, nor from the first. In the Mantissa Linnaeus changes the application of the name. Following "*Panicum alopecuroid. Excludatur et reformatum restitua-tur sequentibus*" he gives a description that is based on some plant having pilose culm, sheaths, and blades, and apparently an inflorescence of pearl millet or of common millet. *Panicum alopecuroides*, "Habitat in China," of the first edition of the Species Plantarum (p. 55) was based on a plant undoubtedly sent to him by Osbeck. <sup>33</sup> In his Dagbok ofwer Ostindsk resa, published in 1757, under date of September 27, 1751, Osbeck lists "*Panicum alopecuroides*" without description, among plants observed growing along hedgerows near Canton. Dr. Stapf, who at our request kindly examined the Chinese plant in the Linnaean Herbarium, identifies it with *Pennisetum compressum* R. Br., specimens of which from China agree perfectly with Linnaeus's description.

Leeke <sup>34</sup> refers *Panicum vulpisetum* Lam., <sup>35</sup> described from Santo Domingo, to *P. indicum*. We have not seen Lamarck's specimen but the description (particularly that of the spike as repeatedly subdivided) applies not to *P. setosum*, but to *Chaetochloa vulpiseti* (Lam.) Hitchc. & Chase, as described in the Grasses of the West Indies. <sup>36</sup> Lamarck mistakenly cited Sloane's plate 70, figure 1, thus giving an erroneous impression of his species, which he described from a specimen in the herbarium of

<sup>28</sup>Zeitschr. Naturw. 79: 17-19. 1907.

<sup>29</sup>Syst. Nat. ed. 10. 2: 870. 1759.

<sup>30</sup>Mant. 2: 146. 1824.

<sup>31</sup>Rumphius's Herb. Amboinense 91. 1917.

<sup>32</sup>Rev. Gen. Pl. 2: 787. 1891.

<sup>33</sup>See Merrill on Osbeck's Dagbok in Amer. Journ. Bot. 3: 571. 1916.

<sup>34</sup>Zeitschr. Naturw. 79: 18. 1907.

<sup>35</sup>Encycl. 4: 735 (err. typ. 745). 1798.

<sup>36</sup>Contr. U. S. Nat. Herb. 18: 350. 1917.

Desfontaines. The specimen in the Sloane Herbarium from which the cited figure was drawn is *Imperata caudata*.<sup>37</sup>

## DESCRIPTION.

Plants perennial, in loose clumps, sometimes of 30 or more culms; culms usually 1 to 2 meters tall, slender to robust, subcompressed, ascending or suberect from the more or less geniculate, sometimes rooting lower nodes, bearing one to several flowering branches from the lower and middle nodes, scabrous below the panicle, otherwise glabrous; sheaths loose, from glabrous to rather densely papillose-hirsute, usually sparsely hirsute along the margin toward the summit, and otherwise glabrous; ligule membranaceous-ciliate, 2 to 3 mm. long; blades mostly rather firm, ascending or spreading, 10 to 40 cm. long, 4 to 18 mm. wide, tapering toward the base (or the reduced upper blades widest at base), acuminate into a long, slender, very scabrous tip, from scabrous on both surfaces (or rarely glabrous beneath) to rather densely papillose-hirsute on both surfaces, more commonly scabrous beneath and sparsely papillose-hirsute above, always stiffly hairy back of the ligule; panicles terminating the primary culm and branches, occasionally one or two axillary panicles borne in the upper sheaths, 10 to 25 cm. long, 8 to 10 mm. thick, excluding the elongate bristles, rather dense, usually somewhat nodding, from pale yellow to dusky purple or brown, the axis slender, scabrous; fascicles sessile, at first ascending, spreading or often reflexed in age; bristles unequal, the outer delicate, scabrous only, most of them shorter than the spikelet, the inner densely silky-plumose below, the hairs directed inward, those of the erect lower part of adjoining bristles matted and beautifully crimped, the bristles spreading above; spikelets solitary, sessile, 3.2 to 4 mm. long, 0.8 to 1 mm. wide, the glumes and sterile lemma very thin; first glume usually minute, often obsolete; second glume exceeding the sterile lemma and the fruit, 5-nerved, abruptly acuminate, ciliolate, sometimes obscurely erose or lobed; sterile lemma 5-nerved, ciliolate, minutely 3-lobed at the truncate apex, the palea sometimes and, less often, a staminate flower developed; fruit indurate, smooth and shining, 2 to 3 mm. long, 0.8 to 1 mm. wide, the narrowed apex of both lemma and palea stiffly ciliate-fringed.

In this species the pubescence of the foliage is exceedingly variable, but the floral characters are unusually constant.

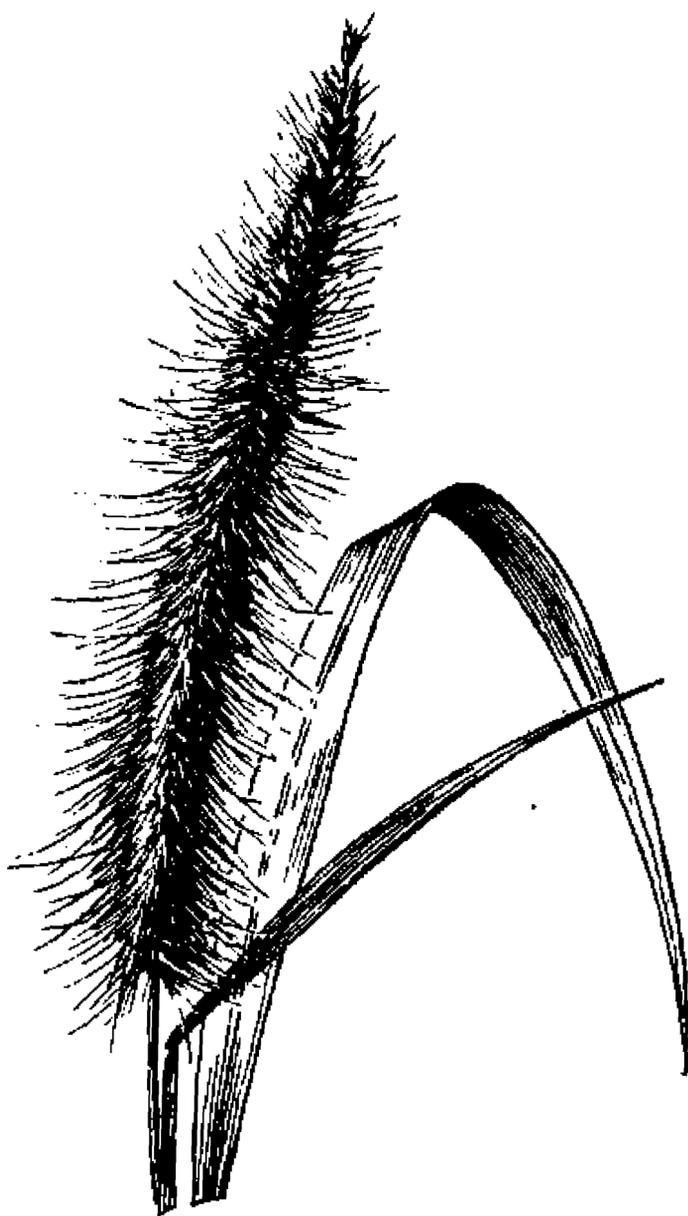


FIG. 68.—*Pennisetum setosum*. From *Amer. Gr. Nat. Herb.* 611, Trinidad.

<sup>37</sup> See Hitchcock, *Contr. U. S. Nat. Herb.* 12: 133. 1908. It is pertinent in this connection to quote Merrill's observation (*Interpretation of Rumphius's Herbarium Amboinense*, p. 27. 1917): "It is not at all certain that in quoting illustrations of various species as synonyms Linnaeus and his contemporaries and immediate successors intended them as exact synonyms; it would seem, in many cases at least, that the citation of illustrations as synonyms was intended to convey to other botanists some conception of what the species was like, and not necessarily to indicate that it was an exact equivalent of the species under which it was cited."

*Pennisetum breve* Nees<sup>38</sup> of Brazil is very closely related to *P. setosum*. Doell reduces it to a variety of that. The type of this, collected by Martius in Bahia, was examined by A. S. Hitchcock in the Munich Herbarium. It is not here included because the plants are much smaller and the fascicles and spikelets are larger. None of this form is found among North American collections; our few specimens are from near Rio de Janeiro. *Panicum alopecuroides* Lam.<sup>39</sup> (not *Pennisetum alopecuroides* (Nees) Steud. 1854), described from Brazil, the type of which, from Rio de Janeiro, was examined by A. S. Hitchcock, in the Lamarck Herbarium in Paris, belongs to this form.

## DISTRIBUTION.

Open slopes and savannas, southern Florida and southern Mexico, through Central America and the West Indies to Brazil, reaching its greatest development on rocky slopes of Mexico and Central America. Specimens from Ashantee, Africa, appear to belong to this species, possibly introduced from America.

FLORIDA: Estero<sup>40</sup> Bay, Garber 28; Sargent in 1905.

JALISCO: Río Blanco, Palmer 677 in 1886. Guadalajara, Pringle 1740.

VERACRUZ: Jalapa, Hitchcock 6544. Zacuapan, Purpus 2154.

MORELOS: Cuernavaca, Pringle 11241.

COLIMA: Alzada, Amer. Gr. Nat. Herb. 433; Hitchcock 7094. Colima, Palmer 1269 in 1891.

GUERRERO: Between Petatlán and Chilapa, Nelson 2149. Acapulco, Palmer 433 in 1895.

OAXACA: Oaxaca, Hitchcock 6187. Trapiche de la Concepción, Liebmann 336, 337, 342.

CHIAPAS: Tuxtla, Nelson 3090.

GUATEMALA: Alta Verapaz, Pittier 217.

HONDURAS: San Pedro Sula, Thieme 636 (J. D. Smith no. 5582).

SALVADOR: Santa Ana, Hitchcock 8795. San Salvador, Renson 324.

NICARAGUA: Masaya, Hitchcock 8708, 8733, 8738. Jinotepe, Hitchcock 8702.

COSTA RICA: Between Boruca and Lagarto, Tonduz (or Pittier) 4457. Surubres, Biolley 17382. Nicoya, Tonduz 13751. Atenas, Hitchcock 8515. Guanacaste, Jiménez 698. Rodeo, Pittier 1614. Pacaca, Pittier 3287.

PANAMA: Taboga Island, Hitchcock 8095.

CUBA: San Juan de Buenavista, Wright 3471.

JAMAICA: Without locality, Swartz.

LEEWARD ISLANDS: St. Christopher, Hitchcock 16349. Guadeloupe, Duss 4152. Dominica, Hitchcock 16436; Jones 5.

WINDWARD ISLANDS: Martinique, Duss 1316, 4017; Hahn 1012. Barbados, Dash 346.

TRINIDAD: Icacos, Amer. Gr. Nat. Herb. 611; Broadway 4964. St. Joseph, Amer. Gr. Nat. Herb. 612.

TOBAGO: Plymouth, Hitchcock 10235. Adelphi, Broadway 4683.

COLOMBIA: Corinto, Pittier 989. Sabanas del Credo, Pittier 1487. Santa Marta, Smith 156, 2532. Without locality, Linden 1560; Triana 340.

VENEZUELA: Dos Caminos, Pittier 5756. Ocumare de la Costa, Pittier 6053. Valencia, Carreño 8237. Without locality, Fendler 1683.

BRAZIL: Ceara, Gardner 1885. Piahy, Gardner. Pará, Goeldi 81, 217.

BOLIVIA: Coripati, Bang 2168.

<sup>38</sup> Agrost. Bras. 281. 1829.

<sup>39</sup> Tabl. Encycl. 1: 169. 1791.

<sup>40</sup> Four specimens of this collection in the National Herbarium are all labeled "Lastero" or "Laster's" Bay. This is obviously an error in copying the name from Garber's original notes.

7. *Pennisetum antillarum* (Poir.) Desv.

*Panicum antillarum* Poir. in Lam. Encycl. Suppl. 4: 275. 1816. "Antilles (V. s. in herb. Desfont.)." The type specimen or a duplicate of it was examined by A. S. Hitchcock in the herbarium of the Botanical Garden at Florence and a fragment of inflorescence was given him for the National Herbarium. So far as known this is the only collection of this species in existence. The description given below, except that of the inflorescence, is translated from Poirét's description and that of Desvaux.

*Saccharum?* *antillarum* Roem. & Schult. Syst. Veg. 2: 877. 1817. Based on *Panicum antillarum* Poir.

*Setaria antillarum* Kunth, Rév. Gram. 1: 46. 1829. Based on *Panicum antillarum* Poir.

*Pennisetum antillarum* Desv. Opusc. 76. 1831. Based on *Panicum antillarum* Poir.

## DESCRIPTION.

Plants probably perennial; culms erect, slender, terete, branching, scabrous below the panicle, otherwise glabrous; sheaths pilose, ciliate at the throat; blades narrowly linear, acuminate, pilose on the upper surface at least toward the base, glabrous beneath; panicle 8 to 15 cm. long, very slender, acuminate, rather dense, the slender angled axis minutely scaberulous; fascicles sessile, spreading; bristles scant, very slender, unequal, most of them about equaling the spikelet, the innermost conspicuously longer, 4 to 6 mm. long; spikelets solitary, sessile, 2 to 2.5 mm. long; glumes and sterile lemma thin, brownish, ciliolate, the first minute, sometimes obsolete, the second exceeding the sterile lemma and the fruit, 5 to 7-nerved, minutely 3-lobed at the apex, the middle lobe acute, exceeding the lateral ones; sterile lemma 3 to 5-nerved, minutely 3-lobed, the middle lobe reduced to a mucro, the palea obsolete; fruit about 1.5 mm. long and 0.4 mm. wide, indurate, smooth and shining, the narrowed apex of both lemma and palea ciliate-fimbriate.

The spikelet and particularly the indurate, fimbriate-tipped fruit show relationship to *Pennisetum setosum*.

Known from a single collection from "Antilles."

8. *Pennisetum crinitum* (H. B. K.) Spreng.

*Gymnothrix crinita* H. B. K. Nov. Gen. & Sp. 1: 112. 1816. "Crescit in littore lacus Cuiseo [Lake Cuitzeo, Michoacán] prope La Puerta de Andaracuas, et juxta S. Rosa, \* \* \* in regno Mexicano." The type specimen has not been examined, but the detailed description agrees perfectly with the numerous specimens from the region whence came the type.

*Pennisetum crinitum* Spreng. Syst. Veg. 1: 302. 1825. Based on *Gymnothrix crinita* H. B. K.

*Pennisetum humboldtianum* Hemsl. Biol. Centr. Amer. Bot. 3: 508. 1885. Based on *Gymnothrix crinita* H. B. K.

## DESCRIPTION.

Plants perennial, glabrous as a whole; culms solitary or few together, erect from a curved or slightly geniculate base, robust, usually 2 meters or more tall, commonly bearing leafy flowering branches from all but the lower nodes, these often bearing sterile branches; internodes conspicuously channeled on the side toward the sheath, the lower mostly compressed, relatively short, the upper elongate; sheaths much shorter than the internodes, rather loose; ligule stiffly ciliate, about 0.5 mm. long; blades erect or ascending, rather thick, flat, those of the main culm 20 to 40 cm. long, 8 to 18 mm. wide, broadest at the base, those of the branches smaller; primary panicles usually



FIG. 69.—*Pennisetum antillarum*. From type specimen.

rather short-exserted, mostly stiffly erect, 12 to 25 cm. long, about 10 mm. thick, excluding the longer bristles, dense or sometimes loose at the base, stramineous or tawny or sometimes with pale bristles and greenish purple spikelets, the axis ridged, scabrous, toward the base often 2 mm. thick, the panicles of the branches commonly partly included, shorter, more slender, less densely flowered; fascicles sessile, ascending; bristles scant, unequal, most of them scarcely exceeding the spikelet, the outer shorter or two or three of them sometimes a little longer, the innermost stouter, 12 to 20 cm. long; spikelets solitary, sessile, 5 to 6 mm. long, about 1.3 mm. wide, acuminate, often blotched with purple, scaberulous toward the summit; first glume one-fourth to half the length of the spikelet, 1-nerved, acute or subacute; second glume slightly shorter than the fruit, 5-nerved, subacute; sterile lemma equaling the fruit or slightly exceeding it, 5-nerved, acuminate, the palea obsolete; fruit indurate, 4.5 to 5 mm. long, about 1.3 mm. wide, acuminate, the tip often spreading, the tip of the palea free.

## DISTRIBUTION.

Moist meadows or wet open ground, in the highlands of southern Mexico.

JALISCO: Río Blanco, *Palmer* 514 in 1886.

GUANAJUATO: Irapuato, *Hitchcock* 7397. Acámbaro, *Amer. Gr. Nat. Herb.* 432; *Pringle* 2608.

VERACRUZ: Río Blanco near Orizaba, *Hitchcock* 6343.

MEXICO: Lechería, *Pringle* 13251.

MICHOACAN: Morelia, *Holway*<sup>41</sup> 3593; *Pringle* 4316; *Arsène* in 1909 and 1910. Pátzcuaro, *Holway* 3629.

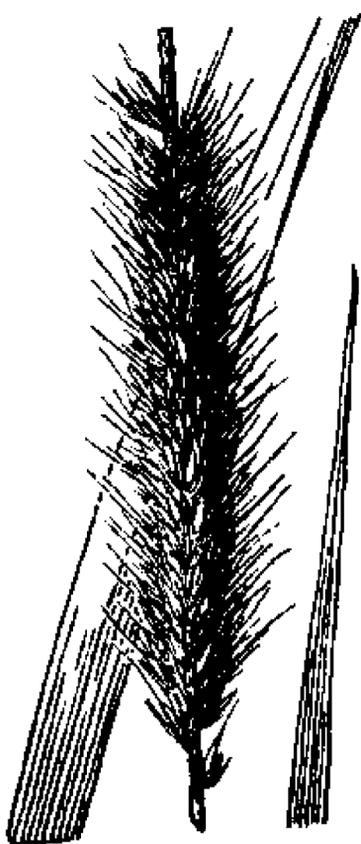


FIG. 70.—*Pennisetum crinitum*. From *Arsène* in 1910, Mexico.

9. *Pennisetum complanatum* (Nees) Hemsl.

*Gymnothrix complanata* Nees, *Bonplandia* 3: 83. 1855. "Seemann n. 1560. Panama." The description indicates an exceptionally small plant with decumbent base, such as Pittier's no. 1901a from Salvador. The type specimen is in the herbarium of the British Museum. Two fascicles from the panicle were kindly sent by Dr. Rendle for deposit in the National Herbarium.

*Pennisetum complanatum* Hemsl. *Biol. Centr. Amer. Bot.* 3: 507. 1885. Based on *Gymnothrix complanata* Nees.

*Gymnothrix mexicana* Fourn. *Mex. Pl.* 2: 48. 1886. "Orizaba \* \* \* (BOURG[EAU] n. 3139, SCHAFFN[ER] n. 105, 174, THOMAS in herb. BUCHINGER, F. MÜLL[ER] n. 2015, BOTT[ERI] n. 143, 1486); Papantla (LIEBM[ANN] n. 344)." The name was earlier listed without description by Hemsley.<sup>42</sup> A specimen of Bourgeau's no. 3139 is in the National Herbarium. Liebmann's no. 344 in the Copenhagen Herbarium, bearing the name in Fournier's writing, has also been examined.

<sup>41</sup> Dr. Holway's Mexican grasses collected in 1899 were sent to the agrostologist of the Department of Agriculture with labels bearing the name, locality, date, and collector's number, but without the name of the collector. By some mischance the collections were attributed to Dr. J. N. Rose, whose name was written by some clerk on the Department of Agriculture label. It was only after the publication of Hitchcock's *Mexican Grasses* (*Contr. U. S. Nat. Herb.* 17: 181-389. 1913) that the mistake was discovered. This and other specimens collected by Holway are there cited as Rose's.

<sup>42</sup> *Biol. Centr. Amer. Bot.* 3: 508. 1885.

*Gymnothrix grisebachiana* Fourn. Mex. Pl. 2: 48. 1886. "Mirador (SCHAFFNER) n. 185. pl. ed. Hohen.)" A specimen of Schaffner's no. 185 was examined by A. S. Hitchcock in the Grisebach Herbarium at Göttingen.

*Pennisetum mexicanum* Hemsl. Biol. Centr. Amer. Bot. 3: 508. 1885, nom. nud.; Ind. Kew. 2: 458. 1894. Based on *Gymnothrix mexicana* Fourn.

## DESCRIPTION.

Plants perennial; culms solitary or few together, erect or ascending from a strong rhizome, 1 to 2 meters tall, sometimes dwarfed, scabrous below the panicle, otherwise glabrous, simple or, more commonly, with one or two, rarely with several, flowering branches, the lower nodes sometimes geniculate, the internodes terete (or the lower slightly compressed) slightly or not at all channeled, not elongate and naked; sheaths loose, commonly as long as the internodes or longer, pilose on the margin at the summit, sometimes pubescent on the collar; ligule ciliate, about 2 mm. long; blades thinner than in *P. crinitum*, mostly somewhat spreading, flat, or folded at base, 20 to 55 cm. long, 5 to 8 or rarely 10 mm. wide, glabrous beneath, very scabrous on the upper surface, often papillose-pilose toward the base and with stiff hairs just back of the ligule, attenuate into an elongate involute setaceous tip; panicles nodding or somewhat flexuous, 7 to 16 cm. long, about 10 to 12 mm. thick, excluding the longest bristles, not so dense as in *P. crinitum*, with tawny or purplish bristles and pale spikelets, the slender axis ridged and scabrous; fascicles on very minute bearded peduncles, ascending; bristles numerous, unequal, most of them exceeding the spikelet, several to many, 12 to 15 mm. long, the innermost 15 to 25 mm. long, but usually not conspicuous as in *P. crinitum*; spikelet solitary, sessile, 6 to 7 mm. long, about 1.8 mm. wide, rather abruptly pointed, minutely scaberulous; first glume one-fourth to one-third the length of the spikelet, thin, 1-nerved, acute to truncate; second glume two-thirds to three-fourths as long as the fruit, 5-nerved, acute or subacute; sterile lemma slightly shorter than the fruit, 5-nerved, acuminate, inclosing a palea of equal length and usually a staminate flower; fruit rather less indurate than in *P. crinitum*, acuminate-tipped, the tip of the palea free.

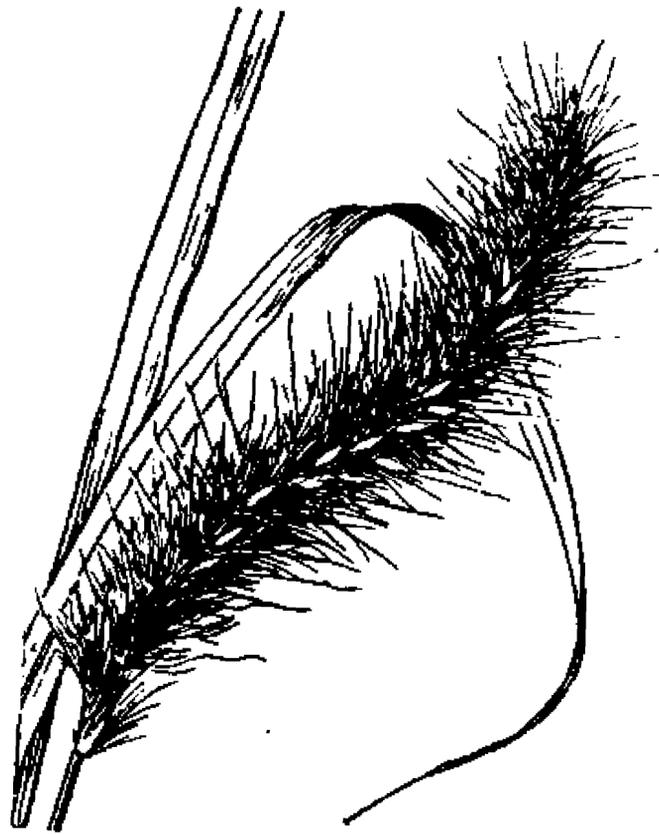


FIG. 71.—*Pennisetum complanatum*. From Türckheim 3835, Guatemala.

## DISTRIBUTION.

Open, rather dry slopes and savannas from near sea level to 1,500 meters altitude from southern Mexico to Panama.

VERACRUZ: Orizaba, Bourgeau 3139; Hitchcock 6356; Mohr in 1857; Müller 2015, Smith 625. Papantla, Liebmann 344. Mirador, Schaffner 185.

GUATEMALA: Cobán, Türckheim 81, 445, 3835. Guatemala City, Hitchcock 9042, 9043, 9058; Popenoe 734. Eureka, Hitchcock 9077. Laguna de Ayarza, Heyde & Lux 3923. Salida de Izabel, Seler 2301. Antigua, Kellerman 5112. Lake Amatitlán, Kellerman 6248.

SALVADOR: Sonsonate, Hitchcock 8973. Izalco, Pittier 1901a. Volcano of San Salvador, Hitchcock 8943.

PANAMA: El Boquete, Hitchcock 8250.

10. *Pennisetum domingense* (Spreng.) Spreng.

*Gymnothrix domingensis* Spreng. in Schult. Mant. 2: 284. 1824. "In S. Domingo. Bertero." The type has not been examined. The description, especially that of the minute involute blades, leaves no doubt of the identity of the species.

*Pennisetum domingense* Spreng. Syst. Veg. 1: 302. 1825. "Hispaniol" [Santo Domingo]. The brief description is doubtless drawn from the same Bertero collection, though *Gymnothrix domingensis* is not mentioned. *Cenchrus parviflorus* Poir. is erroneously given as a synonym. That name, as shown by Hitchcock,<sup>43</sup> is a synonym of *Chaetochloa geniculata* (Lam.) Millsp. & Chase.

## DESCRIPTION.

Plants glabrous, perennial; culms terete, solid, slender, rigid, glaucous, glabrous, as much as 7 meters tall, branching, the branches borne singly or in fascicles of 2 to 4, about equaling the main culm, stiffly spreading at an angle of about 30 degrees; nodes mostly swollen; sheaths 3 to 5 cm. long, much shorter than the elongate



FIG. 72.—*Pennisetum domingense*.  
From Türckheim 3669, Santo Domingo.

internodes, those subtending the fascicles loose and flat; ligule lacerate-ciliate, about 0.5 mm. long; blades 0.5 to 4 cm. long, 1 to 2 mm. wide, involute, divergent, firm, falling from the sheaths in age; panicles 3 to 5 cm. long, terminal only, erect, loosely flowered, the slender axis angled, scabrous; fascicles on minute pubescent pedicels, ascending or spreading, the scabrous bristles slender, flexuous, unequal, most of them 4 to 10 mm. long, the innermost less slender and 15 to 20 mm. long; spikelet 4.2 to 4.5 mm. long, about 1.4 mm. wide, obscurely strigose; first glume about one-third the length of the spikelet, faintly 3 to 5-nerved, erose; second glume two-thirds as long as the spikelet, 5-nerved, acute; sterile lemma nearly equaling the fertile lemma, 5-nerved, sulcate down the middle, abruptly and minutely mucronate, the palea equaling the lemma and inclosing a well-developed staminate flower; fruit brownish, 4 to 4.2 mm. long, about 1 mm. wide, acuminate, the lemma mucronate.

The above description is drawn from a single incomplete specimen, Türckheim's no. 3669. The following note is given by Türckheim on the specimen in the herbarium of the Berlin Botanic Garden [translated]: "Near Maniel de Ocoa, 300 meters altitude; dry ground among shrubs. Only one plant, 7 meters high. October, 1910." The species is apparently very rare.

## DISTRIBUTION.

On dry shrubby hillsides, Santo Domingo and eastern Cuba.  
CUBA: Eastern Cuba, Wright 1547.  
SANTO DOMINGO: Maniel de Ocoa, Türckheim 3669.

11. *Pennisetum durum* Beal.

*Pennisetum durum* Beal, Grasses N. Amer. 2: 163. 1896. "*P. crinitum* Scribn. ined \* \* \* Mexico, Pringle 489, 817." Dr. Beal's work was based on the collections in the herbarium of the Michigan Agricultural College. In this herbarium are two specimens of "*Pennisetum crinitum* Scribn." which are marked "*durum* Beal" in Beal's handwriting. These are Pringle's nos. 498 and 817, both from the state of

<sup>43</sup>Contr. U. S. Nat. Herb. 22: 168. 1920.

Chihuahua. Since no. 498 is erroneously cited as 489, the second specimen cited, Pringle's no. 817, is taken as the type. This is a single complete culm 1.5 meters tall.

*Pennisetum crinitum* Scribn.; Beal, Grasses N. Amer. 2: 163. 1896. Not *Pennisetum crinitum* Spreng. 1825. A herbarium name given as synonym of *P. durum*.

*Pennisetum pringlei* Leake, Zeitschr. Naturw. 79: 33. 1907. "Mexiko." The detailed description identifies the species. No specimen is cited, but from the specific name it is to be supposed that the description was drawn from one of Pringle's three collections of this species, his numbers 498, 817, or 4962.

## DESCRIPTION.

Plants perennial; culms few to several from a hard knotted crown, erect, mostly rather robust and rigid, 1.2 to 2 meters tall, usually glaucous, strigose or scabrous on the nodes and just below them, otherwise glabrous, slightly compressed, simple or rarely with a few leafy branches from the upper nodes; sheaths loose, mostly much shorter than the internodes, pubescent on the margin toward the summit and usually on the collar, otherwise glabrous or rarely scaberulous, the scarious margin (especially in the large lower leaves) sometimes produced into an erect auricle at the summit; ligule a ring of stiff hairs 1.5 to 2 mm. long; blades ascending or spreading, mostly rather firm, scabrous and sparsely pilose on both surfaces, or smooth or glabrous beneath, rarely also on the upper surface, 15 to 60 cm. long, 5 to 17 mm. wide, narrowed to the base (often in the lower leaves almost petiole-like) and tapering into a long involute-setaceous scabrous tip; panicles terminal and on slender naked peduncles exerted from the upper 2 to 4 sheaths, 1 to 4 peduncles from a sheath, the panicles nodding, 3 to 10 cm. (rarely 11 to 12 cm.) long, mostly 8 to 10 mm. thick, usually pale, the axis very slender, angled and scabrous; fascicles sessile, ascending; bristles rather scant, unequal, most of them shorter than the spikelet, the innermost longer, sometimes twice the length of the spikelet; spikelet solitary, sessile, 6 to 7 mm. long, about 1.5 mm. wide, acuminate, glabrous; glumes 1 to 3-nerved, acutish, the first about one-third and the second half the length of the spikelet; sterile lemma equaling the fruit or slightly shorter, 5-nerved, acute, its palea obsolete; fruit subindurate, acuminate.



FIG. 73. — *Pennisetum durum*.  
From type collection.

## DISTRIBUTION.

On dry rocky slopes in the highlands of Mexico; apparently rare.

CHIHUAHUA: Santa Eulalia Mountains, *Pringle* 498. Potrero Mountains, *Pringle* 817.

OAXACA: Sierra de San Felipe, *Pringle* 4962; *Conzatti & González* 491.

12. *Pennisetum distachyum* (Fourn.) Rupr.

*Pennisetum distachyum* Rupr. Bull. Acad. Sci. Brux. 9<sup>2</sup>: 242. 1842. "(Sectio Gymnothrix. Beauv.) (Coll. H. Gal[eotti]. no. 5680.) [Perennial].—Cette espèce remarquable et qui atteint la taille élevée de 15 à 16 pieds, croît par grosses touffes, comme les Bambusae, dans les ravins sombres et humides de la Barranca de San Martin, près de Zacuapan (État de Vera-Cruz), à 1,500 pieds de hauteur absolue." No further description is given. The name is given by Fournier as a synonym of *Gymnothrix distachyo* Fourn.

*Gymnothrix distachya* Fourn. Mex. Pl. 2: 48. 1886. "*Pennisetum distachyum* Rupr. in *Bull. Acad. roy. Brux.* ix, n. 8. (nomen)." Fournier cites four specimens, among them that to which Ruprecht gave the name, Galeotti's no. 5680. This specimen, which, since Ruprecht's name is used, must be taken as the type, has not been examined. One of the other specimens cited, Botteri's no. 1214, is represented in the National Herbarium by three specimens, one being the scant-bristled, greenish-panicked form (to which the name *P. distachyum* is here applied) and two being the many bristled, tawny panicked form described below as *P. prolificum*. Botteri's numbers are known to be badly mixed. Little reliance can be placed on citations of



FIG. 74.—*Pennisetum distachyum*.  
From Botteri 96, Mexico.

his specimens. Fournier's description is unsatisfactory, being mostly a comparison with "*G. tristachya* H. B. K.," which he thinks is but 3 to 4 feet tall, and under which, as shown by the specimens cited, he confused two species, *P. distachyum* and the form with longer purplish bristles and spikelets with staminate lower floret which he described as *Gymnothrix bambusiformis*. But the description of the bristles as not numerous and but little exceeding the spikelet points to the scant-bristled form heretofore called *P. tristachyum* (H. B. K.) Spreng.<sup>44</sup> by American authors.

#### DESCRIPTION.

Plants perennial; culms 1 to 4 meters tall; robust, glabrous or scabrous below the nodes, mostly solitary, erect or ascending from a decumbent base, often rooting at the geniculate lower nodes, branching from the middle and upper nodes, the primary branches ascending, the secondary and ultimate branchlets spreading or nodding, with 1 to 4 slender-peduncled drooping panicles from each sheath, the whole forming a top-heavy leafy compound inflorescence; nodes appressed-hirsute; sheaths loose, mostly shorter than the internodes, hirsute along the margin and at the summit or glabrate; ligule stiff, lacerate-ciliate, 2 to 3 mm. long; blades flat, mostly spreading, appressed-hirsute on both surfaces or glabrate beneath and sometimes nearly so above, those of the main culm 25 to 45 cm. long, 1.5 to 3.5 cm. wide, narrowed or attenuate at base, the attenuation sometimes elongate, the apex acuminate, but not setaceous-tipped, those of the branches smaller, lanceolate, rounded or slightly narrowed at base; panicles numerous, dull green, terminal and axillary, the slender flexuous scabrous peduncles unequal, the longest often as much as 15 to 20 cm. long, one of the cluster of panicles usually partly included, the panicles rather densely flowered, 3 to 8 cm. long, rarely 10 cm. long, about 1 cm. wide, excluding the longest bristles, usually tapering to the apex, the longer ones flexuous, the axis slender, angled,

<sup>44</sup> This species based on *Gymnothrix tristachya* H. B. K. (Nov. Gen. & Sp. 1: 113. 1816), described from Ecuador, has less freely branching culms, longer and narrower blades, longer panicles, longer bristles, and larger spikelets. The locality cited with the original description is "prope Puenbo \* \* \* regni Quitensis." Mr. Gagnepain, of the Paris Herbarium, states that the Puenbo specimen is very poor, but that a specimen from Quito, a panicle and part of a branch of which were kindly sent to the National Herbarium, agrees perfectly with the type. Specimens from Ecuador and Peru agree exactly with this and with the original description and the illustration published later (H. B. K. Nov. Gen. & Sp. 7: pl. 679. 1825). Other specimens commonly referred to *P. tristachyum* belong to various allied species.

scabrous; fascicles on minute pubescent peduncles, ascending; bristles slender, scant (mostly less than 20), unequal, most of them shorter than the spikelet or but little exceeding it, the innermost about twice as long as the spikelet; spikelets 4.5 to 5.5 mm. long, 1 to 1.2 mm. wide, acuminate; glumes unequal, obscurely ciliolate, the first minute, 1-nerved, acute or obtuse, the second about one-third to nearly half the length of the spikelet, 3-nerved, acute or subacute; sterile lemma slightly exceeding the fertile lemma, 5-nerved, depressed down the middle, scabrous, especially toward the summit, acuminate, the palea wanting; fruit acuminate, but little indurate, the lemma 5-nerved and scabrous toward the summit, the margins thin and flat.

This species is very closely related to *Pennisetum latifolium* Spreng. of the Atlantic slope of South America from Brazil to Uruguay. That, like *P. distachyum*, has been referred to *P. tristachyum*. The illustration given by Doell.<sup>46</sup> as *Gymnothrix tristachya* H. B. K. represents *P. latifolium*. In that species, described from Montevideo, the blades are on the average longer for their width than in *P. distachyum*, the panicles are mostly longer and yellowish, and the bristles longer, the innermost one three to four times the length of the spikelet.

## DISTRIBUTION.

In moist ground, in ravines and along stream borders and irrigation ditches, in the uplands from southern Mexico to Costa Rica.

VERACRUZ: Zacuapan, *Purpus* 2894. Mirador, *Liebmann* 339. Orizaba, *Botteri* 96, 631, 1209, 1214 in part; *Bourgeau* 2543; *Müller* 2066; *Seaton* 291. Córdoba, *Bourgeau* 1664.

OAXACA: Cuicatlán, *Pringle* 5558, 5559.

GUATEMALA: Baja Verapaz. *Türkheim* 3880.

COSTA RICA: San Francisco de Guadalupe, *Jiménez* 2; *Tonduz* 8020, 14064. San José, *Hitchcock* 8448. San Ramón, *Tonduz* 17910.

13. *Pennisetum prolificum* Chase, sp. nov.

Plants perennial; culms 2 to 4 meters tall (probably taller, the base not seen), very robust, glabrous, branching from the upper nodes, the branches often in fascicles of 2 to several, relatively slender, repeatedly fasciculately branching, the ultimate branchlets very slender, nodding, their nodes often strongly geniculate, the very numerous panicles 2 to 5 together on very slender, flexuous, usually glabrous peduncles, mostly 2 to 10 cm. long, the terminal panicle often solitary, the whole system of branches forming a great drooping leafy compound tawny inflorescence often 1 meter or more long and probably nearly as wide; nodes glabrous or strigose; sheaths loose, glabrous or ciliate on the margin above, sometimes with a few long soft hairs at the summit; ligule stiff, lacerate-ciliate, about 2 mm. long; blades flat, mostly spreading, 15 to 50 cm. long, 2 to 4 cm. wide (on the average a little shorter and broader than those of *P. distachyum*), narrowed but not long-attenuate at base, glabrous on both surfaces or slightly scabrous above, those of the branches progressively smaller, the ultimate ones much more reduced than those of *P. distachyum*; peduncles unequal, one panicle of a fascicle partly included; panicles tawny, 3 to 5 cm. long, about 1 cm. wide,



FIG. 75.—*Pennisetum prolificum*. From type specimen.

<sup>46</sup> In Mart. Fl. Bras. 2<sup>a</sup>: pl. 41. 1877.

denser than in *P. distachyum*, slightly tapering or obtuse at the apex, the slender angled axis minutely scabrous; fascicles nearly sessile, somewhat spreading; bristles slender, numerous, more spreading than in *P. distachyum*, most of them exceeding the spikelet, the innermost not conspicuously longer than the rest; spikelet similar to that of *P. distachyum*, but minutely scabrous only or glabrous, the glumes thinner, more obtuse, the first usually nerveless, often erose; sterile palea wanting; fruit scarcely indurate (thinner than in *P. distachyum*).

Type in the U. S. National Herbarium, no. 250836, collected on rocky slopes, barranca of Metlac, altitude about 900 meters. State of Veracruz, Mexico, January 29, 1895, by C. G. Pringle (no. 6075; distributed as *Pennisetum bambusiforme* Hemsl.)

None of the specimens seen shows the base of the plant. This species has been confused with *P. bambusiforme*, from which it differs in its smooth or nearly smooth blades, denser inflorescence, much shorter and more densely flowered, tawny panicles, somewhat shorter bristles, less unequal in length, and in the absence of the sterile palea.

#### DISTRIBUTION.

Rocky slopes, uplands of southern Mexico.

VERACRUZ: Orizaba, *Botteri* 1214; *Mohr & Botteri* in 1856. Barranca of Metlac, *Pringle* 6075.

GUERRERO: Sierra Madre, *Langlassé* 849.

OAXACA: Plunia, *Nelson* 2484.

#### 14. *Pennisetum bambusiforme* (Fourn.) Hemsl.

*Gymnothrix bambusiformis* Fourn. Mex. Pl. 2: 48. 1886. "Prope *Mirador* (SCHAFFNER. n. 338)" is the only specimen cited. The name was earlier listed without description by Hemsley.<sup>46</sup> Schaffner's no. 338 has not been examined. It seems possible that "Schaffn." may be an error. Liebmann's no. 338 is from *Mirador*, and the specimens of this collection distributed from the Copenhagen Herbarium are labeled "*Gymnothrix bambusaeformis* Fourn. determ. Fournier," and agree perfectly with Fournier's description. Fournier, however, cites Liebmann's no. 338 under "*G. tristachya* H. B. K." As stated above (under *Pennisetum distachyum*), Fournier's idea of that species was confused. His description of *G. bambusiformis* is fairly detailed. The characters that point most certainly to the identification here made of *G. bambusiformis* are [translated]: "Bristles unequal, of which one is constantly longer, most of them twice the length of the spikelets," and "neuter floret 2-paleate." In the species described above as *Pennisetum prolificum*, which has been confused with *P. bambusiforme*, the bristles are not very unequal, the innermost one scarcely noticeably longer (most of them are about once and a half the length of the spikelet), and the lower floret is empty.

*Pennisetum bambusiforme* Hemsl. Biol. Centr. Amer. Bot. 3: 507. 1885, nom. nud.; Ind. Kew. 2: 458. 1894. Based on *Gymnothrix bambusiformis* Fourn.

*Pennisetum tristachyon* var. *bambusiforme* Leake, Zeitschr. Naturw. 79: 33. 1907. Based on *Gymnothrix bambusiformis* Fourn.

*Pennisetum tristachyum* var. *galeottianum* Leake, Zeitschr. Naturw. 79: 33. 1907. "Mexiko." Leake places the various allies of *P. tristachyum* under that species as varieties. His var. *bambusiforme* is based on *Gymnothrix bambusiformis*, hence the name is a synonym of *P. bambusiforme*; but it is uncertain to which of the forms Leake applies the name. He includes *Gymnothrix distachya* Fourn. as a synonym, but in his brief diagnosis says "Culmi nodi glabri." In *P. distachyum* the nodes are appressed-hirsute; in *P. bambusiforme* and *P. prolificum* they are glabrous or strigose. The diagnosis of var. *galeottianum* is: "Culmi nodi pilosi: spiculae 4-4.5 mm. longae." In Galeotti's no. 5871 (*P. bambusiforme*) the lower nodes present are strigose but the

<sup>46</sup> Biol. Centr. Amer. Bot. 3: 507. 1885.

spikelets are 5 mm. or more long. A specimen of that collection in the herbarium at Vienna is labeled "*Pennisetum tristachyum* var. *Galeottianum* Leeke, n. var." and is probably the type. Galeotti's no 5871 differs from other specimens of *P. bambusiforme* in that the sterile floret is empty in about half the spikelets examined. Otherwise the specimen has the characters of this species.

## DESCRIPTION.

Plants perennial, the culms very robust, probably as much as 6 meters tall (the base not seen), glabrous, branching from the upper nodes, the branches often in fascicles of 2 or 3 (on the average less numerous than in *P. prolificum*, slender, repeatedly branching, the whole forming a drooping compound leafy inflorescence, looser and less massive than in *P. prolificum*; nodes glabrous, rarely appressed-pubescent; sheaths loose, ciliate on the margin and with an erect tuft of white hairs at the summit (old sheaths commonly glabrescent), the sheaths of the inflorescence on the average longer than in *P. prolificum* and somewhat inflated; ligule lacerate-ciliate, about 2 mm. long; blades flat, rather firmer than in the two preceding species, ascending or spreading, those of the main culm 20 to 35 cm. long, 2 to 3.5 cm. wide, narrowed, sometimes somewhat attenuate at base, scabrous or appressed-pubescent on the upper surface, softly appressed-pubescent beneath, sometimes glabrescent, the blades of the ultimate branchlets narrow, much reduced; peduncles slender, scaberulous, flexuous, unequal, one panicle of the fascicle partly included; panicles purplish tawny, 5 to 12 cm. long (rarely longer), about 1 cm. wide, excluding the longest bristles, loose, flexuous, tapering at the apex, the slender angled axis scabrous or hispidulous; fascicles on minute pedicels, not crowded, ascending; bristles slender, flexuous, numerous, very unequal, most of them about twice the length of the spikelet, the innermost sometimes as much as 2 cm. long; spikelets 5 to 6 mm. long, 1 to 1.2 mm. wide, scabrous; glumes unequal, the first minute, usually nerveless, obtuse or erose, the second one-fourth to one-third the length of the spikelet, 1 to 3-nerved, acute or erose; sterile lemma exceeding the fertile lemma, 5 to 7-nerved, attenuate into a slender flexuous tip, inclosing a well-developed palea and usually a staminate flower; fruit 4.5 to 5 mm. long, the lemma scabrous toward the acuminate apex, but slightly indurate.



FIG. 76.—*Pennisetum bambusiforme*. From Jiménez 990, Costa Rica.

## DISTRIBUTION.

On rocky slopes and cliffs, between 900 and 2,800 meters altitude, southern Mexico to Peru.

VERACRUZ: Mirador, Liebmann 338. Petlapa,<sup>47</sup> Liebmann 340.

OAXACA: Comaltepec, Galeotti 5871.

<sup>47</sup> We are unable to locate this station, but most of Liebmann's collections were made in Veracruz. It may be in Oaxaca.

GUATEMALA: Pansamalá, *J. D. Smith* 1853; *Türckheim* 34. Cobán, *Türckheim* II. 2136, II. 2183. El Palmar, *Kellerman* 6262. Volcán Atitlán, *Kellerman* 5781. Volcán del Fuego, *Seler* 2422.

COSTA RICA: Rancho Redondo (Goicoechea), *Jiménez* 990. "Cabeceras del Bkis," *Pittier* 10573.

COLOMBIA: Bogotá, *Apollinaire & Arthur* 12.

PERU: Santa Ana, *Cook & Gilbert* 1632.

#### EXCLUDED SPECIES.

The following names at some time included in *Pennisetum* comprise only those based on species found in America:

*Pennisetum corrugatum* (Ell.) Nutt. = *Chaetochloa corrugata* (Ell.) Scribn.

*Pennisetum crugalli* (L.) Baumg. = *Echinochloa crugalli* (L.) Beauv.

*Pennisetum geniculatum* (Lam.) Jacq. = *Chaetochloa geniculata* (Lam.) Millsp. & Chase.

*Pennisetum germanicum* (Beauv.) Baumg. = *Chaetochloa italica germanica* (Mill.) Scribn.

*Pennisetum italicum* (L.) R. Br. = *Chaetochloa italica* (L.) Scribn.

*Pennisetum laevigatum* (Muhl.) Nutt. = *Chaetochloa geniculata* (Lam.) Millsp. & Chase

*Pennisetum montanum* (Griseb.) Hack. = *Hymenachne montana* Griseb.

*Pennisetum myosuroides* (H. B. K.) Spreng. = *Cenchrus myosuroides* H. B. K.

*Pennisetum pungens* Nutt. = *Cenchrus myosuroides* H. B. K.

*Pennisetum scandens* (Schrad.) Jacq. = *Chaetochloa scandens* (Schrad.) Scribn.

*Pennisetum verticillatum* (L.) R. Br. = *Chaetochloa verticillata* (L.) Scribn.

*Pennisetum viride* (L.) R. Br. = *Chaetochloa viridis* (L.) Scribn.