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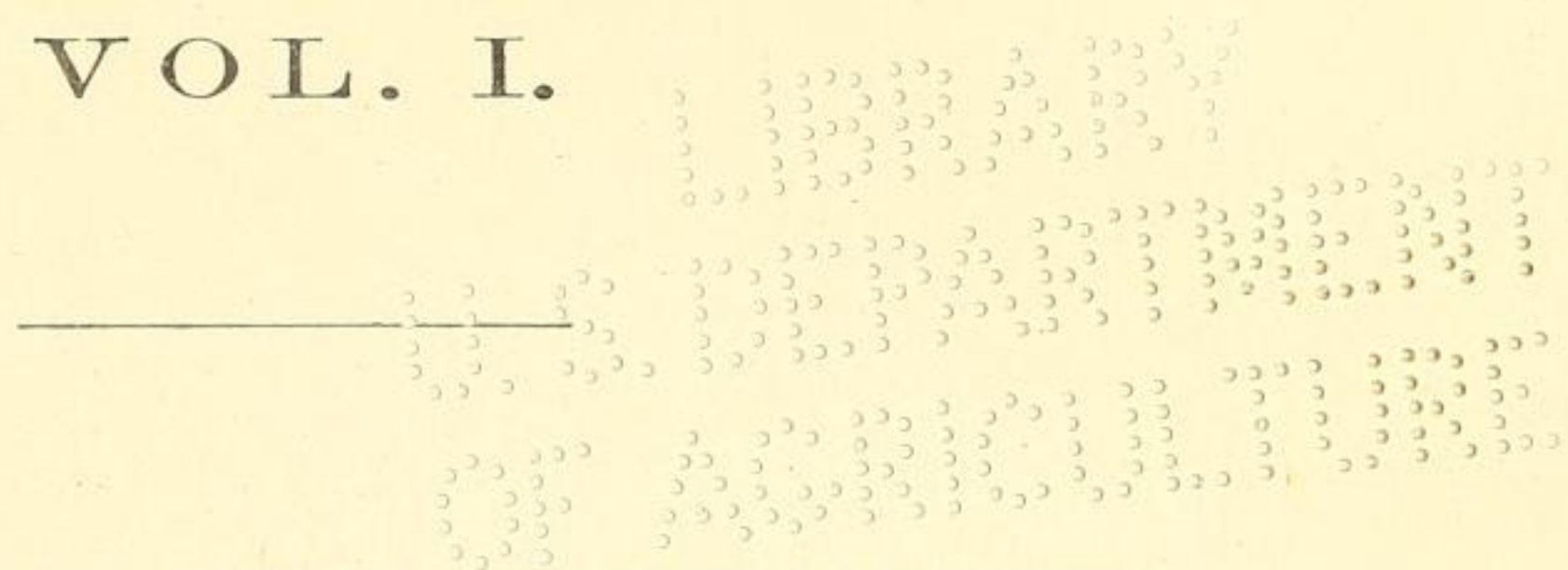
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U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF BOTANY.

ILLUSTRATIONS OF NORTH AMERICAN GRASSES.

VOL. I.



GRASSES OF THE SOUTHWEST.

PLATES AND DESCRIPTIONS

OF THE

GRASSES OF THE DESERT REGION OF WESTERN TEXAS, NEW MEXICO,
ARIZONA, AND SOUTHERN CALIFORNIA.

By DR. GEO. VASEY,
BOTANIST, DEPARTMENT OF AGRICULTURE.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1891.

THE
MUSEUM
OF
THE
CITY OF
NEW YORK

LETTER OF TRANSMITTAL.

WASHINGTON, *September*, 1891.

SIR: I have the honor of presenting for publication the first volume of the proposed work called "Illustrations of North American Grasses," which have been issued as Bulletin No. 12, parts I and II; and it is proposed to follow this with a second volume of plates and descriptions of the "Grasses of the Pacific Coast."

Respectfully,

GEO. VASEY,
Botanist.

Hon. J. M. RUSK,
Secretary of Agriculture.

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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF BOTANY.

BULLETIN No. 12.

GRASSES OF THE SOUTHWEST.

PLATES AND DESCRIPTIONS

OF THE

GRASSES OF THE DESERT REGION OF WESTERN TEXAS, NEW MEXICO,
ARIZONA, AND SOUTHERN CALIFORNIA.

Part I.

By DR. GEO. VASEY,
BOTANIST, DEPARTMENT OF AGRICULTURE.

ISSUED OCTOBER 13, 1890.

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE
1890.

NOTE.

This Bulletin is to constitute the first half of the first volume of a work entitled "Illustrations of North American Grasses." The work when completed will consist of two volumes, the first entitled "Grasses of the Southwest," the second, "Grasses of the Pacific Slope." Proper title-pages and indexes will be published with the last part of each volume.

Compliments of
J M Rusk
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

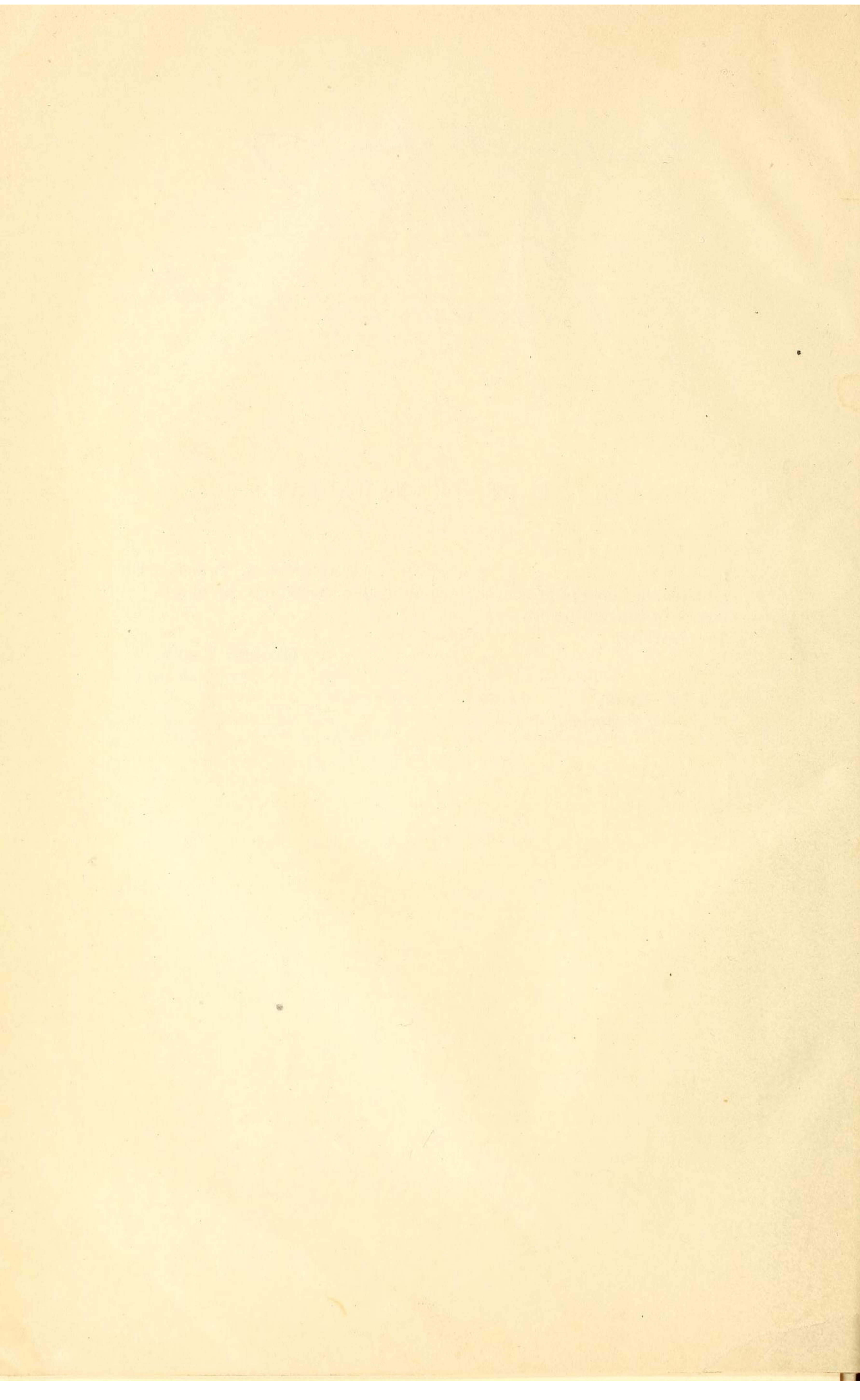
WASHINGTON, *June 5, 1890.*

SIR: I have the honor of presenting for publication the manuscript of a Bulletin on the Grasses of the Southwest.

Respectfully,

GEORGE VASEY,
Botanist.

Hon. J. M. RUSK,
Secretary of Agriculture.



INTRODUCTION.

The region of country immediately adjoining the northern boundary of Mexico, including the western part of Texas, and the greater part of New Mexico, Arizona, and southern California, is one of remarkable heat and aridity. It is mainly a region of elevated plains, called mesas, intersected by mountain ranges which occasionally run into high peaks, and is drained by comparatively few streams, which, on account of the limited rain-fall, cease to flow during a good part of the year, or convey only the waters obtained from distant portions of the country.

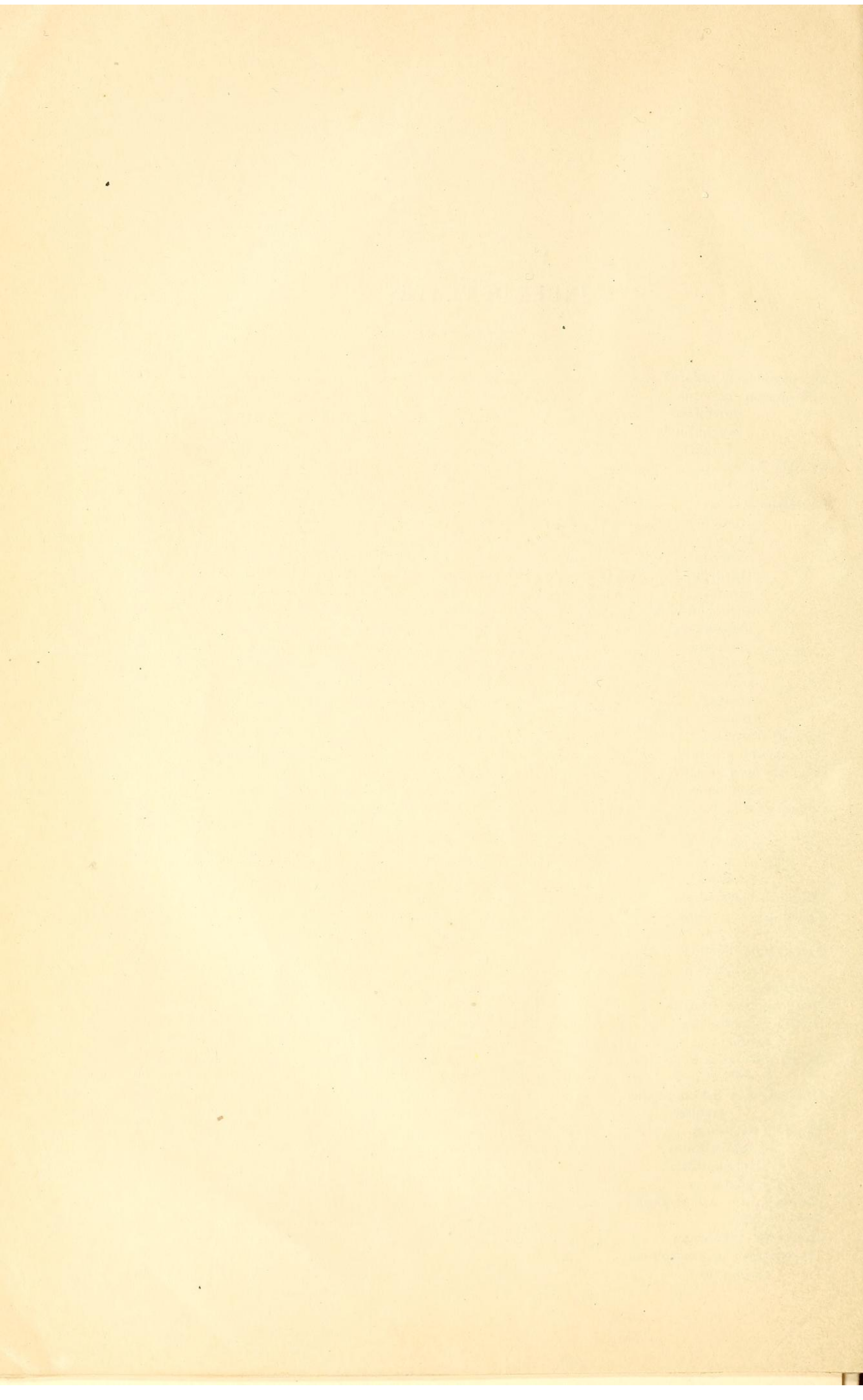
Most of the region lies north of the thirty-second parallel of latitude, and in the western part reaches into Utah and Nevada. It is with great propriety called the desert belt. The country northward, and east of the Rocky Mountains, as far as the one hundredth meridian, is an elevated arid plain, but with more abundant grasses, although rarely forming a continuous and connected sod.

In the desert belt, however, the grasses become scanty, not in variety of species, but in distribution, some of them being short-lived, springing up suddenly after the summer rains and rapidly maturing; others perennial, growing in bunches, and having deeply penetrating roots which enable them to endure the long droughts of the country. Nowhere do the native grasses form a continuous sod, but grow in scattered bunches in connection with the low bushes which prevail on the mesas or among the chaparral.

The country embraced in this desert belt is an extension northward of the great plateau of northern Mexico, as is shown in the similar character of its vegetation. The grasses are largely the same, or of the same genera. But the grasses, like the rest of the vegetation, are peculiar to the region. Here one never sees the common grasses of the Eastern States. The vegetation is as different from that of the Eastern States as is that of the northern portion of the Sahara. Hence arises the utility of bringing to the notice of the public, and especially of the residents of this region, the information contained in this work. It is not a manual or description of all the grasses of the region, but it furnishes illustrations and descriptions of some of the more interesting and some of the commoner grasses of the country. Many of them were observed and specimens collected by the naturalists of the Mexican Boundary Survey, and by those of the Pacific Railroad Survey, but few or none of these have heretofore been illustrated or fully described. True, the descriptions here given are mostly in technical language, but accompanied by the illustrations they afford the best possible means of recognition. Probably the most important agricultural question before the people of this region is how to increase the production of grasses and forage plants on the arid lands. It is the opinion of many that this can be done by bringing under cultivation some of the native species. Experiments are about to be undertaken in this direction by the Agricultural Experiment Stations and by individuals. The first step in such an enterprise is a knowledge of or an acquaintance with the native species. Nothing can be better adapted to this object than the work here undertaken, and in this way the knowledge of the scientist can be made helpful to the practical economist. In this first part of the work fifty plates of grasses are given. A second part of an equal number of plates is now in preparation, after which it is proposed to publish an analytical synopsis of all the grasses of the desert region. The drawings of the grasses have been made chiefly by Mr. William R. Scholl, and in the description of the species I wish to acknowledge important aid from Mr. Frederick V. Coville, Assistant Botanist.

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GRASSES OF THE SOUTHWEST.

PART I.

No. 1.

ERIOCHLOA SERICEA Munro.

Roots long, unbranched, but giving off a few fibrillæ.

Culms tufted, simple, $\frac{1}{2}$ to 3 feet high, stiffly erect, slender, striate, short-villous at the nodes and sparingly minutely hairy where not sheathed.

Radical *leaves* numerous, 6 to 12 inches long, erect, flat or involute, striate, minutely pubescent or glabrous, $\frac{1}{2}$ to 1 line broad, the sheaths free. Cauline leaves 3 or 4; sheaths contiguous or nearly so, striate, minutely pubescent or glabrous, villous at the apex; ligule a row of dense straight hairs; blades like those of the root-leaves, spreading, 3 to 9 inches long, uppermost often shorter.

Inflorescence a racemose compound spike, the peduncle usually exerted from the uppermost sheath; axis minutely pubescent; spikes 4 to 7, sessile or the lower short-peduncled, erect, contiguous, or nearly so, $\frac{3}{4}$ to $1\frac{1}{2}$ inches long.

Spikelets elliptical-oblong, acute, depressed, $1\frac{1}{2}$ to 2 lines long, imbricated (one-half their length) in 2 rows along the outer side of the flat rachis of the spike, each sessile on an annular swelling of the apex of a short, long-villous pedicel (about as broad as long), hairs equaling the spikelet.

Glumes 3; outer 2 equal, membranaceous, inclosing the rest of the spikelet, ovate, oblong, acute, 5-nerved, villous without; flowering glume glabrous, thickened-coriaceous, minutely rugose, elliptical-oblong and acute, rounded on the back.

Flower single, hermaphrodite. Palet similar in texture to the flowering glume, 2-nerved, flat on the back. Stamens 3, the anthers two-thirds as long as the palet. Stigmas 2, fimbriate, purple, nearly one-half the length of the palet, on slender styles.

PLATE I; *a*, spikelet opened so as to show the glumes, palet, pistil, and stamens. In the figure the flowering glume is too much narrowed toward the apex, the palet is not represented as flat on the back, and the stigmas and anthers are too short.

This species seems to be principally confined to western Texas and New Mexico, extending northward into the Indian Territory. It affords a considerable quantity of foliage, is perennial, and should be tried with reference to its agricultural value.



No. 2.

PANICUM BULBOSUM H. B. K.

Rootstock creeping, slightly branching, the yearly growth short (commonly $\frac{1}{2}$ inch), base of the culm becoming enlarged into a corm $\frac{3}{8}$ to $\frac{3}{4}$ inch long, or sometimes nearly wanting. Roots simple, strong.

Culms erect, single or few together in a loose clump, slender or stout (sometimes $\frac{1}{4}$ inch thick), simple, glabrous, glaucous at the nodes.

Leaves with striate blades 1 to 4 lines broad. Radical few, commonly 1 to 2 feet long; sheath elongated, loose, glabrous or the margins sometimes ciliate; blade glabrous or very sparingly hirsute at the base, slender-acuminate at the apex; ligule short, fimbriate. Sheaths of the stem 2 to 4, not contiguous, sheathing, glabrous; blades as in the radical leaves.

Inflorescence an exsert-pedunculate, usually open panicle 9 to 20 inches long; main axis glabrous or occasionally scabrous, pubescent at the forks; spikelets borne singly on short, scabrous pedicels, or sometimes sessile.

Spikelets $1\frac{1}{2}$ to 2 lines long, nearly terete, elliptical-lanceolate to oblong, bluntly acute.

Glumes 4, glabrous, membranaceous, purple or pale green; 2 lower empty; first broadly ovate, acute, 3- to 7-nerved, frequently unsymmetrically, one-third to one-half the length of the spikelet; second as long as the spikelet, oblong, bluntly acute, 5- to 7-nerved.

Flowers 2. Lower staminate; glume like the second empty glume; palet hyaline, thin-membranaceous, 2-nerved. Upper flower hermaphrodite; glume coriaceous, minutely corrugated, obsoletely few-nerved, acute; palet 2-nerved, similar in texture to the glume; stamens 3; styles long.

PLATE II; *a*, three spikelets enlarged; *b*, spikelet opened to show the parts; *c*, portion of the base of the culm, and the corm of the preceding year. On the left, in *b*, in order from below, are the lower empty glume, first flowering glume, and palet of the staminate flower, on the right the second empty glume, the second flowering glume, and to the left of the stamens and pistil the palet of the fertile flower.

This grass should be one of great agricultural value. Its bulbous rootstocks contain a store of moisture which enables it to endure a protracted drought, and as it grows of large size it would produce a great amount of fodder.



PANICUM BULBOSUM, H. B. K.

PANICUM CILIATISSIMUM Buckley.

Rootstock and roots slender.

Culms varying from erect at the ends of the rootstock to procumbent and even creeping, glabrous, except a ring of reflexed hairs at the nodes; erect stems from a few inches to 2 feet high, commonly with short sterile branches, slender, the internodes sometimes 3 inches long; creeping stems long, thicker, profusely branching, with shorter internodes, rooting at the nodes.

Leaves with long-ciliate, usually sparingly hirsute sheaths, and flat, smooth, or sometimes slightly hirsute blades tapering from base to apex. Sheaths of the erect stems frequently distant, those of the creeping stems shorter but mostly contiguous. Blades of the creeping stems seldom exceeding $1\frac{1}{2}$ inches, those of the erect plants usually longer.

Inflorescence a small narrow panicle $2\frac{1}{2}$ inches long or reduced to a few spikelets, terminating the culm, exsert-stipitate in the erect plant (in creeping plants terminating short axillary branches as well, and partly sheathed, all intermediate stages being found), bearing the spikelets terminal or laterally sessile on the flat minutely pubescent branches of the panicle.

Spikelets $1\frac{1}{2}$ to 2 lines long, oblong, acuminate, slightly obcompressed.

Glumes 4; 3 lower membranaceous; first lanceolate, acuminate, glabrous, 3- to 5-nerved, nearly as long as the spikelet; second ovate, short-acuminate, pubescent, sometimes minutely villous-ciliate near the margins, many (about 11-)nerved; third similar to the last, but glabrous down the middle, most of the nerves of that area obsolete; fourth (flowering) glume coriaceous, indistinctly few-nerved, minutely corrugated, bluntly acute.

Flowers 2. Lower reduced to a hyaline, 2-nerved, oblong palet subtended by the third glume; or sometimes with 3 stamens. Upper hermaphrodite; palet of the same texture as its glume, indistinctly 2-nerved; glume closely embracing the grain; stamens 3.

PLATE III; 1, erect stem; 2, creeping stem; a spikelet opened to show the parts.



PANICUM LACHNANTHUM Torrey.

Roots slender.

Culms closely tufted, with numerous short sterile branches from near the base, erect or ascending, 1 to 2½ feet high, slender, glabrous.

Leaves with flat blades 1 to 2 lines wide; sheaths from smooth to divaricately villous, those of the lower part of the stem long and far exceeding the short internodes, those (sheaths) of the rootstock densely soft villous; ligule about 1½ lines long, broadly obtuse, apical margin fimbriate; blade from glabrous to minutely pubescent, commonly 2 to 4 inches long.

Inflorescence a panicle on a long slender peduncle. Panicle contracted, 4 to 9 inches long, composed of 7 to 9 erect or appressed sessile branches 1 inch or more long; spikelets closely racemose on the branches; pedicel flat; branches of the panicle triangular, both with green scabrous angles.

Spikelets narrowly to broadly lanceolate-acuminate, 1½ to 2 lines long, showing an inclination toward an arrangement in 2 rows along the raceme.

Glumes 4; 3 lower membranaceous, empty; first a minute, hyaline, obtuse scale from ½ line long to nearly obsolete; second narrowly lanceolate, acuminate, 3- to 5-nerved, densely long-villous on the back, hairs when the grain is mature, spreading in all directions as if from a point in the center of the spikelet; third similar to the last but broader and about 5-nerved, its middle portion glabrous, intramarginal hairs as in the second glume and similarly spreading; fourth (flowering) glabrous, thin, coriaceous, with thin membranaceous margins, indistinctly 3-nerved, minutely roughened in longitudinal lines, lanceolate, acuminate, when mature chestnut-brown.

Flower single, hermaphrodite. Palet similar in texture, shape, and color to the flowering glume, nerveless. Stamens 3; anthers ¼ line long, one-half as broad. Stigmas long, cylindrical.

Grain inclosed by the palet and its glume, oval, obcompressed, white, slightly exceeding ⅔ line long.

PLATE IV; *a*, spikelet opened to show its parts, on the left the second glume and flowering glume, on the right the third glume and palet. The first glume, which should stand on the right, is omitted; the inflexed membranaceous margins of the flowering glume and palet are not shown; and the ovary is represented as of the size of a mature grain with the anthers twice their real length.

This grass grows freely on stony hills, and probably is capable of resisting drought. It seems deserving of trial as an agricultural grass for the southwest.



PANICUM LACHNANTHUM, Torr.

SETARIA CAUDATA R. & S.

Plant annual.

Rootstock none. Roots slender.

Culms 2 to 2½ feet high, branching from the base, scabrous or nearly glabrous; nodes provided with a ring of silky appressed hairs; branches usually short and sterile.

Leaves of the stem 4 or 5; sheaths usually distant, glabrous, ciliate on the margins, villous at the apex; blade 1 to 3 lines broad, usually 5 to 9 inches long, flat, glabrous beneath, scabrous above; ligule about 1 line long, cut nearly to the base into silky hairs. Radical leaves like those of the stem.

Inflorescence a contracted spike-like panicle 3 to 4 lines broad (exclusive of the bristles), 3 to 6 inches long, on a moderately long exerted peduncle; branches of the panicle short (1 to 3 lines), spikelets sessile or nearly so, some of the pedicels sterile and prolonged into slender scabrous bristles 6 lines long or less. Spikelets ovate, acute, semi-terete, 1 to 1½ lines long.

Glumes 4; 2 lower empty, membranaceous, glabrous; first broadly ovate, acute, 3-nerved, one-half the length of spikelet; second broadly oval, obtuse or mucronate, 5-nerved, nearly as long as the spikelet, fitting closely to the flowering glume; third like the second but slightly longer, acute, and subtending a rudimentary lanceolate hyaline palet; fourth (flowering), when in position, narrowly ovate, acute, coriaceous, rounded and minutely rugose-roughened on the back, obscurely 5-nerved.

Flower hermaphrodite. Palet lanceolate when in position, coriaceous (the infolded margins membranaceous), flat on the back when mature, obscurely 2-nerved. Stamens 3. Stigmas 2, oblong.

PLATE V; *a*, spikelet with its accompanying bristle. The spikelet is opened to show its parts. The flowering glume is represented too short, and should be acute, while the back of the palet is not represented as flat.

This grass has much the habit of German millet, and with proper cultivation would probably produce an abundant crop.



No. 6.

CENCHRUS MYOSUROIDES H. B. K.

Culms erect or from an ascending base, usually simple, 2 to 4 feet high, stout, glabrous, glaucous.

Leaves of the stem 6 to 10; sheaths glabrous, nearly contiguous; blade glabrous to minutely strigose, flat or sometimes involute, 2 to 4 lines wide, commonly 5 to 12 inches long; ligule fimbriate to the base. Radical leaves early dying.

Inflorescence a short-pedunculate or partly sheathed, compact, erect spike 3 to 4 lines thick, 3 to 8 inches long, rachis minutely pubescent, spikelets borne singly.

Spikelets 2 to 2½ lines long surrounded at the base by a ring of many retrose barbed stiff bristles of different lengths, the longest equaling the spikelets; body lanceolate, acute, terete.

Glumes 4; first membranaceous, ovate, 1- to 3-nerved, acute, one-half the length of the spikelet; second membranaceous, ovate, 5- to 7-nerved, acute, equaling the spikelet; third like the second, but subtending a hyaline 2-nerved palet (this lanceolate when in position); fourth (flowering) like the second and third, but rather coriaceous, the nerves more obscure and seldom green.

Flower hermaphrodite. Palet similar in shape and texture to its glume, but 2-nerved. Stamens 3, anthers linear, about 1 line long. Stigmas 2, linear.

Grain ¾ line long, somewhat obcompressed, quadrangular, oblong, very obtuse, with an embryo three-fourths as long, when mature inclosed in the glumes and bristles, the whole falling off together.

PLATE VI; *a*, spikelet closed; *b*, spikelet opened, the bristles removed. On the right in *b* are the first glume, third glume and sterile palet, on the left the second glume, flowering glume, and its palet.

This grass will grow in very dry soil, and will produce a good crop of forage, but is somewhat objectionable on account of the prickly seed-envelopes.



CENCHRUS TRIBULOIDES L.

Plant annual. Roots slender.

Culms glabrous, a few inches to 3 feet high, usually branching from the base and procumbent, rooting at the lower nodes, or sometimes the shorter plants erect.

Leaves of the stem 3 to 10; sheaths glabrous, rarely ciliate on the margins above, usually loose, commonly contiguous; blade 6 inches long or less, 1 to 2 lines broad, flat or sometimes involute; ligule about $\frac{1}{2}$ line long, deeply densely fimbriate.

Inflorescence a short-pedunculate or partly sheathed spike of clusters, 4 inches long or reduced to a single cluster, the rachis nearly smooth. Clusters composed of 2 to 3 spikelets surrounded by an involucre. Involucre thick, coriaceous, cleft to the base on the side next the rachis or on both sides, inclosing the spikelets; the outer surface provided with numerous bristles and spines flattened below and retrorsely barbed, those toward the base of the involucre smaller, the larger $2\frac{1}{2}$ lines long.

Spikelets 2 to 3 in each involucre, 1 at least fully developed and with the following structure (the others rudimentary in various degrees).

Glumes 4; 3 lower membranaceous; first short, ovate, acute, 1- to 3-nerved, empty; second broadly lanceolate, 5-nerved, acute, nearly as long as the involucre, empty; third like the second, but subtending a flower; fourth (flowering) a little larger and similar in form to the second and third, but thin-coriaceous.

Flowers 2. Lower staminate, with a thin hyaline 2-nerved palet; stamens 3. Upper with a thin-coriaceous palet, hermaphrodite; ovary flattened, circular in outline; stamens 3, anthers $\frac{1}{2}$ line long, dehiscing much earlier than those of the staminate flower.

Grain inclosed in the spikelet, spikelet inclosed in the involucre, the whole disarticulating from the spike together.

PLATE VII; *a*, external view of the involucre; *b*, the same cut open to show the spikelets; *c*, a single fully developed spikelet opened to show the parts. On the left are the second glume, the fourth glume, and the hermaphrodite flower; on the right are the first glume, the third glume, and the staminate flower. The first glume should be inserted below the second, and is represented twice too long, as are the anthers of the hermaphrodite flower.

This species is too common in sandy grounds, where its spiny burs are an annoyance to men and beasts and an injury to the wool of sheep that graze near it.



STENOTAPHRUM AMERICANUM Schrank.

Rootstock apparently creeping. Roots fibrous-branched.

Culms creeping and rooting at the nodes, or procumbent, from 2 feet long to very short, simple or with a few main branches, glabrous, enlarged at the nodes, and there provided with a short sterile branch or fascicle of leaves.

Leaves of the stem several, pale green; sheaths glabrous, or slightly ciliate on the margin above, usually loose and not contiguous; blade 2 to 3 lines wide, from 8 inches long to very short, flat, thick (nerves obscure, midrib prominent beneath), glabrous, abruptly rounded at the apex, rarely acute; ligule minute, densely fimbriate.

Inflorescence a usually sheathed spike terminating the stem and main branches; rachis thickened and enlarged (reaching 3 lines in diameter and 4 inches in length); spikelets embedded singly sessile, or with 1 to 3 additional short-pedicellate ones, at each joint, arranged along 2 nearly opposite sides of the rachis but facing one way.

Spikelets lanceolate-ovate, $1\frac{1}{2}$ to $2\frac{1}{2}$ lines long.

Glumes 4; first membranaceous, hyaline, small, nerveless, and obtuse or sometimes one-half the length of the spikelet; second membranaceous, 7- to 11-nerved, ovate, acute, as long as the spikelet, empty; third similar in form, somewhat coriaceous, but 5-nerved, subtending a flower; fourth like the third, but more coriaceous, also subtending a flower.

Flowers 2. Lower staminate; stamens 3; palea coriaceous below, 2-nerved. Upper flower hermaphrodite; stamens 3; stigmas 2, cylindrical or club-shaped.

PLATE VIII; figure below at the right, joint of the rachis showing 2 spikelets, the lower sessile, the upper pedicelled; at the left, spikelet opened to show the parts. In the flower on the right, which is the hermaphrodite one, the stigmas should be twice as long and proportionally broader. The stamens have matured earlier and are not shown.

This grass grows in sandy land especially near the sea-coast. It has strong creeping roots, which render it capable of enduring great drought. It has been recommended in Florida as a very valuable pasture grass.



THURBERIA ARKANSANA Benth.

Plant annual.

Rootstock none. Roots very slender.

Culms erect, simple or branching from the base, slender, commonly 9 to 18 inches high, sometimes depauperate, glabrous.

Leaves of the stem 3 to 5; sheaths contiguous, glabrous or sparingly villous, the margin villous-ciliate; blade flat, 1 to 4 inches long, 1 to 2 lines broad, flaccid, scabrous, and usually sparingly minutely villous-pubescent; ligule about $\frac{1}{2}$ line long, the apex narrowly fringed.

Inflorescence a panicle at first partly sheathed, finally pedunculate, 3 to 6 inches long; branches slender, seldom exceeding 1 inch in length; spikelets borne singly on pedicels $1\frac{1}{2}$ lines long or shorter.

Spikelets linear, $1\frac{1}{2}$ to 2 lines long (exclusive of the awn), nearly terete, jointed to the pedicel below the glumes.

Glumes 3; first and second of equal length, similar, lanceolate, acute, green, nerveless or obsoletely 3-nerved, scabrous-pubescent without, apices slightly separated; third (flowering) not green except the 3 nerves, glabrous, rather thick, lanceolate, folded and compressed, awned on the back a little below the apex; apex cleft half-way to the origin of the awn; awn slender, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, little twisted, abruptly bent at the middle.

Flower single, hermaphrodite; rachilla prolonged above the flower (!) into a minute filiform rudiment about $\frac{1}{2}$ line long, naked or surmounted by a minute scale; palet very thin, hyaline, narrowly linear, 2-nerved; lodicules 2, about $\frac{1}{2}$ line long; stamens 3, anther oblong, about $\frac{1}{5}$ line long; stigmas cylindrical, on short distant styles.

Grain linear-oblong, remaining closed within the glumes, the spikelet disarticulating below them.

Plate IX; *a*, first (on the left) and second glumes; *b*, flowering glume and flower. The rudimentary prolongation of the rachilla shown in *b* is usually twice as long and is inserted at a point on the axis near the middle of the base of the palet, not on the flowering glume, as shown in the figure.



HILARIA CENCHROIDES H. B. K., var. TEXANA Vasey.

Plant perennial.

Rootstock none. Roots slender, branching.

Stems of two kinds, (1) runners and (2) normal culms. Runners with 1 or few nodes, producing a plant at each; internodes several inches long, slender, terete, glabrous. Culms erect, 6 to 12 inches high, slender, densely tufted from a single rootstock, glabrous, retrosely long-villous at the nodes.

Leaves of the stem 2 to 4; sheaths about 1 inch long, distant, tightly sheathing, glabrous; blade $\frac{1}{2}$ to 1 line wide, seldom exceeding 3 inches in length, flat, scabrous above and on the margins, rarely beneath, otherwise smooth except sometimes a few long hairs. Root-leaves similar, several on each stem, sheaths imbricated.

Inflorescence a usually slender-pedunculate spike $\frac{3}{4}$ to $1\frac{1}{2}$ inches long; rachis flat, zigzag, minutely pubescent, spikelets inserted in clusters of 3 (resembling a single spikelet) on opposite sides, contiguous or one-half overlapping.

Spikelets $2\frac{1}{2}$ to $3\frac{1}{2}$ lines long, the parts spreading above.

(1) MIDDLE SPIKELETS.

Glumes 3; first and second equal, similar, nearly as long as the spikelet, body many-nerved, coriaceous below, scabrous, compressed, at the middle separating into two linear obtuse spreading lobes becoming membranaceous-hyaline at the apex, bearing in the fork an awn slightly exceeding the spikelet; third (flowering) broadly oblong below, hyaline, 3-nerved, compressed, abruptly tapering from below the middle into a slender compressed neck.

Flower pistillate. Palet similar to the flowering glume but narrower and 2-nerved, and with it forming a cavity below and a neck above. Ovary and afterward the grain inclosed in this cavity. Styles long, lying in the neck, very slender above; stigmas cylindrical, the body thick.

(2) LATERAL SPIKELETS.

Glumes 4; first similar to that of the middle spikelet, but inequilateral, and with shorter awn; second similar to the first but merely mucronate; third and fourth each subtending a flower, alike, thin-membranaceous, lanceolate, hyaline, 1-nerved or with 1 or 2 additional lateral nerves.

Flowers staminate. Palet thin-membranaceous, hyaline, 2-nerved, linear. Stamens 3, anther narrowly linear.

Grain inclosed primarily in its palet and glume, these becoming shining-coriaceous, the whole inclosed in the empty glumes, the entire cluster of spikelets dropping off together.

PLATE X; *a*, cluster of three spikelets; *b*, staminate flowers of one of the lateral spikelets; *c*, pistillate flower of the middle spikelet. In *b*, one of the spikelets should be sessile. In *c*, the stigmas are nearly twice too short and proportionally too narrow, their bodies too slender, and the filaments not thick enough below.

This species differs from the Mexican type in being more slender, with longer culms, more spikelets in the spike, and the spikelets narrower and smooth instead of scabrous.



HILARIA MUTICA Benth.

Plants perennial.

Roots thick, simple, with a cork-like covering. Rootstock creeping, woody, scaly-sheathed.

Culms erect or from an ascending base, 9 to 20 inches high, somewhat tufted, usually with many sterile branches below, glabrous, sometimes hairy at the nodes.

Leaves of the stem 4 to 10; sheaths imbricated below, distant above, glabrous, the margins sometimes ciliate above; blade 1 to 1½ lines broad, reaching 6 inches long, flat or involute, usually slightly scabrous, otherwise smooth; ligule about ½ line long, fimbriate.

Inflorescence a close spike, pedunculate or scarcely exerted, 1½ to 3 inches long; spikelets arranged in clusters of 3 on opposite sides of the flat rachis, imbricated.

Spikelets 2 to 3 lines long, with a tuft of long hairs surrounding the cluster at the base.

(1) MIDDLE SPIKELETS.

Glumes 3; first and second alike, oblanceolate, 1-nerved at the base, with ciliate membranaceous margins, the nerve splitting above into several branches, continued into short aristæ, or the lateral ones joined into a fimbriate membrane; third (flowering) glume membranaceous, linear, obtuse, 3-nerved.

Flower hermaphrodite. Stamens 3; anther narrow-linear, ½ to 2 lines long, the narrow cells free at the ends. Styles 2, long; stigmas long, narrow-cylindrical, with thick bodies, exerted from the apex of the tube formed by the palet and glume.

(2) LATERAL SPIKELETS.

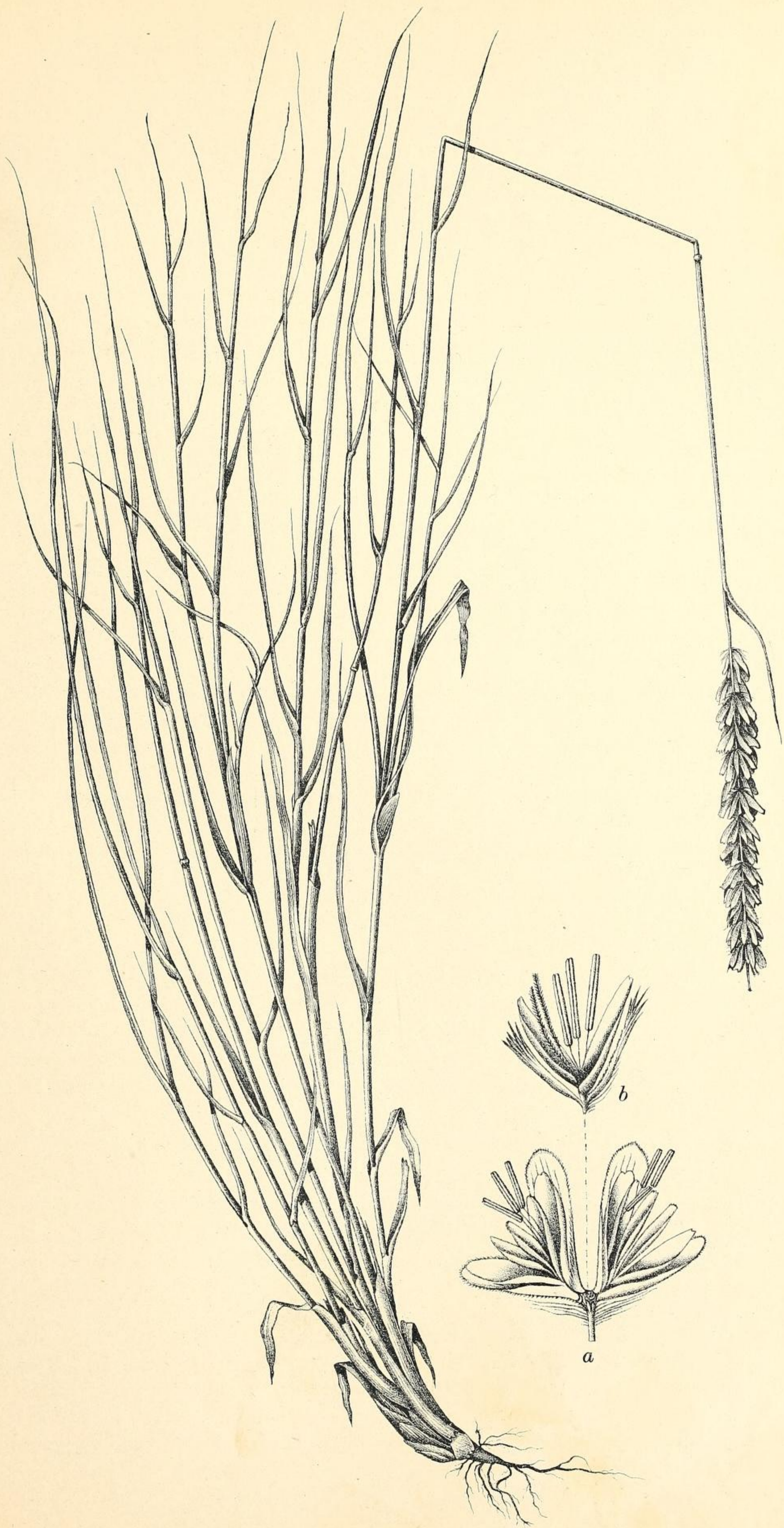
Glumes commonly 5 to 6; two lower empty, upper successively shorter, apices of all even; first lanceolate, several-nerved, ciliate on the membranaceous margins and apex, usually with a short lateral awn on the margin nearest the middle spikelet; second similar, but linear and unawned; flowering glumes narrowly quadrangular-oblong, truncate, membranaceous, 3-nerved.

Flowers staminate. Palet similar to the glume but narrower, 2-nerved. Stamens 3, similar to those of the middle spikelet, those of the upper flowers successively shorter.

Grain inclosed in the finally coriaceous and shining flowering glume and palet, these remaining attached in the cluster of spikelets, the whole dropping off together.

PLATE XI; *a*, two lateral spikelets of a cluster, and *b*, middle spikelet opened to show the parts. The cluster is viewed from the side toward the rachis of the spike. The lateral awn of the two glumes uppermost in *a* is not shown, nor are the stamens of the upper flowers of the lateral spikelets shown. In *b*, the styles are those of an unopened flower, and in all cases the cells of the anthers are represented as united even to their ends.

This species and another similar one (*H. Jamesii*) are called *gietta* by the Mexicans, and in some localities also called 'black grama.' In southern New Mexico and Arizona they are the prevailing grama grasses, taking the place of the white grama (*Bouteloua oligostachya*) which covers the plains of western Kansas and Nebraska. The species here described is one of the most important forage grasses of this region.



HILARIA MUTICA, Benth.

ÆGOPOGON GEMINIFLORUS H. B. K.*

Plant annual.

Culms procumbent and branching at the base, or even creeping and rooting at the lower nodes; erect parts about 1 foot high, very slender, glabrous.

Leaves of the stem 3 to 6; sheaths slender, glabrous, usually not quite contiguous; blade $\frac{1}{2}$ to 1 line broad, $\frac{1}{4}$ inch long, flat, flaccid, glabrous; ligule conspicuous, about 1 line long, the apex short-lacerate.

Inflorescence racemose; spikelets in umbels of 3, one nearly sessile; umbels on short, slender, scabrous peduncles, usually turned to one side, in a raceme $1\frac{1}{2}$ to 3 inches long; rachis slender, scabrous.

Spikelets lanceolate, acute, excluding the awns about 2 lines long, pedicelled ones a little smaller.

Glumes 3; first and second similar, 1-nerved, made up of a narrow body excurrent into an awn, and 2 narrow, lateral, membranaceous, from truncate to acuminate wings (one shorter than the other); third (flowering) lanceolate, 3-nerved, each nerve excurrent into an awn, middle one (shorter in the pedicelled spikelets) nearly as long as the spikelet, lateral ones minute.

Flower single, hermaphrodite. Palet membranaceous, lanceolate, 2-nerved, each nerve excurrent into a minute tooth. Stamens 3, anthers about $\frac{3}{4}$ line long, linear, the cells joined only at the middle. Stigmas short, cylindrical.

Grain not seen, but probably inclosed in the spikelets, the umbel of 3 dropping off together.

PLATE XII; lower figure, cluster of three spikelets; upper figure, spikelet opened to show the parts. The lateral lobes of the first and second glumes are broader and usually less acute than in the figure. In the upper figure the position of the first glumes is reversed, and in both figures the stamens and pistils are omitted.

*This description was made from a single set of specimens cultivated from Mexican seed. They are taken to be the typical form of H. B. K. Several forms whose specific relationships have not all been well worked out occur in the southwestern United States and Mexico, and none of them, although they may prove to be varieties of this species, were noted in writing the description.



CATHESTECUM ERECTUM Vasey & Hackel.

Plant perennial.

Roots slender. Rootstock none.

Stems of two kinds, (1) runners and (2) erect culms. Runners slender, with internodes few to several inches long, glabrous, arcuate, giving rise to a new plant at each node. Culms densely tufted below, many of them short and leafy, a few elongated, very slender, 6 to 10 inches high, glabrous.

Leaves of the root numerous; sheath short, $\frac{1}{2}$ to 1 inch long, glabrous, long-ciliate at the apex; blade 3 inches or less long, about $\frac{1}{2}$ line wide, scabrous on the margins, otherwise glabrous or rarely with a few long hairs; ligule minute, fimbriate. Leaves of the stems 2 or 3; sheaths about 1 inch long, distant, otherwise like those of the root; blade from 1 inch long to almost wanting.

Inflorescence racemose; spikelets in a raceme of 4 to 8 clusters; racemes slender-pedunculate, about 1 inch long, single or 2 or 3 together from the uppermost sheath; rachis very slender, flat, glabrous or slightly scabrous; clusters short-pedicellate, composed of 3 spikelets, middle spikelet short-pedicelled, lateral nearly sessile.

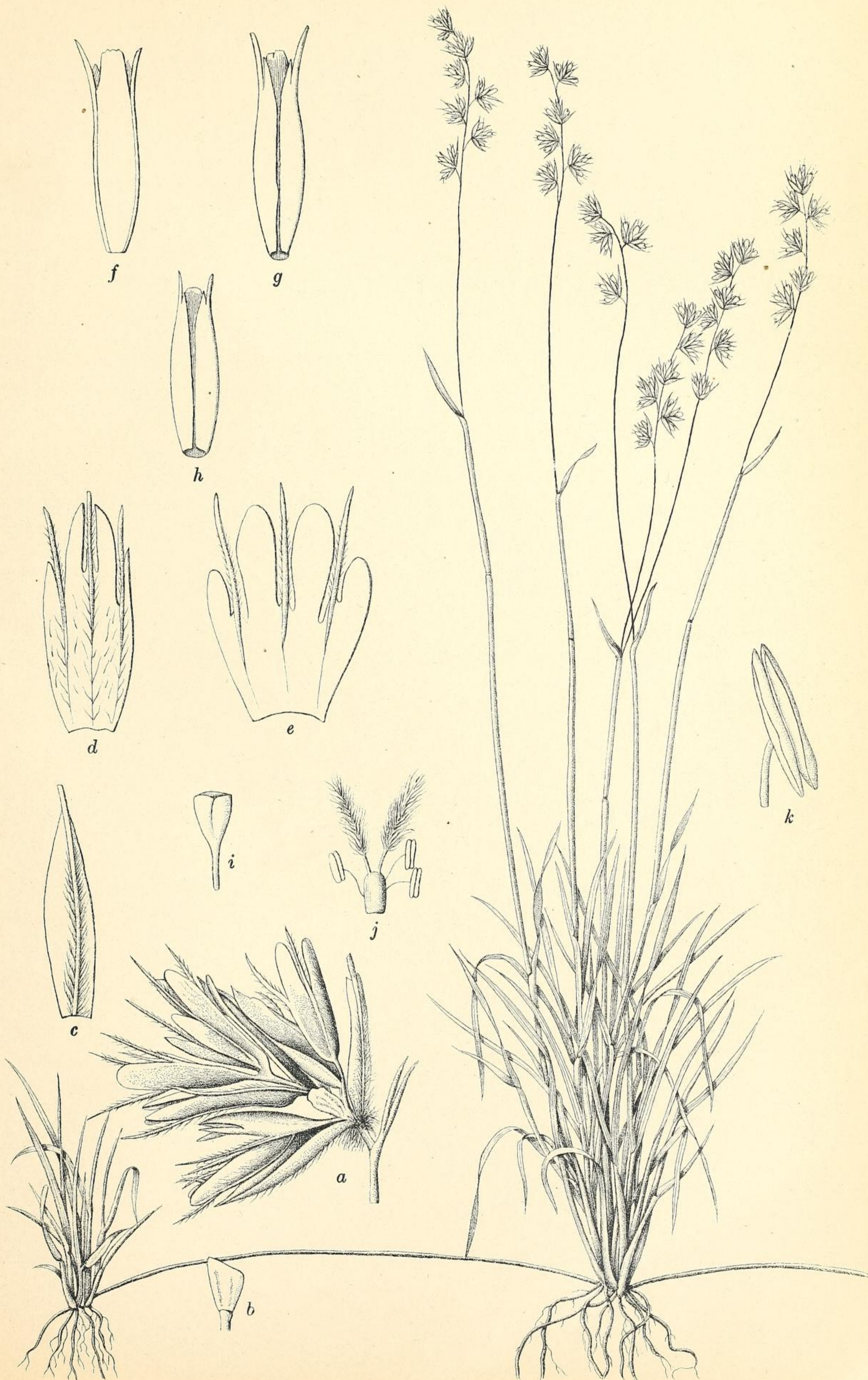
Glumes 4 to 6; first small, truncate-cuneate, empty, nearly nerveless; second empty, lanceolate, 1-nerved; others subtending flowers, 4-lobed, 3-nerved, more or less scabrous on the back, the nerves extending into a short scabrous awn between the lobes.

Flowers 3 to 4, hermaphrodite (?); palet lanceolate, 2-nerved, stamens 3, anthers 1 to $1\frac{1}{2}$ lines long; pistils not detected; sterile prolongation of the rachilla sometimes found at the apex of the spikelets.

Grain not found.

PLATE XIII; *a*, cluster of spikelets; *b*, first glume; *c*, second glume; *d* and *e*, two flowering glumes; *f*, palet, from the back; *g* and *h*, palets, from the front; *i*, sterile prolongation of the rachilla; *j*, stamens and pistils; *k*, anther and upper portion of filament.

This grass is found on the arid bluffs of the Rio Grande in Texas, and westward near the Mexican border as far as Sonora. It is too small to be of much economic importance.



TRAGUS RACEMOSUS Hall.

Plant annual.

Roots very slender.

Stem branching and procumbent at the base, sometimes rooting at the lower nodes, glabrous, 15 inches or less in height; depauperate plants sometimes simple, erect, and but 2 to 3 inches high.

Leaves of the stem 3 to 6; sheaths usually not contiguous, glabrous, often somewhat swollen; blade 1 to 2 lines broad, 1 to 2 inches long, or the uppermost nearly obsolete, glabrous except the coarsely ciliate-toothed margins, thick, pale green; ligule a dense row of short hairs.

Inflorescence a dense cylindrical spike of clusters of spikelets $2\frac{1}{2}$ to $3\frac{1}{2}$ lines thick, 1 to 4 inches long, frequently sheathed at the base, never long-peduncled; clusters nearly sessile, arranged singly on all sides of the terete minutely pubescent rachis.

Spikelets 2 to 3 in each cluster, closely spiked (backs together) on a short rachis; uppermost commonly reduced to a single echinate glume; lowest and usually the middle one perfect; rachis sometimes produced as a rudiment above the base of the upper flower.

Glumes 3; first ovate, small, thin, hyaline, nerveless; second thick, ovate to lanceolate, acute, the back ridged with several (commonly 5 to 7) nerves converging at the apex and beset with hooked spines; third (flowering) lanceolate, acute, mucronate-awned, slightly coriaceous, glabrous, 3-nerved.

Flower single, hermaphrodite. Palet lanceolate, membranaceous, 2-nerved. Stamens 3; anthers short, oblong; stigmas cylindrical, slender.

Grain light-brown, oblanceolate-oblong, slightly obcompressed, apiculate, short-stipitate, about $\frac{1}{2}$ line long.

PLATE XIV; *a*, cluster of two spikelets opened to show the parts. The spikelet on the right shows the first glume (very small), the second glume (echinate), the flowering glume and its palet, and between them an organ probably meant to represent an anther. The spikelet to the left shows the same parts except the first glume which is replaced by the rudimentary prolongation of the rachis. The second spikelet should be raised on a slight prolongation of the rachis.

This is a widely distributed semi-tropical grass, not of economic value.



TRAGUS RACEMOSUS, Hall.

ELIONURUS BARBICULMIS Hackel.

Rootstock not seen, apparently creeping. Roots rather thick, mostly simple, unbranched, with a thin brown bark.

Culms densely tufted, erect, 1 to 3 feet high, slender, rigid, below the nodes pilose, a little lower scabrous, and lower yet glabrous; many short, producing only leaves.

Leaves of the stem 3 to 5; sheaths slender, usually not contiguous, glabrous, sparingly long-ciliate on the margins above; blade 8 inches long or less, the uppermost often entirely wanting, about $\frac{1}{2}$ line wide, closely involute, long-pilose on the margins below, densely hairy for a short distance from the ligule within, otherwise glabrous, rising erect from the sheath; ligule a dense row of stiff hairs. Root leaves and those of the abortive stems similar to the last, but reaching 1 foot in length, tips frequently flexuous.

Inflorescence a more or less pedunculate terminal distichous spike, 2 to 4 inches long, about 3 lines thick, densely villous on both the rachis, pedicels, and spikelets; rachis flat.

Spikelets inserted 2 together on one side of the rachis at each joint; one sessile, 3 to 4 lines long; other pedicelled, of about the same length, including the pedicel.

Glumes 4; first lanceolate, several-nerved, densely villous on the back, apex bifid into two slender points; second lanceolate, 3-nerved, more or less villous in the middle of the back, these two inclosing the rest of the spikelet; third thin, membranaceous, laterally 2-nerved, ciliate on the inflexed margins; fourth (flowering) lanceolate, membranaceous, 1- to 3-nerved, glabrous.

Flower of sessile spikelet hermaphrodite; palet lanceolate, minute, membranaceous; lodicules 2, about $\frac{1}{5}$ line long, thick; stamens 3, linear, anthers $1\frac{1}{2}$ to 2 lines long; stigmas long, cylindrical. Flower of pedicelled spikelet staminate; palet wanting, lodicules as in the hermaphrodite flower; stamens 3, shorter than the others.

Grain light-brown, obcompressed, elliptical-lanceolate, acute at each end; embryo occupying half its length. Rachis of the spike finally disarticulating just below the nodes, bearing the 2 spikelets, one containing the grain.

PLATE XV; *a*, portion of the rachis of the spike, showing the two spikelets at a node, opened to show their parts. The palet of the lower spikelets is not shown.

This species occurs on rocky hills in western Texas, southern New Mexico, and Arizona, and the adjacent parts of Mexico.



HETEROPOGON CONTORTUS R. & S.

Rootstock short. *Roots* stout.

Culms tufted, smooth, branching above, erect, about 3 feet high.

Leaves 6 to 12 inches long, upper ones gradually shorter; blade flat, upper surface and margins rough, lower surface smooth; sheath smooth, much flattened.

Inflorescence spicate, cylindrical, about 2 inches long without the awns, main rachis smooth.

Spikelets 3 to 5 lines long, in pairs, lower sessile and perfect, upper on a short pedicel, and staminate only. Male spikelets turned to one side of the spike, almost concealing the fertile ones.

Glumes in the female spikelets 4, outer hard, hairy, convolute; second much narrower, hard, 3-nerved; third very thin, hyaline, smaller; fourth hyaline at the base, above extended into a hard twisted and bent awn 2 to 3 inches long or more. Glumes of the male spikelet 4; first ovate-lanceolate, flattish, keeled near the margin, thick, green, ciliate, many-nerved, margins thin; second thinner, narrower, 3-nerved, ciliate on the margin; third and fourth hyaline, somewhat shorter.

Stamens 3. *Styles* 2.

PLATE XVI; *a*, pair of spikelets, the upper male, the lower female, with the long twisted and pubescent awn; *b*, a male flower spread open to show the parts. The fourth glume is omitted.

This grass furnishes a large amount of foliage, and is deserving of trial in cultivation.



No. 17.

TRACHYPOGON POLYMORPHUS Hack.

Rootstock short. Roots strong.

Culms tufted, smooth, bearded at the joints, unbranched, erect, 2 to 3 feet high.

Leaves. Lower ones 6 to 12 inches long, about 2 lines wide, attenuated to a point, scabrous, sparingly hairy toward the base; sheaths hairy, the lower ones longer than the internodes, the upper shorter; ligule 1 to 2 lines long, ovate-lanceolate, sparingly hairy.

Inflorescence a narrow, slender spike, rather loose, 4 to 6 inches long, erect; the rachis slightly hairy at the joints, otherwise smooth.

Spikelets in pairs, 3 to 4 lines long, each 1-flowered, the lower flower sessile and male only, the other on a short pedicel and perfect. Male spikelets: first and second glumes thick; first oblong-linear, 7- to 9-nerved, sparsely pubescent, obtuse, ciliate at apex; second lanceolate-oblong, 3-nerved, acute; third and fourth thin, hyaline. Female spikelet like the male except the flowering glume; this terminating in a hairy, twisted awn, about 2 inches long. Stamens 3. Styles 2, stigmas plumose.

PLATE XVII; *a*, pair of spikelets opened to show the parts.



No. 18.

ANDROPOGON CIRRHATUS Hackel.

Rootstock short. Roots strong.

Culms tufted, 2 to 3 feet high, slender, branching above, of 6 to 8 joints; lateral branches arising singly, slender, becoming long-exserted.

Leaves. Sheaths narrow, close, smooth, striate; ligule short, truncate, smooth; blade 3 to 6 inches long, 1 to 2 lines wide, attenuated to a long acute point, rigid, smooth, except the roughish margins.

Inflorescence terminal on the culm and its branches, in a spike-like raceme about 2 inches long consisting of 10 to 15 joints; rachis smooth.

Spikelets in pairs. Female spikelets sessile, about 3 lines long; first glume linear-lanceolate, thick, 2-toothed at apex, smooth except the scabrous keel and margins, 7- to 9-nerved; second glume slightly shorter than the first, acute, much thinner, 3-nerved above, smooth; third glume one-fourth shorter than the first, hyaline, linear-oblong, obtuse, 2-nerved, ciliate on the margins; fourth glume as long as the third, hyaline, bifid, attached below to an awn 6 to 8 lines long. Male spikelet rather shorter than the female, about equaling its pedicel; pedicel smooth except a tuft of cilia near the apex; glumes 4, much as in the female, but without the awn of the third glume.

PLATE XVIII; *a*, pair of spikelets; *b*, female spikelet opened to show the parts; *c*, male spikelet opened.

This is related to the broomsedge (*A. scoparius*), and is rather rare.



ANDROPOGON HIRTIFLORUS Kunth.

Culms 2 to 4 feet high, densely tufted on a short rootstock, erect, rather slender and wiry, with generally single branches from the upper joints; lower internodes compressed, furrowed on the inner face; branches becoming long-exserted and flower-bearing at the extremity, smooth.

Leaves crowded below, distant above; lower sheaths compressed, short, with scattering hairs or nearly smooth; ligule membranaceous, short, truncate; blade flat, 2 to 6 inches long, 1 to 2 lines wide, firm and erect, rather scabrous, acuminate.

Inflorescence terminating the culm and branches as a loose, narrow, few-flowered, spike-like raceme, consisting of 10 to 20 joints, 2 to 3 inches long; branches slender, long-exserted from the sheaths.

Spikelets in pairs at the joints of the flattened hairy rachis, lower perfect and fertile, upper sterile. Perfect spikelet 4 lines long; glumes 4, two of hard texture and two hyaline; first linear-lanceolate, roughened on the back, covered with long white hairs; second thinner, keeled, without hairs, minutely scabrous; third hyaline, a little shorter than the second, slightly ciliate, deeply bifid, attached below to its twisted and bent awn, which is 8 or 10 lines long; fourth hyaline, entire, inclosing the proper flower. Sterile spikelet: pedicel about 2 lines long, flattened, ciliate; glumes generally 2; first lanceolate, acuminate, green, thick, hirsute; second hyaline, inclosed by the first.

PLATE XIX; *a*, pair of spikelets, the perfect one sessile, and the sterile one on a pedicel; *b*, perfect flower with the glumes spread out. The outer or first glume does not show the long hairs.

This species also is related to *A. scoparius*. It is found on rocky hills in western Texas, in the Santa Catalina and Huachuca Mountains of Arizona, and in Mexico.



ANDROPOGON SACCHAROIDES Swartz.

Rootstock short. Roots strong.

Culms tufted, smooth (nodes bearded or in some forms smooth), simple or branched, erect, 2 to 4 feet high, often with 5 or 6 joints.

Lower *leaves* 1 foot or more long; blade flat, narrow, acuminate, somewhat scabrous on both surfaces and on the margins; sheaths smooth, striate, shorter than the internodes, open; ligules broadly ovate, laciniate.

Inflorescence paniculate, oblong, about 4 inches long, composed of numerous (20 to 50) closely approximate and appressed sessile spike-like branches 1 inch or more long; spikelets imbricated.

Spikelets in pairs at the joints of the branches, one sessile and perfect, the other on a short pedicel and either male or imperfect. Perfect spikelets 2 lines long with 2 outer hard glumes and 2 inner hyaline ones; first about 7-nerved, sparsely hairy, 2-toothed at the apex, second obscurely 3-nerved, third and fourth hyaline, latter terminating in a twisted awn sometimes 8 or 10 lines long. Male or sterile spikelet on a pedicel of about its own length, consisting of only 1 linear, pubescent, 5- to 7-nerved, glume; pedicel covered with long, fine, white hairs.

PLATE XX; *a*, perfect spikelet; *b*, both the sterile and perfect spikelets.

This species is common on rocky banks and borders of streams. It extends northward to southern Colorado and Kansas, and deserves trial as an agricultural grass for dry and sandy lands. There are several varieties.



No. 21.

ANDROPOGON WRIGHTII Hackel.

Rootstock thick. Roots very strong.

Culms cæspitose, 2 to 3 feet high, unbranched, smooth, slightly hairy at the nodes.

Leaves. Sheaths smooth, striate, shorter than the internodes; ligules 1 line long, obtuse, smooth; blades 5 to 12 inches long, 2 to 3 lines wide, light green, smooth, the margins scabrous.

Panicle 2 to 3 inches long, consisting of 5 to 7 clustered or approximate spike-like branches $1\frac{1}{2}$ to 2 inches long, shortly pedicellate, erect, and densely flowered; rachis flattened, hairy, ciliate.

Spikelets about 3 lines long, in pairs, one female, one male. Female spikelet sessile, lance-oblong, hairy at the base, sparsely hairy on the back below; first glume thick, 7-nerved above; second nearly equal to the first, 3-nerved; third and fourth hyaline, fourth with an awn $\frac{1}{2}$ inch long. Male spikelet on a ciliate pedicel of half its length, about 3 lines long; first glume 9- to 11-nerved at the base, ciliate on the margins above; second more acute, 3-nerved, ciliate; third hyaline, nearly equaling the second; fourth very minute or wanting.

PLATE XXI; *a*, pair of spikelets; *b*, female spikelet spread open to show the parts; *c*, male spikelet opened.

This resembles the preceding species, but is smaller and with fewer spikes. It is rare, at least north of the boundary.



ARISTIDA ARIZONICA Vasey.

Rootstocks unknown. Roots rather stout, simple above, with a thin bark.

Culms erect, simple, closely tufted, 1 to 2½ feet high, glabrous.

Leaves all radical or originating near the base of the culm; sheaths imbricated, glabrous, sometimes 6 inches long; blades commonly 3 to 5, sometimes 10 inches long, glabrous, involute when dry; ligules a minute dense ring of hairs.

Inflorescence an exsert-pedunculate panicle 4 to 12 inches long; branches short, rarely exceeding 2 inches, nearly erect; spikelets singly sessile or short pedunculate.

Spikelets (excluding the awns) ½ to ¾ inch long, awl-shaped, nearly terete.

Glumes 3; first linear, two-thirds the length of the spikelet, membranaceous, 1-nerved, aristate, acute with 2 minute accessory teeth, the midnerve and awn-point scabrous; second as long as the spikelet, narrower than the first, similar to it, the awn-point a little longer; third (flowering) glume coriaceous, as long as the second, closely involute, very slender, scabrous; apex twisted two or three times, then produced into 3, straight, terete, not twisted, scabrous awns diverging when dry, usually a little longer than the spikelet; middle one slightly the longest; rachilla slightly elongated between the second and third glumes, densely villous.

Flower single, hermaphrodite. Palet minute, nearly 1 line long. Lodicules 2, lanceolate, as long as the palet. Stamens 3, anthers linear nearly 1 line long. Stigmas 2, cylindrical.

Grain awl-shaped, about 4 lines long, closely enwrapped in the flowering glume; rachilla disarticulating obliquely just above the second glume.

PLATE XXII; *a*, spikelet, empty glumes spread open; *b*, the same empty glumes removed, flowering glume open to show the palet and stamens. The stigmas are not shown.

A common grass of the mesas and hills, which early in the season furnishes good grazing for animals.



a

b

ARISTIDA ARIZONICA, Vasey.

ARISTIDA DIVARICATA H. B. K.

Rootstocks not seen. Roots rather stout, branching only below.

Culms tufted, erect, branching only at the base, 1 to 3 feet high, minutely reticately scabrous, simple, most of its length taken up by the panicle.

Leaves few, those of the stem 3 to 5; sheaths glabrous or minutely scabrous, imbricated, usually with a few long hairs at the apex; ligule a row of short hairs, with sometimes a few long ones intermixed; blades commonly 3 to 6 inches long, involute, usually glabrous beneath and scabrous above, never hairy. Root leaves similar, blades a little shorter.

Inflorescence paniculate. Panicle usually 9 to 18 inches long, frequently sheathed at the base; rachis nearly terete, glabrous; branches long (the lowest commonly 5 inches), widely spreading, naked at the base, flat, scabrous on the margins; spikelets borne singly, mostly short-peduncled, and appressed to the branches.

Spikelets linear-subulate about 6 lines long (excluding the awns), somewhat compressed.

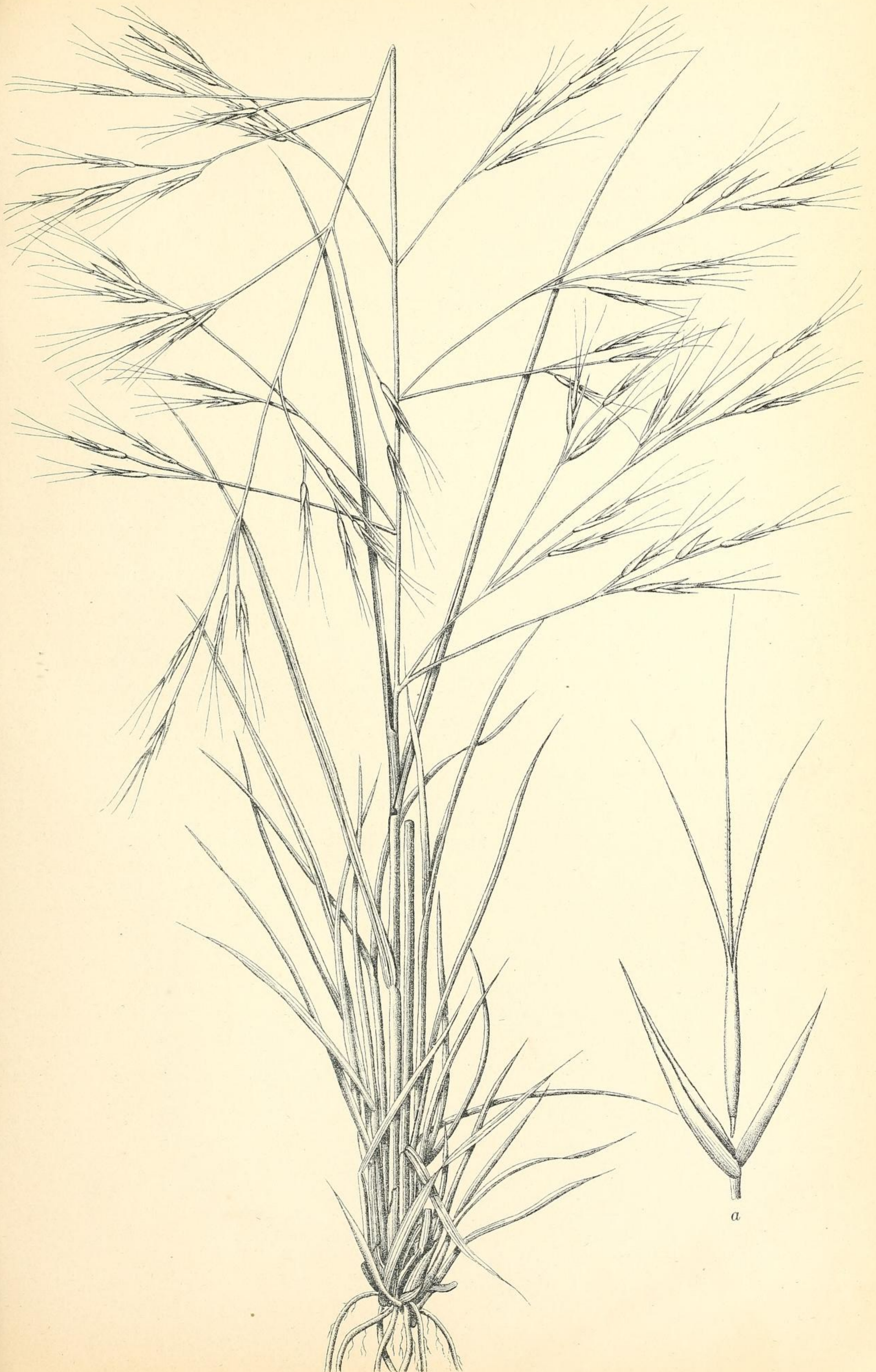
Glumes 3; first and second nearly equal, slightly spreading, narrowly linear, acute, membranaceous, tawny and purple in color, compressed, 1-nerved, nerve scabrous on the back; third (flowering) coriaceous, closely involute into a slender-cylindrical tube, scabrous above, slightly shorter than the empty glumes, scarcely twisted at the apex, produced into 3 straight, terete, scabrous, awns slightly diverging when dry, two lateral ones about as long as the body of the glume, middle one from one-half to twice longer. Rachilla elongated, between second and third glumes, to the length of $\frac{1}{2}$ line, densely short-villous.

Flower single, hermaphrodite. Palet minute, lanceolate, $\frac{1}{2}$ line long. Lodicules 2, shorter than the palet, linear-oblong. Stamens 3; anthers linear, $\frac{3}{4}$ line long. Stigmas 2, cylindrical.

Grain about 4 lines long, awl-shaped, tightly clasped by the flowering glume. Rachilla disarticulating above the second glume.

PLATE XXIII; *a*, spikelet, glumes spread apart and rachilla separated at its point of disarticulation. The hairs on the apex of the sheaths are not shown, nor those on the rachilla above the second glume. The diameter of the tube of the flowering glume is often nearly twice as great.

Grows on dry or sandy hills and plains, extending to southern California.



STIPA FLEXUOSA Vasey.

Culms closely set on a short horizontal rootstock with slender roots, erect, $1\frac{1}{2}$ to 3 feet high, slender, terete, smooth, unbranched.

Leaves of the stem 2 to 4; sheaths smooth, close, usually imbricated; blades about 1 line broad, a few inches to 1 foot long, involute or the upper flat, glabrous on the back, minutely pubescent on the upper surface, hairy at the angle of the ligule; ligules membranaceous, 1 to 2 lines long, lacerate when old, broader than the blade.

Inflorescence paniculate. Panicle 6 to 12 inches long, erect; rachis slender, terete, glabrous; branches slender, flexuous, few-angled, scabrous, bearing towards the apex a few pedicelled spikelets.

Spikelets single, 1-flowered, on pedicels about 2 lines long, lanceolate, awl-shaped when closed, 6 to 9 lines long exclusive of the awn.

Glumes 3; first narrowly lanceolate, acute, membranaceous; glabrous, 1-nerved or with 2 lateral nerves at the base, hyaline above, green or purple below, as long as the spikelet; second similar, about one-fifth shorter, 3- to 5-nerved; third (flowering) about $2\frac{1}{2}$ lines long closely involute about the flower into an awl-shaped terete body, villous on the outside, coriaceous at maturity, 5-nerved apex produced into a slender scabrous awn twisted in a right-handed spiral for about 5 lines, then bent, then twisted as before for about $3\frac{1}{2}$ lines, then bent, and above the second bend not twisted. Rachilla elongated between the second and third glumes to the length of $\frac{3}{4}$ line, villous.

Flower hermaphrodite. Palet about one-third the length of the glume, oblong, obtuse, hyaline. Stamens 3; anthers linear, 1 to $1\frac{1}{2}$ lines long, apex of each cell of the anther bearing a small tuft of hairs. Stigmas rather short, oblong.

Grain awl-shaped, about 2 lines long, inclosed in the glume, rachilla disarticulating just above the second glume, detached portion ending in a sharp point.

PLATE XXIV; *a*, and *b*, spikelet, the parts spread open and the upper portions of the rachilla detached at the point of disarticulation. The figure does not show the regular bends in the awn, nor the tufts of hairs at the apex of the anther cells.

This is more slender than *S. avenacea*, with smaller flowers, the flowering glume pubescent throughout, and the apex crowned with a row of white hairs.



MUHLENBERGIA DISTICHOPHYLLA Kunth.

Rootstock not seen. Roots strong, branching rather early.

Culms tufted, erect, $2\frac{1}{2}$ to 4 feet high, simple, glabrous, glaucous where not sheathed, stout, rigid.

Leaves of the stem 2 to 4; sheaths long, usually imbricated, not hairy, commonly minutely roughened; blade 3 to 12 inches long, about 1 line wide, flat and keeled or conduplicate, harsh, scabrous on the midrib and margins, glaucous green; ligule membranaceous, narrow, long-acuminate, sometimes $\frac{3}{4}$ inch long, fragile. Root leaves with sheaths mostly loose and compressed; sheaths sometimes 9 inches long, and the entire leaf exceeding 3 feet.

Inflorescence paniculate. Panicle 8 to 18 inches long, erect, contracted; branches numerous, seldom exceeding 3 inches, scabrous as well as the rachis.

Spikelets polygamous, very numerous, borne singly on slender scabrous pedicels, about 1 line long, linear-oblong, obtuse or acute.

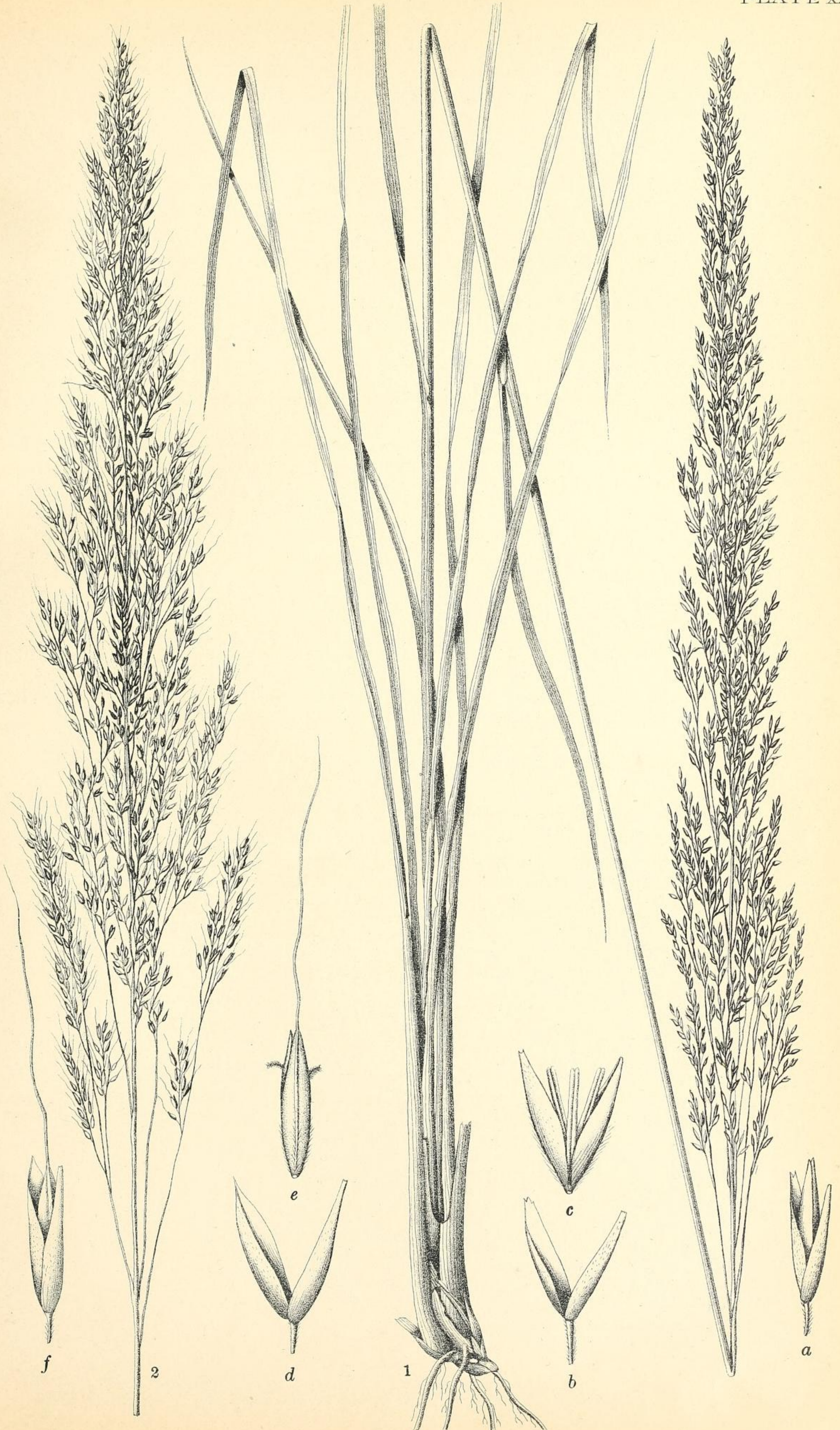
Glumes 3; first and second nearly equal, membranaceous, tawny, often purple at the base, about 1 line long, slightly scabrous on the back, acute, or sometimes obtuse and erose at the apex, 1-nerved, rarely with 2 rudimentary lateral nerves; third (flowering) similar to the others, densely pilose below, with a strong middle nerve and usually 2 indistinct ones on either side; middle nerve in the hermaphrodite spikelets produced, from below the apex of the glume, into a slender, scabrous, terete, somewhat flexuous, purple awn 4 to 6 lines long; glume of the staminate spikelets awnless.

Flowers single in the spikelets. Palet of staminate flower thin, membranaceous, lanceolate, with 2 very slender approximate nerves, slightly hairy on the back; stamens 3, anthers linear, nearly as long as the spikelets. Palet of hermaphrodite flower similar to the other; stamens 3, anthers linear, nearly as long as the spikelet; ovary globular, styles long, stamens cylindrical.

Grain linear-oblong, brown, inclosed in the glume and palet; rachilla disarticulating above the second glume.

PLATE XXV; 1, male plant; 2, hemaphrodite plant; *a*, staminate spikelet; *b*, first and second glumes of the same; *c*, third (flowering) glume, palet, and stamens of the same; *f*, hermaphrodite flower; *d*, first and second glumes of the same; *e*, third (flowering) glume, palet, and stigmas of the same. In the hermaphrodite flower the stamens are not shown.

A coarse, strongly rooted, perennial grass, perhaps having agricultural value. It is one of the grasses called *saccato*.



MUHLENBERGIA GRACILIS Trinius.

Rootstocks short, ascending.

Culms tufted, erect, 9 to 24 inches high, unbranched above the base, glabrous.

Leaves all radical; sheaths of the outer ones short (1 to 3 inches long), loose, flattened, slightly scabrous on the back, inner longer and sheathing, uppermost usually reaching to, and sheathing, the inflorescence; blade 6 inches or less long, in line with the sheaths, usually involute, scabrous on the back, glabrous above; ligule membranaceous, about $\frac{1}{4}$ to $\frac{1}{2}$ inch long, at the base broader than the blade, apex slender-acute and often lacerate, the whole shriveled when old.

Inflorescence paniculate. Panicle sheathed or long-pedunculate, 2 to 7 inches long, erect or nearly so; rachis scabrous; branches scabrous, 2 inches long or less, nearly erect.

Spikelets lanceolate, acute, 2 lines long exclusive of the awn, borne singly on short pedicels.

Glumes 3; first lanceolate, acuminate-aristate, 1-nerved, scabrous on the back, about 1 line long, lead-colored below, hyaline above; second slightly longer, similar in texture, scabrous on the back, ovate-oblong, truncate, 3-nerved, nerves produced into aristate points; third (flowering) lanceolate, involute, 1-nerved or with two additional nearly marginal nerves, scabrous on the back, ciliate on the margins, as long as the spikelets, straw-colored, with a lead-colored apex tapering into a not twisted slender, scabrous, flexuous awn about $\frac{1}{2}$ inch long.

Flower single, hermaphrodite. Palet lanceolate, slightly shorter than its glume, obtuse when flattened, 2-nerved, scabrous on the back. Stamens 3; anthers linear, about 1 line long. Stigmas cylindrical, purple.

Grain not seen. Palet and glume coriaceous when old.

PLATE XXVI; *a* and *b*, spikelet, the parts spread open, and the rachilla broken above the second glume; *c*, second glume; *d*, first glume; *e*, same as *b*, showing the back of the flowering glume.

This species is common on stony ridges or hills from Mexico to Montana, and a small form occurs in California.



No. 27.

EPICAMPES MACROURA Benth.

Rootstock ascending, thick. Roots strong, little branched.

Culms tufted, erect, $2\frac{1}{2}$ to $3\frac{1}{2}$ feet high, glabrous, simple.

Leaves of the root several; sheaths mostly loose above and involute, 6 to 9 inches long, glabrous; blade inserted on the back of the sheath, erect, commonly 1 foot long, glabrous, usually involute; ligule 3 to 6 lines long, lanceolate, coriaceous below, membranaceous above and on the margins, broader than the blade, appearing as a direct continuation of the sheath. Leaves of the stem 2 to 3, similar to those of the root; sheaths imbricated and mostly clasping; blade frequently much shorter.

Inflorescence paniculate. Panicle short-pedunculate, erect, usually 8 to 16 inches long; rachis terete, scabrous, branches imbricated, 1 to 4 inches long, nearly erect, scabrous, bearing the spikelets singly on short scabrous pedicels.

Spikelets nearly terete, lanceolate and acute when closed, about 1 line long.

Glumes 3; first and second nearly equal, two-thirds the length of the spikelet, oblong-lanceolate, acute or acuminate, 1-nerved, scabrous on the back; third (flowering) similar in texture, a little longer, oblong, obtuse and bifid at the apex, with a short scabrous awn or mucro from the angle, 3- to 5-nerved, scabrous on the back.

Flowers single, hermaphrodite. Palet equaling the third glume, oblong, obtuse, 2-nerved, rarely scabrous. Stamens 3; anther linear, $\frac{3}{4}$ to 1 line long. Styles distinct, short; stigmas about half the length of the anthers, oblong, the fimbriæ long.

Grain dark brown, linear-oblong, obtuse or acutish at base and apex, terete, inclosed in the flowering glume and palet; rachilla disarticulating above the second glume.

PLATE XXVII; *a*, first (on the right) and second glume; *b*, flowering glume (on the right) and palet, open to show the stamens and pistil. The styles are much too long, while the stigmas should be twice as long and nearly four times broader.

This is another of the grasses called saccato, or saccatone.



EPICAMPES MACROURA, Benth.

EPICAMPES RIGENS Bentham.

Rootstocks rather slender, ascending. Roots rather stout, little branched.

Stems tufted, erect, commonly 2 to 6 feet high, glabrous, simple. Leaves of the root few; sheath glabrous or slightly scabrous above, usually clasping, seldom exceeding 5 inches in length; blade elongated, often exceeding 1 foot, usually involute, scabrous; ligule about 1 line long, truncate, margin minutely ciliate. Leaves of the stem 2 to 4, similar; sheaths mostly long and imbricated, often exceeding 1 foot.

Inflorescence paniculate. Panicle spike-like, 6 to 12 inches long, commonly $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, usually sheathed at the base; branches 1 inch long or less, appressed to the terete scabrous rachis. Branches and pedicels scabrous.

Spikelets lanceolate, narrowed at the base, terete, acute at the apex, $1\frac{1}{2}$ to 2 lines long, borne singly on the pedicels, rachilla pilose between the second and third glumes.

Glumes 3; first and second nearly equal, lanceolate-oblong, obtuse or acute, 1-nerved, scabrous, two-thirds the length of the spikelet; third (flowering) broadly lanceolate when spread open, acute, 3- to 5-nerved, scabrous, with neither awn or mucro, hyaline below, usually lead-colored above.

Flower hermaphrodite, single. Palet lanceolate, equaling its glume, 2-nerved, acute at the apex. Stamens 3; anthers linear, about 1 line long. Stigmas short, long-fimbriate.

Grain not seen. Rachilla probably disarticulating above the second glume.

PLATE XXVIII; *a* and *b*, spikelet, opened and the parts separated; *c*, same, closed and facing in the opposite direction. The ovary is more than five times too long, and was probably drawn from a half matured specimen.

This is a coarse grass growing in dense clumps, and is also sometimes called *saccato*. It does not extend far northward.



CHLORIS ALBA Presl.

Plant annual.

Root slender, numerous.

Culms branching from the base and lower axils, procumbent at the base, rarely rooting at the lower nodes, glabrous, commonly $1\frac{1}{2}$ to 3 feet high, often less.

Leaves 4 to 8 on the stem; sheaths glabrous, more or less bladderly-inflated, often loose, usually not contiguous; blades 1 to $2\frac{1}{2}$ lines broad, 9 inches long or much shorter, flat, glabrous beneath, scabrous on the margins and above.

Inflorescence a sheathed or pedunculate cluster of sessile spikes. Spikes 5 to 15, 2 to $3\frac{1}{2}$ inches long, only slightly spreading; rachis filiform, terete, straight, scabrous; spikelets closely set, sessile, in 2 rows along one side.

Spikelets compressed, 2-flowered; lower flower hermaphrodite; upper staminate or reduced to a sterile glume, $1\frac{1}{4}$ to 2 lines long (exclusive of awns and hairs).

Glumes 4; first one-third to one-half the length of the spikelet, lanceolate, acute or obtuse, membranaceous, 1-nerved, nerve scabrous; second about two-thirds the length of the spikelet, lanceolate, acute, membranaceous, its single nerve scabrous and produced into an aristate point nearly reaching the apex of the spikelet; rachilla pilose between the second and third glumes; third (flowering) obovate, compressed, apex narrowed making the glume hooded, pilose in irregular areas on the back, or glabrous, the margin short-pilose below, and on either margin near the apex long-pilose, hairs two-thirds as long as the spikelet, apex of the glume produced into a slender, scabrous, straight, not twisted awn two to three times the length of the spikelet; sterile glume similar in shape to the flowering glume, but smaller and glabrous, with a nearly equal awn. Rudiment of a third flower sometimes present.

Flower hermaphrodite. Palet oblanceolate, 2-nerved, margins folded inward. Stamens 3; anthers small, sagittate-lanceolate, $\frac{1}{4}$ line long; stigmas small, cylindrical. Flower of sterile glume sometimes wanting, sometimes represented only by a palet, rarely by stamens also.

Grain narrowly fusiform, acute at both ends, $\frac{3}{4}$ to 1 line long, inclosed in the flowering glume, the rachilla disarticulating above the second glume.

PLATE XXIX; *a* and *b*, spikelet, rachilla broken at the point of disarticulation, and the parts spread open. In *a* the shorter glume should be on the right and below, the longer on the left. In *b*, the sterile glume and the rudiments of a third flowering glume are shown.

This species is common in the southern parts of this region, and still more common in Mexico.



No. 30.

CHLORIS CILIATA Swartz, var. TEXANA Vasey n. var.

Plant annual.

Culms tufted, erect, compressed, glabrous, branching only at the base.

Leaves of the stem 3 to 5; sheaths not contiguous, glabrous, conspicuously striate, rarely loose; blades 1 to $2\frac{1}{2}$ lines wide, 9 inches or less long, flat or sometimes involute, scabrous on the margins.

Inflorescence a short-pedunculate cluster of 4 to 6 sessile spikes. Spikes $2\frac{1}{2}$ to $3\frac{1}{2}$ inches long, slightly spreading; spikelets in 2 rows along one side of the slender scabrous rachis, inserted in each row at intervals of about $\frac{5}{8}$ line.

Spikelets 1 to $1\frac{1}{2}$ lines long, truncate-cuneate, compressed.

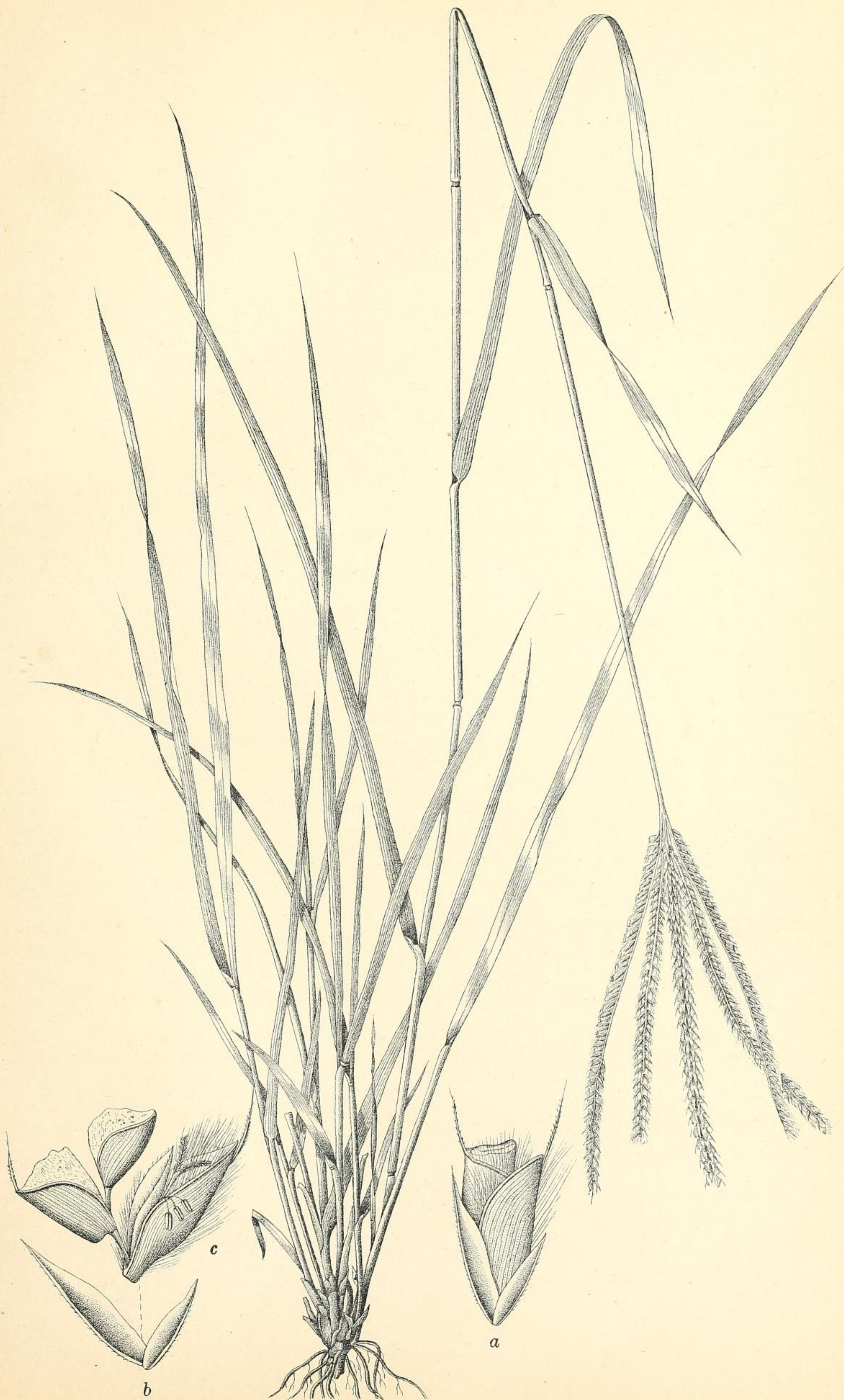
Glumes 4; first and second lanceolate-oblong, acute, 1-nerved (nerves scabrous on the back) first about one-half the length of the spikelet, second nearly as long as the spikelet and with a short scabrous point; third (flowering) glume very broadly oblong, acute, 3-nerved (2 lateral nerves nearly marginate), sharply folded down the middle, densely long-pilose on the median nerve and on the middle third of the marginal nerves, bearing below the apex a short straight scabrous awn about one-half the length of the spikelet; fourth (sterile) glume broadly truncate-cuneate, 3-nerved, glabrous, folded down the middle, awned like the flowering glume. 2 or 3 additional successively smaller rudiments of glumes, of similar shape but unawned, often present. Rachilla short-pilose between the second and third glumes.

Flower single, hermaphrodite. Palet ovate, acute, 2-nerved, margins folded inward, nerves ciliate, body of the palet curved inward transversely and outward longitudinally. Stamens 3; anthers ovate-sagittate, $\frac{1}{4}$ line long. Stigmas cylindrical.

Grain not seen. Rachilla when mature disarticulating above the second glume.

PLATE XXX; *a*, spikelet; *b* and *c*, same, with the parts spread open and the rachilla broken at the point of disarticulation.

This variety (?) differs conspicuously from the type in the longer spikes; but we lack authentic specimens for comparison. It was collected near Brownsville, Texas, and probably is not found far from the coast.



No. 31.

CHLORIS CUCULLATA Bischoff.

Plant annual.

Culms erect, at the base procumbent, 9 to 24 inches high, somewhat compressed or nearly terete, glabrous, branched only at the base.

Leaves of the root numerous; sheaths 3 inches long or less, glabrous, compressed, glaucous, with conspicuous membranaceous margins, the outer loose; blades 1 to 9 inches long, $\frac{3}{4}$ to $1\frac{1}{2}$ lines wide, usually longitudinally folded, glaucous, scabrous on the midrib margins and upper surface, apex abruptly acute or mucronate; ligule about $\frac{1}{2}$ line long, membranaceous, minutely ciliate at the apex. Leaves of the stem 2 to 4, similar to those of the root; sheaths not contiguous, upper more or less inflated; blade of the uppermost leaf often very small.

Inflorescence a more or less long-peduncled cluster of sessile spikes. Spikes 7 to 16, 1 to 2 inches long; spikelets borne in 2 rows along one side of the slender, scabrous rachis, inserted in each row at intervals of about $\frac{5}{8}$ line.

Spikelet slightly less than 1 line long, of the form of an equilateral triangle.

Glumes 4; first and second oblong-lanceolate, hyaline, 1-nerved, nerve green and usually glabrous, apex acute or obtuse, first about $\frac{1}{3}$ line long, second $\frac{1}{2}$ to $\frac{2}{3}$ line; third (flowering) glume compressed, 3-nerved, short-ciliate on the keel and intramarginal nerves, otherwise glabrous, bearing below the apex a minute scabrous awn $\frac{1}{2}$ line long, each half of the glume oval, bluntly acute at either end; fourth (sterile) glume compressed, glabrous, awned similarly to the third, 5- to 7-nerved, the lateral nerves distant from the middle nerve, each half of the glume wedge-truncate, as broad as long, apex and free margin involute. Rudiment of a fifth glume usually present.

Flower single, hermaphrodite. Palet oval, 2-nerved, apex broadly notched, nerves ciliate, intramarginal, the narrow margins inflexed. Stamens 3; anthers ovate, sagittate, minute. Stigmas short, cylindrical.

Grain oblong, acute at both ends, loosely inclosed in its glume and palet, upper portion of the spikelet falling away together, rachilla disarticulating above the second glume.

PLATE XXXI; *a* and *b*, spikelet, the parts opened and the rachilla broken at the point of disarticulation. The flowering glume (to the left in *b*) should be ciliate on the back and the awn scabrous. The sterile glume (on the right in *b*) should be similarly awned, and the palet should be ciliate on the margins.



CHLORIS GLAUCA Vasey.

Plant annual, entirely glabrous.

Culm single, erect, 2 to 4 feet high, glabrous, unbranched.

Leaves of the root numerous; sheath very closely compressed, equitant, widely diverging, about 3 lines wide when folded, 8 inches or less long, continuing into the blade with a mere slight contraction at the mouth; blade folded below, flat above, keeled, 3 to 4 lines wide, 4 to 12 inches long, abruptly obtuse at the apex; second, third, and usually fourth internodes of the culm very short, their leaves similar to those of the root and appearing to start from the first node of the stem. Succeeding leaves 1 or 2, with longer close sheaths; blade nearly wanting.

Inflorescence an erect, pedunculate, umbellate cluster of 8 to 15 spikes. Spikes 3 to 5 inches long; rachis triangular, scabrous; this and the first and second glumes greenish straw-color, remainder of the spikelets very dark brown or black.

Spikelets in 2 rows on one side of the rachis, inserted alternately, those in each row at intervals of about $\frac{1}{2}$ line, 1 line long.

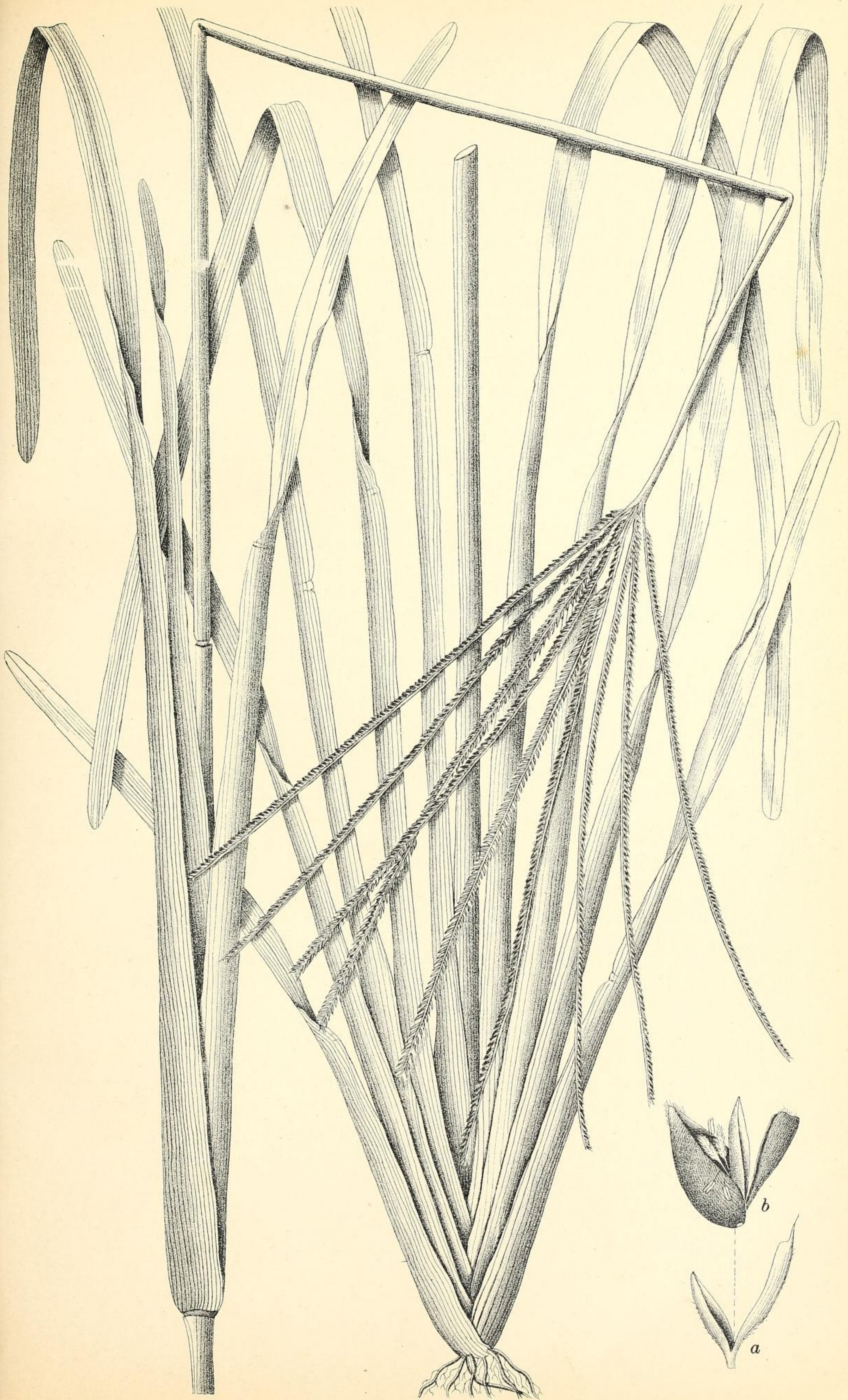
Glumes 4; first $\frac{5}{8}$ line long, ovate-lanceolate, acute, inæquilateral, with 1 rigid scabrous nerve; second 1 line long, linear, notched at the apex, nerved like the first, nerve produced into a short deflexed scabrous mucro, mucros second along the edge of the spike; third (flowering) glume compressed, scabrous toward the apex, each half oblong, acute; fourth (sterile) glume obovate, truncate, scabrous along the upper margin, rolled into a tube.

Flower single, hermaphrodite. Palet oblanceolate-oblong, notched at the acute apex, 2-nerved, with additional inflexed membranaceous margins. Stamens 3; anthers oblong-linear, $\frac{1}{4}$ line long, notched at the apex. Stigmas short cylindrical.

Grain oblong, acute at either end, triangular in cross-section; rachilla disarticulating above the second glume.

Plate XXXII; *a* and *b*, spikelet opened to show the parts; rachilla broken at the point of disarticulation. The leaf belonging to the uppermost node of the stem is not shown.

NOTE.—This species was inserted here, by mistake, instead of *Chloris Swartziana* Doell. (*Chloris petraea* Swz.), which occurs in Texas near the coast. It is much less robust, with narrower leaves, fewer spikes (3 to 5), and some difference in the flowers. It is possible, however, that both species may occur, although *Chloris glauca* is principally known from Florida.



CHLORIS GLAUCA, Vasey.

No. 33.

CHLORIS VERTICILLATA Nuttall.

Plant annual.

Culms single or few in a tuft, 10 to 16 inches high, branching at the base, the branches commonly sterile, spreading below.

Leaves sometimes obtuse, but usually acuminate, at the apex; sheath provided at the throat, especially near the margin within, with a few long slender hairs.

Inflorescence short-pedunculate or sometimes sheathed below. Spikes 8 to 14, 4 to 6 inches long, often naked at the base, clustered at the apex of the stem and at that point hairy, or a few verticillate branches in 1 or 2 series on a prolongation of the axis. Spikelets arranged in 2 rows on one side of the slender, scabrous rachis, at intervals in each row of about 2 to 2½ lines.

Spikelet about 1½ lines long, cuneate-obovate, compressed.

Glumes 4; first and second with 1 scabrous nerve, first as long as the spikelet, lanceolate, aristate-acute; second with a longer point, exceeding the spikelet; third (flowering) glume 3-nerved, bearing a slender scabrous awn (4 to 5 lines long) below the apex, broadly oblong, bluntly acute at each end, short-pilose on the midrib and intramarginal nerves, elsewhere glabrous; fourth (sterile) glume broadly obovate, nearly truncate, 3-nerved, glabrous, with an awn 3 to 4 lines long; small fifth glume, similar in form to fourth, usually present.

Flower sometimes single, hermaphrodite. Palet narrowly oblong, 2-nerved, nerves ciliate and margins inflexed. Stames 3; anthers minute. Stigmas cylindrical. Flower often present in the axil of the fourth glume, sometimes hermaphrodite, sometimes reduced to an empty palet.

Grain not seen.

PLATE XXXIII; *a*, spikelet opened to show the parts, the rachis broken. The figure represents an unexpanded panicle; when expanded, the branches are spread at right angles with the axis.



BOUTELOUA.

The genus *Bouteloua*, which includes those grasses popularly called grama grass, is a very large one in the Southwest, embracing many species, both annuals and perennials. They are nearly all nutritious and valuable for pasturage. The general characters of the inflorescence are as follows: 1 or several-flowered spikes single at the apex of the culm, or several disposed in a raceme; these spikes closely crowded or loosely imbricated with spikelets arranged on one side of the rachis in 2 rows; spikelets usually consisting of 1 perfect flower and a pedicel (bearing 1 to 3 stiff awns, and usually a few imperfect glumes with the awns); one or two additional imperfect flowers rarely present in the spikelet; flowering glumes variously lobed at the apex, lobes terminating with awns. The several species present a great diversity in the details of these general features.

BOUTELOUA ARENOSA Vasey.

Plant annual. Roots few, fibrous.

Culms in tufts, erect or decumbent, simple or geniculate and branching below, slender, 6 to 10 inches long.

Leaves sparse; sheath loose, shorter than the internode, striate; ligule conspicuous, strongly ciliate; blade $\frac{1}{2}$ to 1 line wide, 1 to 2 inches long, long-acuminate.

Panicle 2 to $2\frac{1}{2}$ inches long, composed of 3 or 4, mostly one-sided sessile spikes, $\frac{1}{2}$ to $\frac{3}{4}$ inches long, erect, or somewhat recurved, consisting of about 20 spikelets arranged alternately on the narrow flattened rachis.

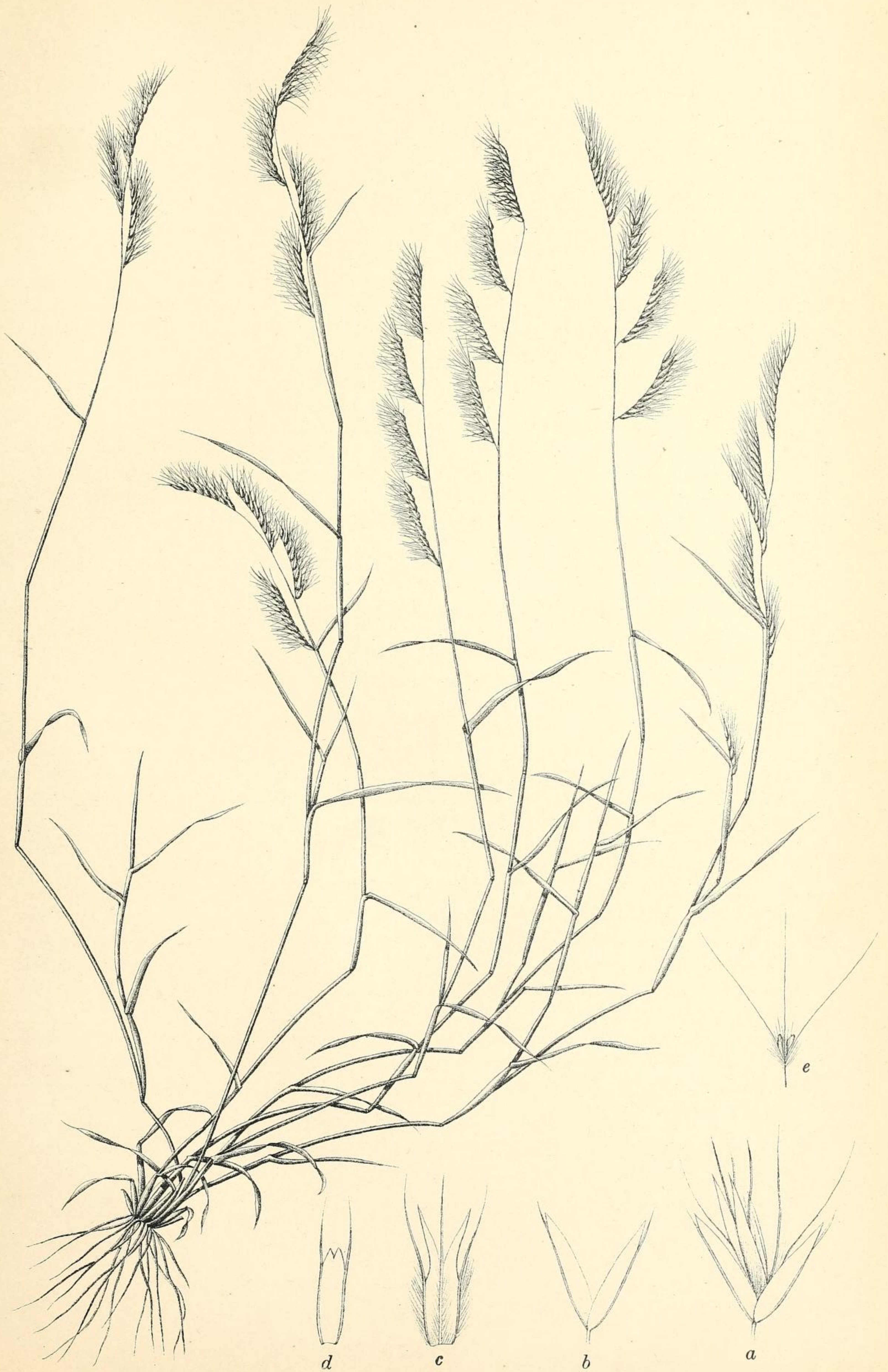
Spikelets imbricated, each with 1 perfect and 1 rudimentary flower, about 3 lines long including the awns.

Empty *glumes* thin, smooth, 1-nerved, oblong-lanceolate, 1 to $1\frac{1}{2}$ lines long, upper usually the longer, both acute and sometimes toothed at the apex and terminated with a short awn; flowering glume woolly externally, dividing into 2 lateral and 1 central awn, body about 1 line long, extending into 2 narrow teeth or lobes rather shorter than the awns, lateral awns nearly 2 lines long, central one somewhat shorter.

Palet narrower than its glume, 2- to 4-toothed, 2-nerved, nerves extended into awns. Imperfect flower inclosed by the flowering glume, consisting of 3 long awns at the summit of a short hairy pedicel, 2 of the awns having each a rudimentary scale at the base.

PLATE XXXIV; *a*, spikelet enlarged; *b*, empty glumes; *c*, flowering glume; *d*, palet; *e*, imperfect flower.

The specimens were from loose sandy soil, at Guaymas on the Gulf of California.



No. 35.

BOUTELOUA ARISTIDOIDES Thurber.

Plant annual.

Culms erect or decumbent, frequently geniculate and branching, slender, growing in clusters, very variable in development, often fruiting when a few inches high, sometimes reaching 2 feet in height.

Leaves with blades varying with the size of the plant from 1 to 3 or 4 inches in length, very narrow, erect, finely pointed; sheath short, striate, smooth except a few long hairs at the top; ligule a short, ciliate ring.

Panicles racemose, terminal and lateral, mostly 2 to 4 inches long, and consisting of 10 to 12 narrow, nearly sessile flower-spikes, these generally one-sided, in age spreading or horizontal, or even reflexed. Spikes $\frac{1}{2}$ to $\frac{3}{4}$ inch long, on short hairy pedicels; each spike with 2 to 4 closely appressed spikelets, lowest without the imperfect flower and pedicel.

Spikelets 3 lines long.

Lower empty glume linear or awl-shaped, one-half as long as the stouter upper one; this 3 lines long, 1-nerved, somewhat pubescent on the back; flowering glume linear-lanceolate, acuminate, 3-nerved, 3-toothed at the apex.

Palet a little shorter, 2-nerved, 2-toothed. Rudimentary flower consisting of 3 long awns on a short pedicel, wanting in the lower spikelet.

PLATE XXXV; *a*, spike; *b*, empty glumes; *c*, flowering glume; *d*, flowering glume of the lowest spikelet; *e*, palet; *f*, rudiment.

This species springs up in great abundance after the summer rains, and for a short time furnishes a large amount of food for stock on the ranges. It is one of the so-called six-weeks grasses.



No. 36.

BOUTELOUA BURKEI Scribner.

Rootstock short, strongly rooted, thickly covered with the crowded culms.

Culms slender, 4 to 8 inches high, with 3 to 4 nodes each.

Leaves mostly crowded at the base, small, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, $\frac{1}{2}$ line wide; ligule very short, ciliate; sheaths narrow, mostly shorter than the internodes.

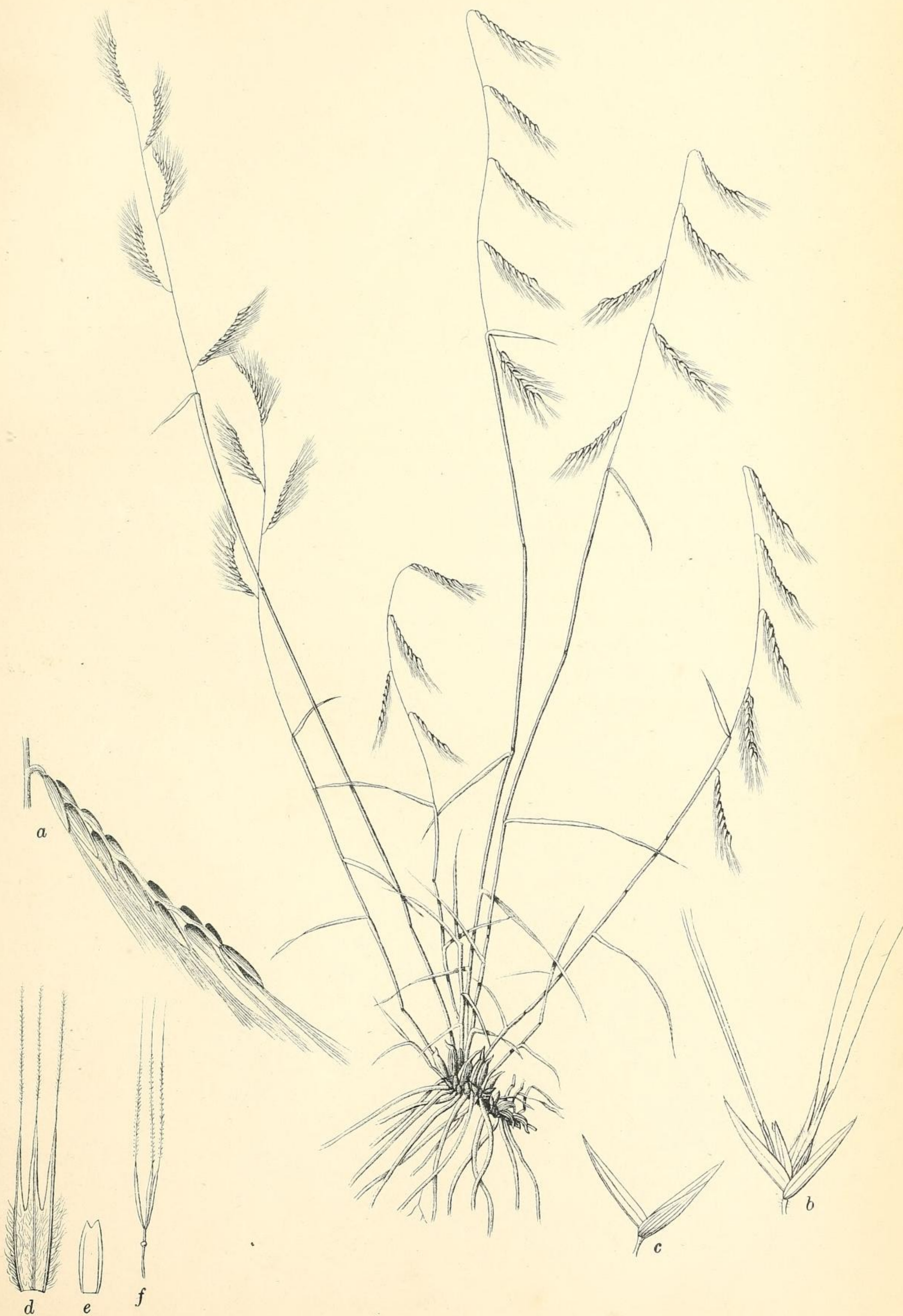
Inflorescence racemose-spicate, about one-third the length of the plant, consisting of about 5 spikes horizontal or even reflexed in age. Spikes $\frac{1}{2}$ to $\frac{3}{4}$ inch long, of 10 to 15 spikelets, arranged in 2 rows on one side of the rachis. Spikelets about 3 lines long including the awns.

Empty *glumes* 2, lanceolate, 1-nerved, smooth, nearly equal; body of the flowering glume less than 1 line long, nearly as broad, pubescent on the back, dividing into 3 lobes extended into awns;

Palet narrow, 2-nerved, 2-dentate at apex; imperfect flower consisting of 3 awns on a short, smooth pedicel.

PLATE XXXVI; *a*, spike; *b*, spikelet; *c*, empty glumes; *d*, flowering glume; *e*, palet; *f*, imperfect flower.

This species is closely related to *B. trifida*, which is somewhat larger, the empty glumes narrower and unequal, and the flowering glume longer and smooth.



BOUTELOUA ERIOPODA Torrey.

Perennial, strongly rooted.

Culms rather weak, straggling, often decumbent and rooting at the lower joints, 1 to 3 feet long, lower part of the culm and sheaths woolly-pubescent, particularly near the roots.

Leaves of the stem 5 or 6; blades narrow, short, 2 to 3 inches long, 1 to 2 lines wide, or from proliferous shoots, sometimes from 4 to 6 inches long; sheaths much shorter than the internodes.

Panicle racemose, 3 to 6 inches long, composed of 5 or 6 one-sided nearly sessile spikes; these 1 to 2 inches long, erect-spreading, each containing 15 to 20 spikelets.

Spikelets each with 1 perfect and 1 imperfect flower, 4 to 5 lines long, including the awns.

Perfect flower: outer empty glumes lanceolate, acuminate, 1-nerved, very unequal, lower about one-half the length of the upper; flowering glume pubescent at the base, otherwise smooth, faintly 3-nerved, linear-oblong, 3 lines long, with 2 narrow teeth at the apex and a middle one prolonged into an awn 1 line long; palet nearly as long, narrower, 2-nerved, finely 2-toothed at the apex.

Imperfect flower consisting of 3 slender awns on a pedicel, with a narrow tuft of hair below the united awns; whole 4 to 5 lines long.

PLATE XXXVII: 1, plant of matured size; 2, panicle of a smaller plant; *a*, empty glumes; *b*, flowering glume, palet, stamens, pistil, and imperfect flower.

This is the common black grama grass of southern New Mexico and Arizona, and is the most valuable grass of the mesas.



No. 38.

BOUTELOUA HAVARDII Vasey.

Rootstock short, roots very strong.

Culms erect, 1 to 2 feet high, leafy at the base, sparsely leafy above.

Lower *leaves* with the blades crowded, concave, rigid, rough on the margins and beneath, ciliate with short, rather distant, hairs; lower sheaths short, loose, striate; ligule a ring of short hairs; upper sheaths becoming much longer, blades shorter.

Panicle $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, composed of 5 to 7 short, thickish, approximate spikes, with short, woolly pedicels; spikes about $\frac{1}{2}$ inch long, erect or spreading, consisting of 9 to 13 crowded spikelets on a hairy rachis.

Spikelets 3 inches long beside the awns of the sterile flower, hairy.

Empty *glumes* lanceolate, acuminate, unequal; upper one 3 lines long, with a thick midrib, pungent, twice as long as the lower, both beset on the back with long white hairs; flowering glumes oblong-lanceolate, 3-nerved, 3 lines long, 3-toothed at the apex, strongly ciliate on the margins.

Palet about as long as its glume, 2-nerved, 2-toothed at the apex. Imperfect flower composed of 3 stout awns, 5 to 6 lines long, these hairy below and united at the summit of a naked pedicel.

PLATE XXXVIII: *a*, spikelet; *b*, flowering glume; *c*, palet; *d*, imperfect flower.



BOUTELOUA HIRSUTA Lagasca.

Roots fibrous, cæspitose.

Culms erect, simple, or in var. *minor* geniculate and branching below.

Leaves usually short, 1 to 4 inches long, narrow, sometimes ciliate on the margins, produced into a long, fine point; lower sheaths short, upper longer, and with shorter blades.

Panicle consisting of from 1 to 3 erect spikes, $\frac{1}{2}$ to $1\frac{1}{2}$ inches long.

Spikelets about 3 lines long, hirsute, densely crowded on one side of the smooth rachis; this extended in a naked point beyond the flowers.

Empty *glumes* unequal, lower about 1 line in length, narrowly lanceolate, acute, smooth; upper about $2\frac{1}{2}$ lines long, lanceolate, acuminate, awn-pointed, with a row of dark or black glands on either side of the midrib, each one emitting a long hair; flowering glume $2\frac{1}{2}$ lines long, including the awns, nearly smooth, oblong, lower half entire, upper divided into 3 lobes, each terminating in a short awn.

Palet narrower, entire, 2-nerved.

Imperfect flower on a short, smooth pedicel, consisting of 3 awns and 3 scales, awns extending a little beyond the perfect flower.

PLATE XXXIX: 1, typical plant; 2, var. *minor*; 3, var. *major*; a, empty glumes; b, perfect and imperfect flowers; c, flowering glume.

Several forms are grouped under this species; the three principal ones being here illustrated. The species has a wide range, from Mexico northward to Montana and east of the Mississippi in Illinois and Wisconsin. It is by no means as plentiful as *B. oligostachya*, and is less valuable as a forage grass.



BOUTELOUA HUMBOLDTIANA Kunth.

Culms erect, rarely branching, firm, 15 to 20 inches high, smooth, leafy below.

Leaves: sheath open, striate, shorter than the internodes; ligule inconspicuous; blade 1 to 2 lines wide, 3 to 6 inches long, scabrous especially on the margins, often sparsely ciliate below.

Inflorescence racemose, 3 to 4 inches long, consisting of about 7 to 9 one-sided, short-pedicelled spikes, lower ones $\frac{1}{2}$ inch or more distant, others gradually shorter; spikes about $\frac{1}{2}$ inch long, each consisting of 7 to 9 smooth spikelets, somewhat loosely overlapping each other.

Spikelets about $\frac{1}{2}$ inch long, including the awns, smooth, consisting of 2 to 3 flowers, upper male, others perfect, or the lower 2 fertile and the upper reduced to an awn.

Empty *glumes* nearly equal, 3 to 4 lines long, keeled, lanceolate, acute; flowering glume of the lower flower 4 lines long, lanceolate, 3-nerved, 3-toothed, at the apex of the second flower similar, but with the teeth extended into long awns (2 to 3 lines long).

Palet nearly as long as the glume, 2-nerved, 2-toothed at the apex. Third flower when present, sometimes with awns still longer, or imperfect or reduced.

PLATE XL: *a*, spikelet; *b*, empty glumes; *c*, flowering glume of the fertile flower; *d*, palet of the fertile flower; *c'*, flowering glume of the second flower; *d'*, palet of the second flower. The sterile flower reduced to a small pedicel is seen in *a*.

It is doubtful whether this plant, which has passed under the name *B. Humboldtiana*, is really identical with that described by Kunth. Our plant is more probably a form of *B. bromoides* Lag. In range it seldom extends north of New Mexico.



No. 41.

BOUTELOUA OLIGOSTACHYA Torrey.

Culms caespitose from a short thick rootstock extending into a thick close mat, slender, smooth, erect, 1 to 2 feet high.

Leaves mostly near the ground; blade short, curled, in moist situations becoming slender and longer, very narrow, attenuate into a slender point; sheath shorter than the internodes, close; ligule very short, ciliate.

Inflorescence consisting of 1 to 3 spikes, densely crowded with flowers on one side of the rachis, 1 to 1½ inches long, usually becoming curved and spreading; rachis narrow and sparsely pubescent.

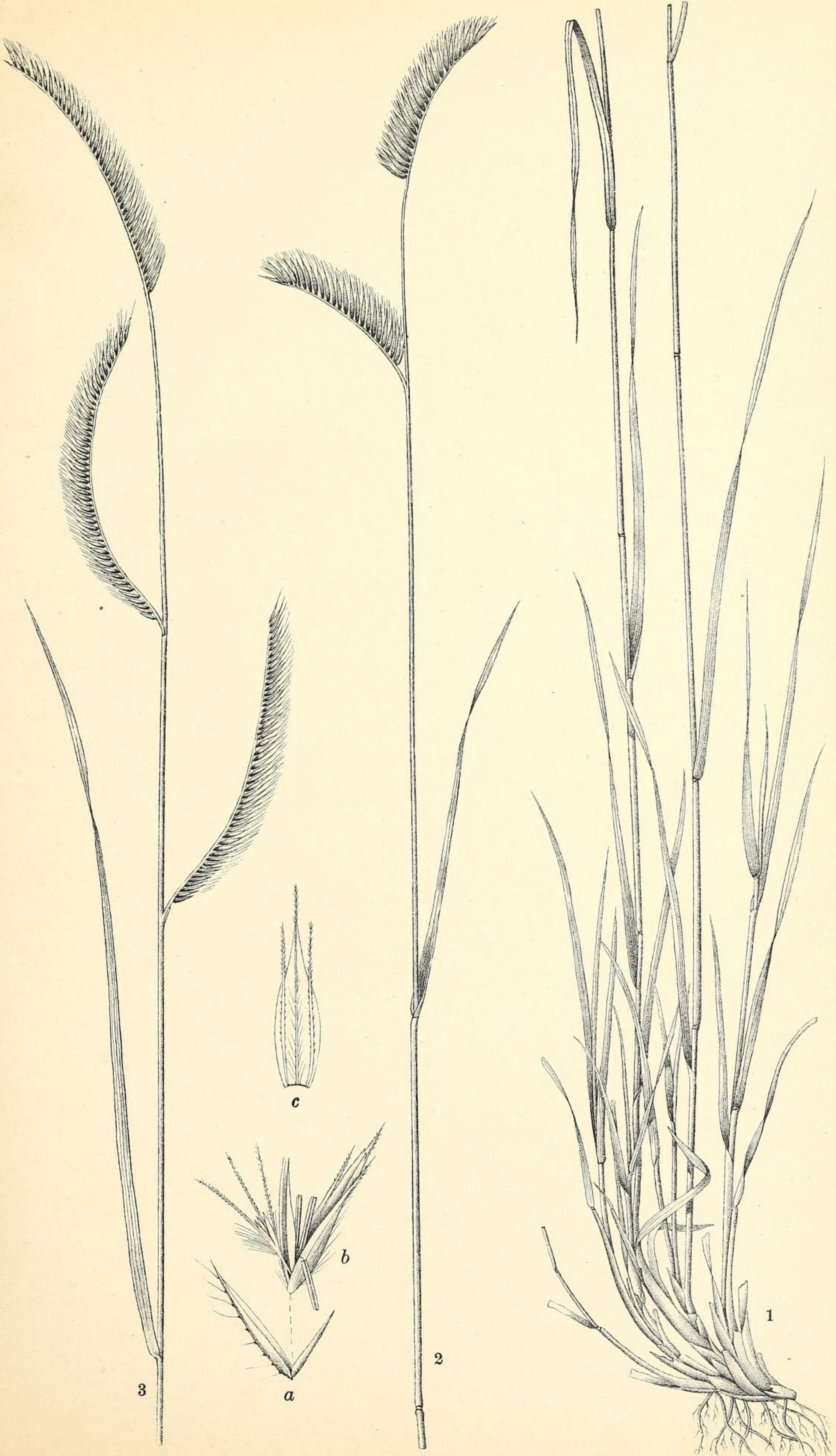
Spikelets very numerous (often 50 or more), in 2 rows on one side of the rachis, nearly at right angles with it, sparsely pubescent, sometimes sparsely granular on the keel, about 3 lines long, containing 1 perfect flower and 1 rudimentary one.

Empty *glumes* unequal, awn-pointed; lower one-half to two-thirds as long as the upper, thin; upper 2½ to 3 lines long, purplish; flowering glume lanceolate, 3 lines long, including the awns, hairy on the back, lobed to or nearly to the middle, middle lobe broad, lateral ones very narrow, all terminating in sharp awns.

Palea nearly equal in length to the flowering glume, narrower, 2-toothed at the apex, 2-nerved. Imperfect flower reduced to 3 equal awns, with 1 or 2 scales at the base, on a short pedicel having a tuft of white hairs at the top.

PLATE XLI: 1 and 2, typical plant; 3, larger form; *a*, empty glumes; *b*, perfect and imperfect flowers; *c*, flowering glume, from the back.

This species is probably more widely spread than any other of the family, and is the one which constitutes with the buffalo grass (*Buchloë dactyloides*) the main vegetation of the vast plains of the West.



No. 42.

BOUTELOUA PROSTRATA Lagasca.

Annual. Roots fibrous.

Culms growing in small depressed tufts, spreading or decumbent, geniculate, leafy to the top.

Leaves with short narrow blades $\frac{1}{2}$ to $1\frac{1}{2}$ inches long; sheath somewhat loose, shorter than the internodes, striate; ligule inconspicuous.

Inflorescence a single terminal spike, generally recurved, $\frac{3}{4}$ to 1 inch long, smooth.

Spikelets 20 to 30, in rows on one side of the smooth rachis, nearly 3 lines long, containing 1 perfect and 2 imperfect flowers.

Empty *glumes* unequal; lower about one-half the length of the upper, narrow; upper about 2 lines long, ovate-lanceolate, acute; flowering glume smooth or slightly pubescent on the back, about 3 lines long, lower half broadly oblong, upper 3-lobed, 3-awned, middle lobe broadest and longest, awns stiff.

Palet nearly 2 lines long, denticulate at the apex. Imperfect flower reduced to 3 stiff awns with 1 or 2 scales at the base. on a short pedicel having a tuft of white hairs at the top.

PLATE XLII: *a*, spikelet; *b*, empty glumes; *c*, flowering glume from the back; *d*, palet; *e*, imperfect flower.

This annual grass is widely distributed from Mexico to Colorado, prevailing in bottom lands, where it frequently mats the ground, but does not seem to be relished by cattle.



No. 43.

BOUTELOUA RACEMOSA Lagasca.

Culms in close tufts from a strongly rooted rootstock 2 to 3 feet high, unbranched.

Leaves with blades 4 to 12 inches long, 2 lines wide, long-pointed, scabrous; sheath loose, sparsely pubescent; ligule short.

Inflorescence racemose, 6 to 9 inches long, composed of 20 to 40 alternate, sometimes one-sided, short-pedicelled or nearly sessile, short spikes, these spreading or recurved, sometimes approximate, sometimes rather distant; common rachis angular, scabrous.

Spikes $\frac{1}{3}$ to $\frac{1}{2}$ inch long, variable in thickness and fullness, usually of about 5 spikelets, sometimes reduced to 2 or 3.

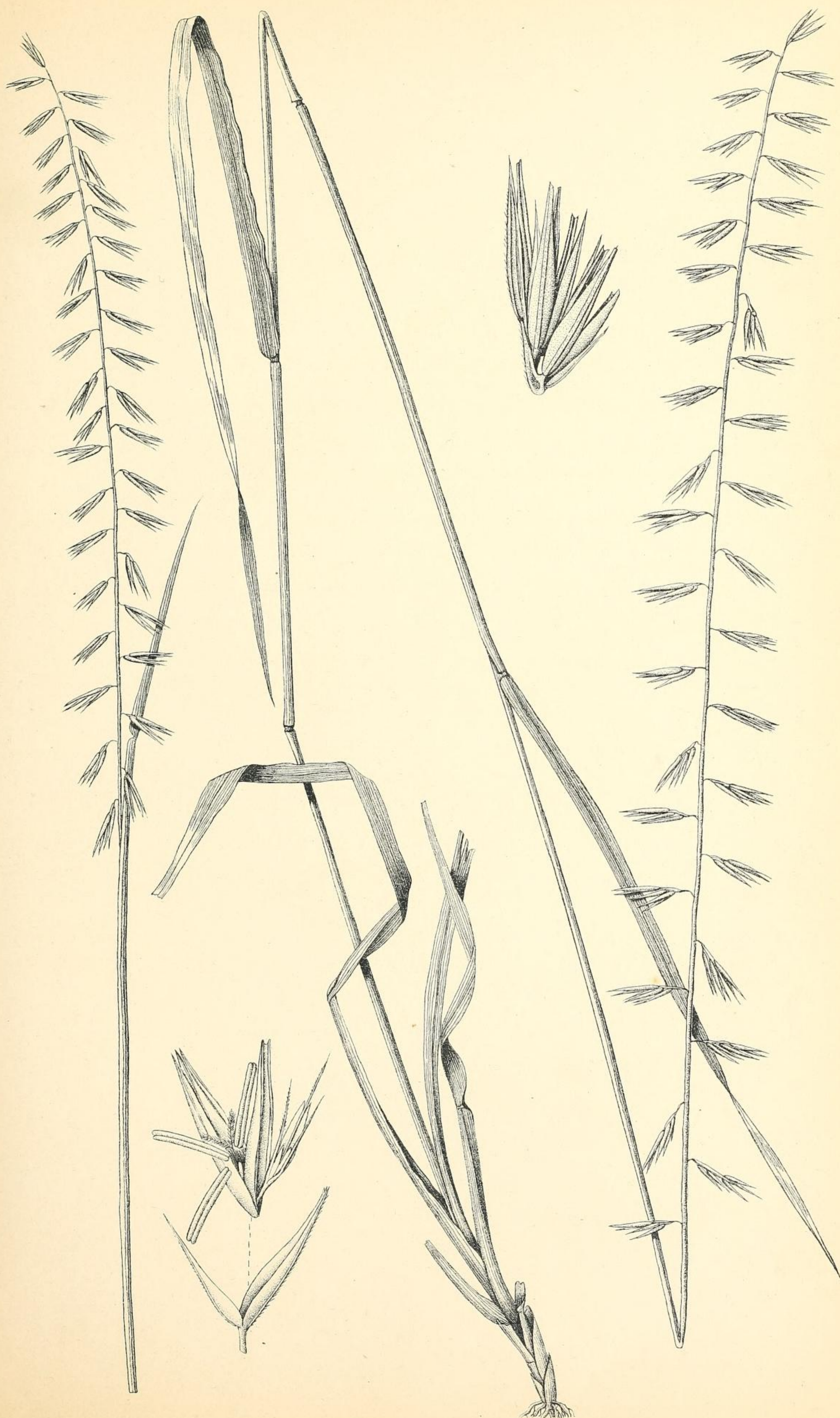
Spikelets 2 to 3 lines long without the awns, each 2-flowered.

Empty *glumes* unequal; lowest one-third shorter than the upper, narrow, awn-pointed; upper 2 lines long or more, ovate-lanceolate, acute; flowering glume about 2 lines long, oblong, smooth or somewhat pubescent on the margins, 3-nerved near the apex, with 3 short arms.

Palea as long as its glume, 2-nerved, 2-toothed at apex. Imperfect flower varying in development from a few rudimentary awns to a nearly full-formed flower, or in var. *aristosa* having a long-awned flowering glume and rudimentary scales.

PLATE XLIII: above, spike of about 3 spikelets; below, flower showing the empty glumes, perfect and imperfect flowers.

This is perhaps more widely diffused than any other species, ranging from Mexico to British America and east of the Mississippi in Illinois, Ohio, and several localities in eastern New York.



No. 44.

BOUTELOUA RAMOSA Scribner.

Culms many from a crowded short rootstock, strongly rooted, wiry-branched and almost woody below, slender, above leafy to the inflorescence, smooth.

Leaves with blades narrow, short, 1 to 2 inches long, attenuated to a fine point; sheath smooth, striate, with a few long hairs at the top; ligule very short.

Inflorescence consisting usually of 2 spikes, 1 to 1½ inches apart at the apex of the culm, 1 to 1¼ inches long, crowded with the 20 to 30 one-sided spikelets.

Spikelets about 2½ lines long, with 1 perfect and 1 imperfect flower.

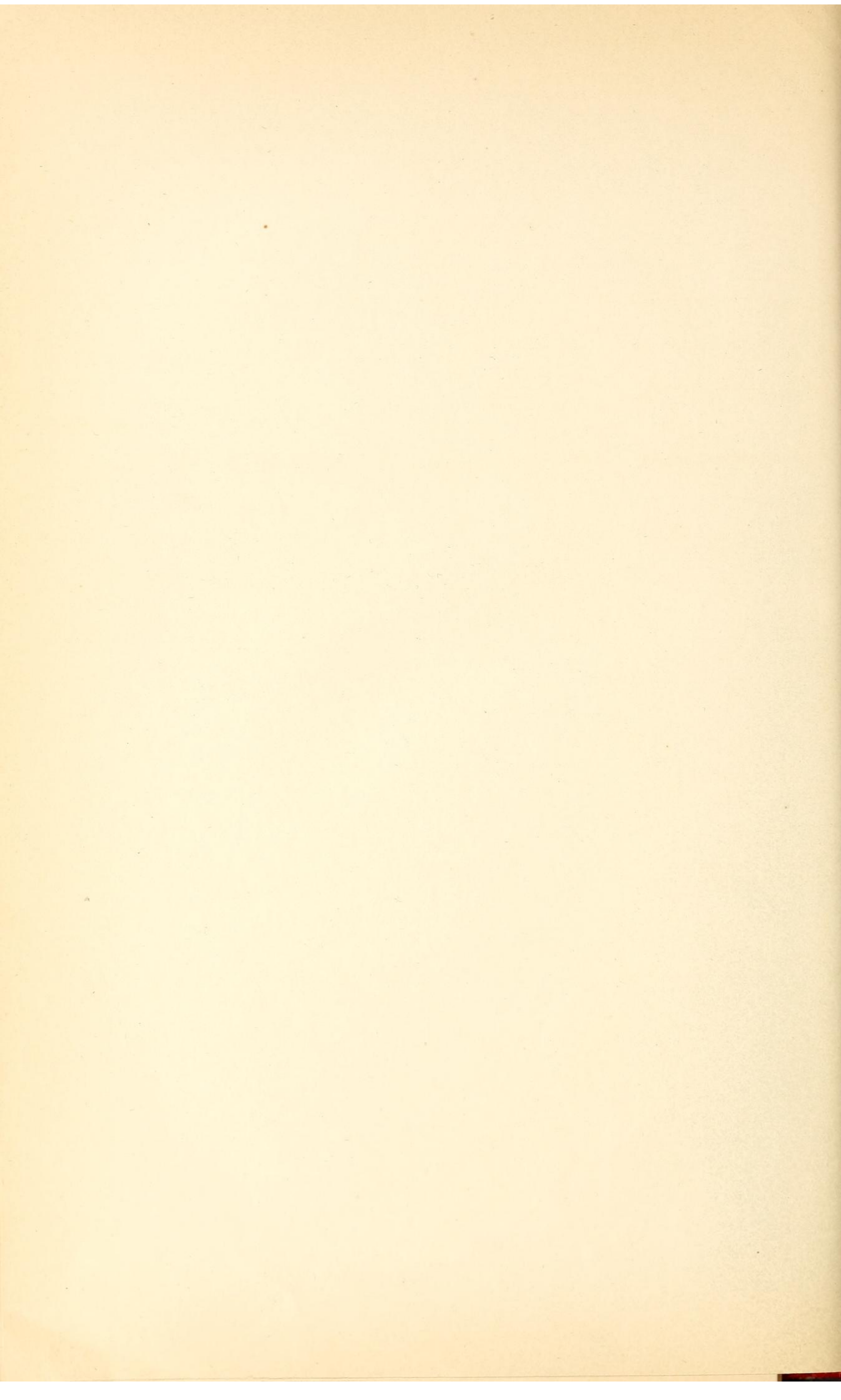
Empty *glumes* smooth, acute, unequal; lower less than one-half as long as the upper, narrow; upper lanceolate, nearly 2 lines long; flowering glumes over 2 lines long, lanceolate, clothed with long white hairs on the back and margins, divided at the apex into 3 sharply awned lobes.

Palet narrower, 2-toothed at the apex, smooth. Imperfect flower consisting of 3 awns with 2 or 3 imperfect glumes at their base, on a short pedicel densely hairy-tufted at the apex.

PLATE XLIV: *a*, spikelet spread open to show the parts; *b*, empty glumes; *c*, flowering glume; *d*, palet; *e*, imperfect or sterile flower and its pedicel.

This species extends from northern Mexico to Arizona and western Texas.





No. 45.

BOUTELOUA STRICTA Vasey.

Culms 2 to 2½ feet high, unbranched, wiry, stiffly erect, smooth; base clothed with old, persistent, broad sheaths.

Leaves few; blade erect, rigid, narrow, becoming setaceous-involute, 4 to 6 inches long, scabrous on the upper surface; lower sheaths broad, loose, smooth, and short, upper becoming long and narrow (3 to 4 inches long); ligule very short, ciliate.

Inflorescence about 4 inches long, consisting of 5 or 6 erect or appressed, narrow, one-sided spikes, these ¾ to 1 inch long, densely crowded with the 30 to 50 spikelets.

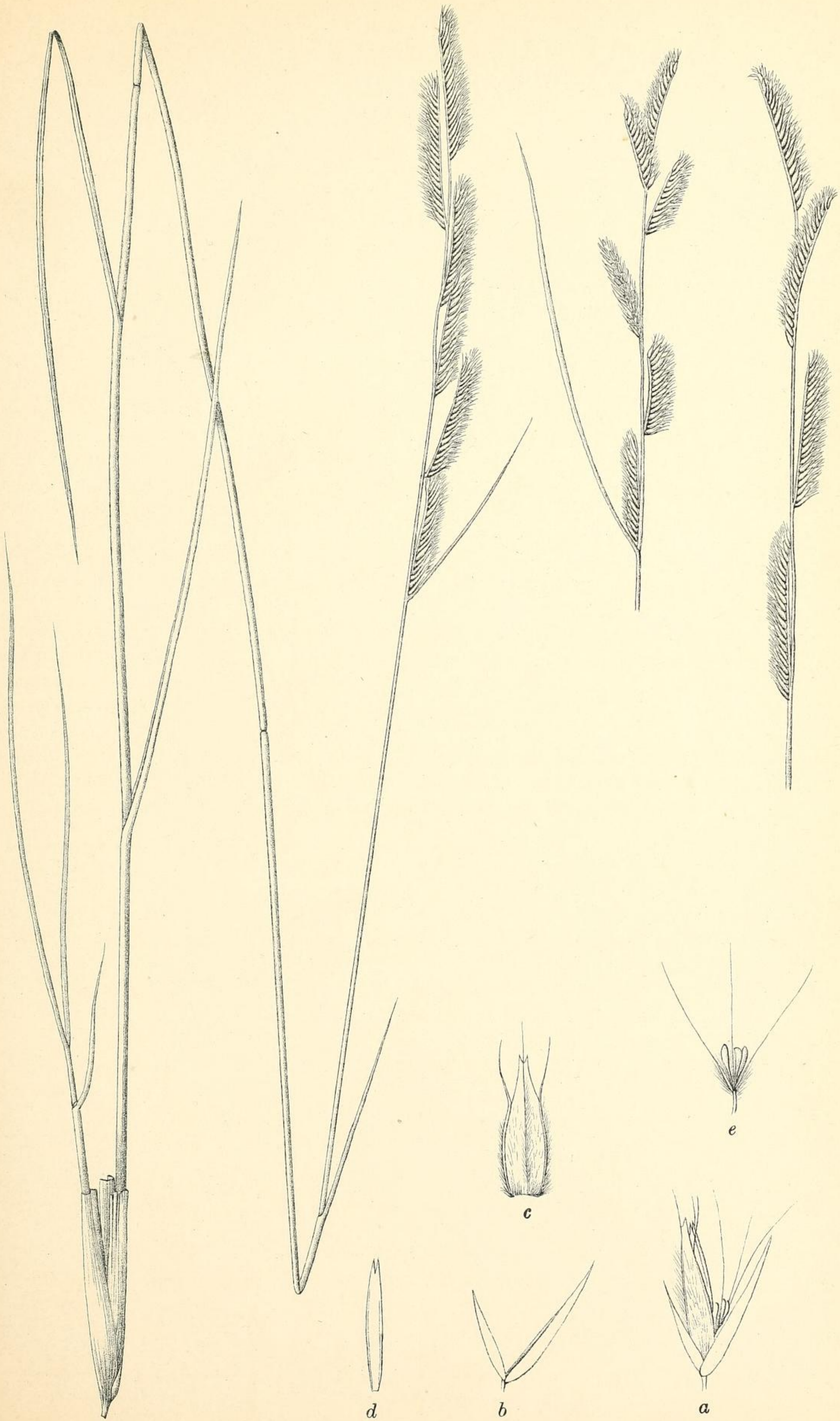
Spikelets 2 lines long, including the awns.

Empty *glumes* unequal, lanceolate, acute; lower one-half as long as the upper, nearly smooth; flowering glume 2 lines long, pubescent externally, oblong-lanceolate, 3-lobed above, lobes awned, lateral lobes a little shorter than the the central one.

Palet narrow, nearly as long as its glume, 2-nerved, 2-toothed at the apex. Imperfect flower consisting of 3 equal awns, with 2 or 3 imperfect glumes at the base, on a short pedicel with a tuft of soft hairs at its apex.

PLATE XLV; *a*, spikelet; *b*, empty glumes; *c*, flowering glume, seen from the back; *d*, palet; *e*, imperfect flower.

This species differs from *B. oligostachya* in its more wiry culms, more rigid habit, setaceous, appressed leaves, and dense, appressed, and more numerous spikes.



No. 46.

BOUTELOUA TRIFIDA Thurber.

Culms 6 to 12 inches long, slender, numerous, crowded on a short rootstock; base often thickened, covered with short, broad sheaths.

Leaves; blades small, radical sometimes 2 or 3 inches long, those of the culm often reduced to $\frac{1}{4}$ inch, smooth or sparsely hairy; sheath shorter than the internode.

Inflorescence of 4 to 6 erect or somewhat spreading smooth spikes, with about 15 to 30 spikelets rather loosely disposed.

Spikelets 3 lines long including the awns, containing 1 perfect and 1 imperfect flower.

Empty *glumes* slightly unequal; upper $1\frac{1}{2}$ lines long; lower one-fourth shorter, smooth, 1-nerved; flowering glumes narrow, body oblong, smooth, less than 1 line long, dividing above into 3 long-awned lobes (2 to $2\frac{1}{2}$ lines long).

Palet somewhat shorter and narrower than its glume, 2-toothed at the apex. Imperfect flower reduced to 3 slender awns slightly enlarged toward the base, on a short, smooth pedicel.

PLATE XLVI; *a*, spikelet; *b*, empty glumes; *c*, flowering glume; *d*, palet; *e*, imperfect flower.

This species closely resembles *B. Burkei*, No. 36, but a close comparison shows important differences.



BUCHLOË DACTYLOIDES Engelman.

Plant usually dioecious, rarely monœcious, male and female flowers heteromorphous.

Culms low, 4 to 8 inches high, in dense matted tufts or patches, interlaced with stolons from a few inches to 2 feet long, with nodes usually 2 to 3 inches apart, these developing tufts of leaves and culms and often taking root.

MALE PLANT.

Culms slender, erect or decumbent at base, with 3 or 4 leaves.

Leaves. Radical 4 to 6 inches long, 1 line or less wide, acuminate, smooth or ciliate, those of the culm $\frac{1}{2}$ to 2 inches long; upper sheaths often longer than the blades, loose; ligule and throat hairy.

Inflorescence a terminal panicle of 2 to 4 approximate, sessile or nearly sessile spikes, each $\frac{1}{2}$ inch or less in length.

Spikelets 5 to 10 or more in 2 ranks on one side of the rachis, crowded, each 2- or 3-flowered, about 2 lines long.

Outer empty *glumes* unequal, 1-nerved or the lower nerveless and minute, the upper one-half to two-thirds as long as the spikelet, oblong, acute, minutely pubescent; flowering *glumes* ovate, 2 lines long, membranaceous.

Palet ovate, acuminate, as long as the flowering *glumes*, 2-nerved; stamens 3; anthers 1 line long, linear.

FEMALE PLANT.

Flowering *culms* short, 2 to 3 inches high, 2 or 3 upper leaves clustered at the apex, their sheaths inclosing the base of the fertile flowers.

Inflorescence consisting of 1 to 3, commonly 2, short, clustered spikes, each 3 to $3\frac{1}{2}$ lines high, and of about 5 spikelets; rachis of the spike thickened.

Spikelets very different from the male ones, being each 1-flowered and the parts much indurated and modified.

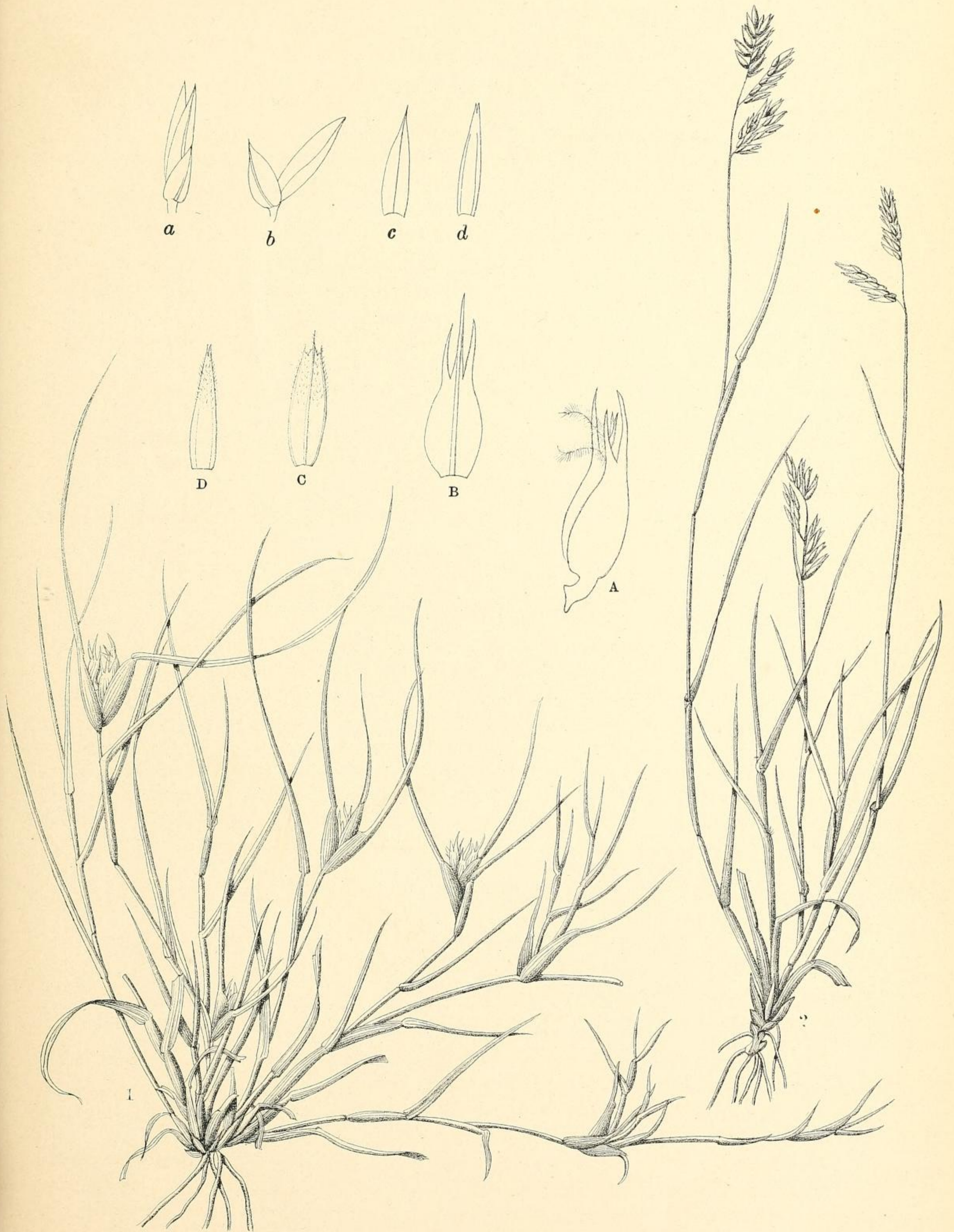
Upper empty *glume* indurated and cohering at the base with the enlarged rachis, becoming almost woody, divided at the apex into 3 or more rigid teeth, body convex externally and infolding the flower on its concave side; all the lower empty *glumes* (except that of the lowest spikelet) thin, ovate, acute, 1-nerved, scale-like, on the inner side of the spikelet; flowering *glumes* coriaceous, 3-nerved, 3-toothed at apex.

Palet similar in texture to the flowering *glume*, 2-nerved, 2-toothed, inclosing the large ovary.

PLATE XLVII; 1, male plant; 2, female plant; *a*, male spikelets; *b*, empty *glumes* of same; *c*, flowering *glume* of same; *d*, *palet* of same; *A*, female spikelet; *B*, upper empty *glume*; *C*, flowering *glume*; *D*, *palet*.

This grass is extensively spread over all the region known as the Great Plains. It grows in extensive patches, spreading largely by means of its stolons (similar to those of Bermuda grass), which are sometimes 3 feet long, with joints every few inches, frequently rooting at the joints and forming new plants.

The flowers of the two sexes are usually on separate plants, but sometimes both kinds are found on different parts of the same plant. This and the grama grass (*Bouteloua oligostachya*) are the principal native grasses of the Plains, and afforded the principal subsistence of the herds of buffalo which formerly inhabited them. It is rapidly disappearing before the advance of settlements.



EREMOCHLOE BIGELOVII Watson.

AND

EREMOCHLOE KINGII Watson.

1. *Eremochloë Bigelovii*.

Culms 6 to 10 inches high, tufted, branching below, smooth; upper portion naked, except 2 or 3 small approximate leaves below the panicle.

Leaves with blades $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, setaceous, striate, pungent.

Panicle small, 1 inch or less long, simple, or with 1 or 2 short branches, few-flowered.

Spikelets 4-flowered; 2 lower neutral; third perfect; fourth, or uppermost, reduced to 3 feathery awns on a short pedicel.

Empty glumes lanceolate, smooth, 1-nerved, about 3 lines long.

Sterile flowers consisting each of a flowering glume and palet. Flowering glume 2-lobed to the middle, densely ciliate, 3-nerved, with a slender feathery awn between the lobes, these tipped with a short awn; palets very narrow, smooth, 2-nerved, 2-toothed at the apex or very rudimentary.

Perfect flower with the flowering glume deeply 3-lobed, lobes extending into stiff ciliate awns; palet two-thirds as long, ovate, abruptly acuminate, smooth, slightly toothed at the apex; awns 3, strongly ciliate and united at the apex of a short smooth pedicel; a linear or awn-like scale sometimes attached to one of the sterile palets.

2. *Eremochloë Kingii*.

Culms low, tufted, 1 to 2 inches high.

Leaves crowded at the base of the stem; sheath dilated, ciliate at the margins and apex, persistent, and with the old blades cut into fibrillæ; blades $\frac{1}{2}$ to 1 inch long, rigid, involute, pungent.

Panicle short, oblong, sheathed at the base by the upper leaf, less simple than in the other species.

Spikelet 4-flowered; flowers as in *E. Bigelovii*.

Empty glumes 4 lines long, acute, smooth.

Sterile flowers more deeply lobed; middle awn membranaceous, margined below.

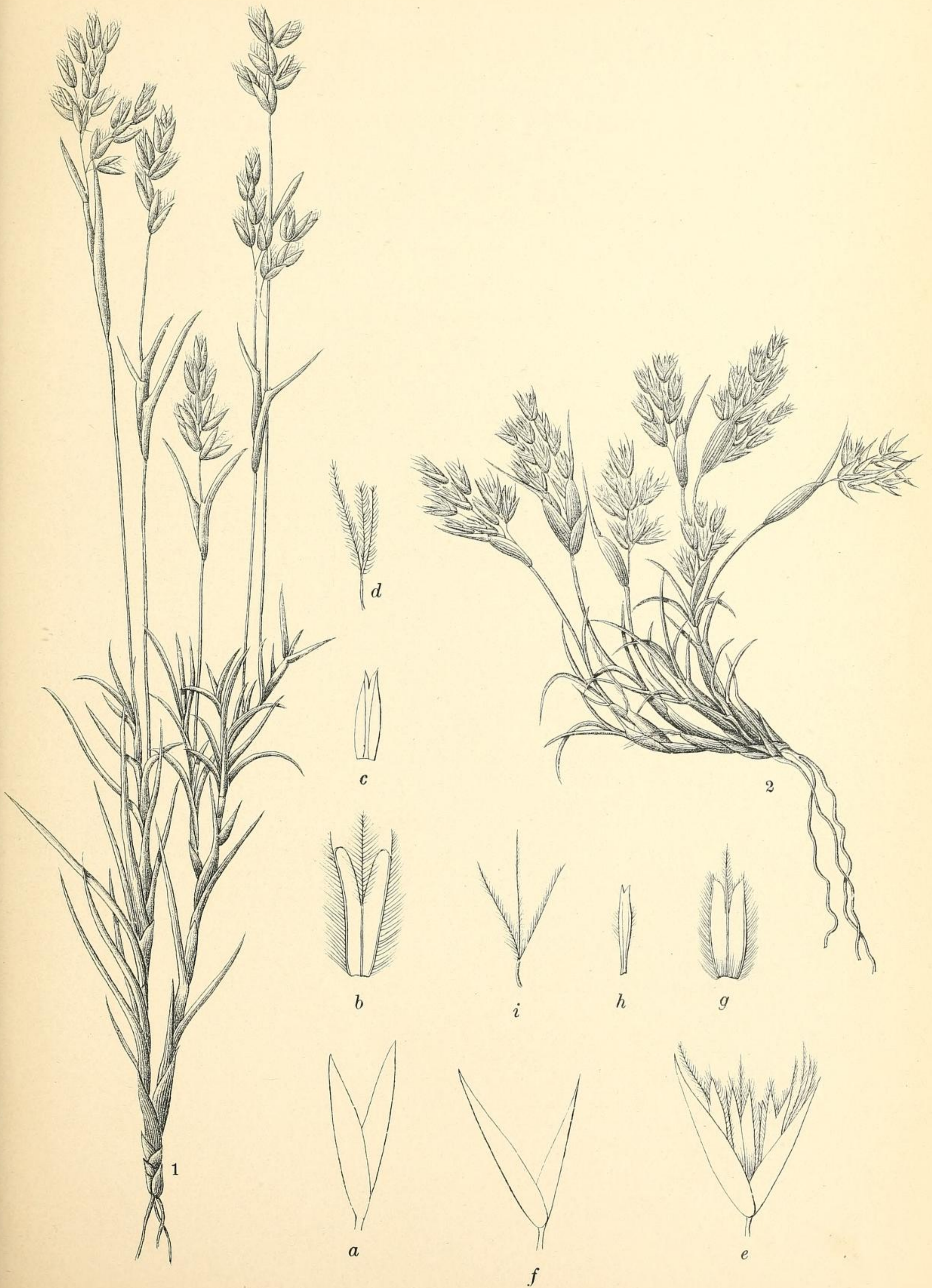
Perfect flower with the flowering glume deeply 3-lobed, middle lobe narrower. Pedicel and awns similar.

PLATE XLVIII; 1, *Eremochloë Bigelovii*; *a*, empty glumes; *b*, flowering glume; *c*, palet; *d*, pedicel and feathery awns.

2, *Eremochloë Kingii*; *e*, spikelet; *f*, empty glumes; *g*, flowering glume; *h*, palet; *i*, pedicel and feathery awns.

Eremochloe Bigelovii was found on the bluffs of the Rio Grande in western Texas. It has not recently been collected.

E. Kingii has been found at Peach Springs, Arizona, and at several places in Nevada.



1 EREMOCHLOË BIGELOVÏI, S. W.

2 EREMOCHLOË KINGÏI, S. W.

MELICA DIFFUSA Pursh.

Plant perennial.

Rootstock not seen. Roots slender.

Culms usually single, simple, erect, 2 to 5 feet high, sometimes shorter, terete, glabrous.

Leaves of the stem 4 to 6; sheaths usually distant, closely sheathing, glabrous, margins grown together to within about $\frac{1}{2}$ inch from the summit; blade 5 to 8 inches long, flat and reaching 4 lines broad, or much narrower ($1\frac{1}{2}$ lines) and involute, smooth or scabrous on both surfaces, scabrous points on the upper surface often producing hairs; ligule 1 to 2 lines long, lacerate when old.

Inflorescence paniculate. Panicle long-pedunculate, 4 to 10 inches long, with 3 to 7 nodes; branches 2 at each node, widely spreading, scabrous; one much the smaller, longer not exceeding $2\frac{1}{2}$ inches; rachis terete, nearly scabrous. Spikelets single, on slender scabrous pedicels enlarged and villous at the apex, abruptly bent just below.

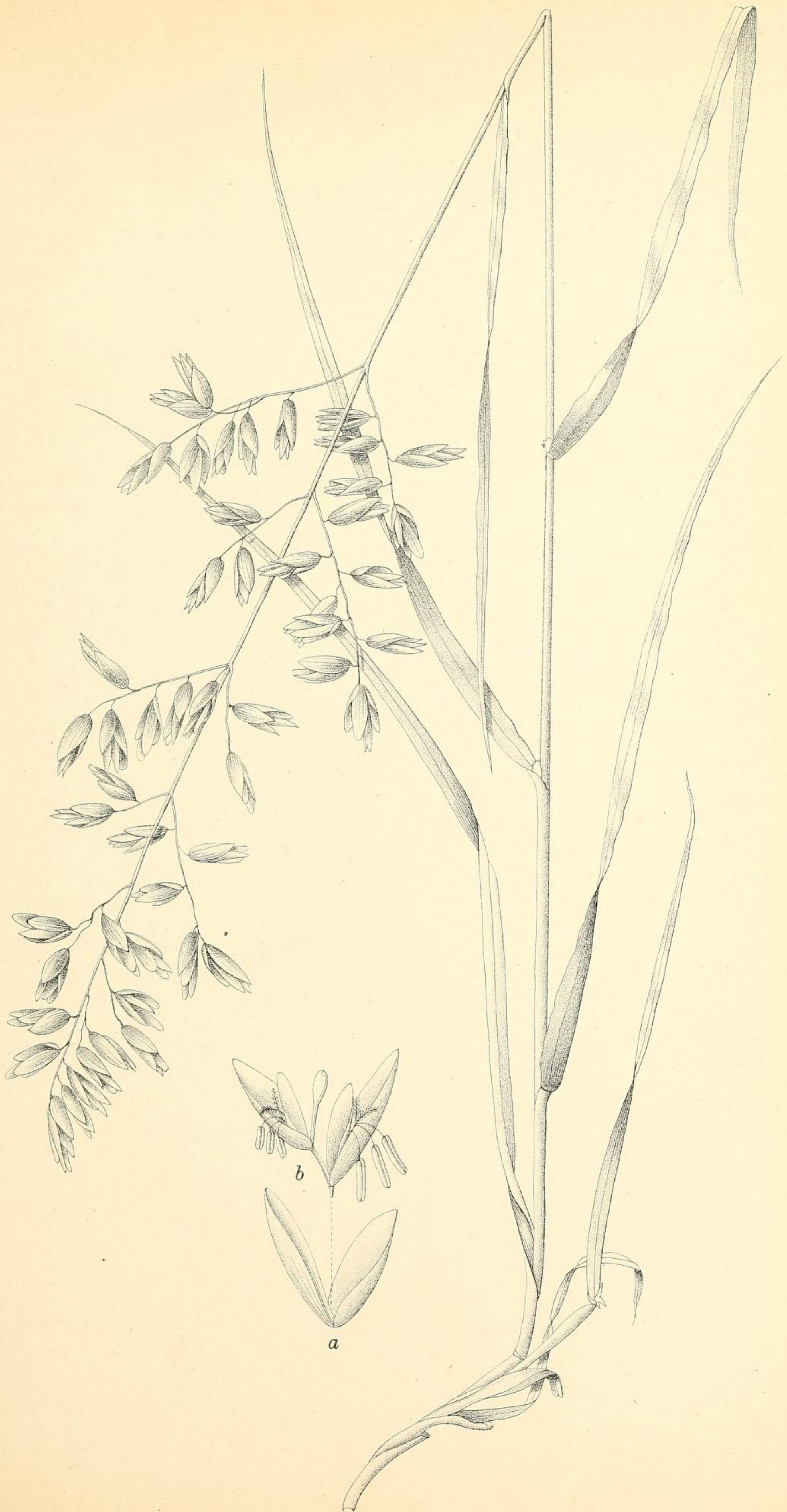
Spikelets narrowly to broadly oblong, slightly compressed, $4\frac{1}{2}$ to 6 lines long, 2- to 4-flowered with rudiments of 1 or 2 others above.

Glumes with green nerved body and membranaceous margins and apex; first 5-nerved, 3 to $3\frac{1}{2}$ lines long, oval, apex from broadly acute to acuminate; second about 5-nerved, 4 to 5 lines long, oblong-oblongate, apex broadly acute; flowering glume narrowly oblong, many-nerved, acute, scabrous on the back, 1 to 3 nerves passing through the membranaceous margin to the apex, lowest 4 to $5\frac{1}{2}$ lines long, upper successively shorter.

Flowers hermaphrodite. Palet oblong-oblongate in position, ciliate on the 2 nerves above, acute, with additional inflexed margins. Stamens 3; anthers linear, about $1\frac{1}{4}$ lines long. Stigmas not seen.

Grain 1 line long, narrowly oblong, obtuse at both ends, loosely inclosed between the glume and palet (and dropping from them when mature?); outer coat loose, wrinkled, and shining.

PLATE LXIX; *a* and *b*, spikelet enlarged showing the parts, rachilla broken above the second glume.



MELICA PORTERI Scribner.

Plant perennial.

Rootstock slender, creeping, scales distant. Roots very slender.

Culms tufted, slender, erect, 2 to 3 feet high, unbranched, glabrous.

Leaves of the stem 7 to 10; sheaths imbricated, sparingly backwardly scabrous, margins grown together; blades 6 to 12 inches long, upper sometimes shorter, 1 to 2 lines wide, flat, usually somewhat scabrous beneath, sparingly pilose above. Leaves of the root, with their sheaths, early decaying.

Inflorescence paniculate. Panicle terminal, short-pedunculate, 8 to 12 inches long; rachis terete, nearly glabrous; branches spreading in anthesis, afterwards erect, 3 inches long or less, scattered, commonly 2 at each node, one much smaller than the other. Spikelets borne singly on slender scabrous pedicels pilose and abruptly bent at the apex.

Spikelet 3- to 5-flowered, 4 to 7 lines long, slightly compressed, linear-oblong, narrowed at base and apex.

Glumes with green nerved body and broad hyaline margins and apex; first ovate, bluntly acute, 2 to 3 lines long, 1- to 5-nerved, middle nerve scabrous; second similar, one-third longer, 7- to 9-nerved; third (flowering) elliptical-oblong, narrowed to the base and apex, about 3 lines long, body rather coriaceous, scabrous on the back, with about 7 principal nerves and often with intermediate slender ones, all converging toward the apex but not uniting and not traversing the hyaline apex of the glume.

Flowers hermaphrodite. Palet oblong-lanceolate when in position, acute, ciliate on the 2 nerves, with additional inflexed membranaceous margins. Stamens 3; anthers linear, 1 line long. Stigmas cylindrical.

Grain (mature?) linear, 1 line long, dropping naked from the spikelet when ripe; pericarp rather loose, wrinkled; rachilla not disarticulating.

PLATE L; *a* and *b*, spikelet opened to show the parts. The second flower at least should have stigmas. The shorter glume in *a* is the outer one.

