

1. *Calamovilfa gigantea* (Nutt.) Scribn. & Merr. GIANT SANDREED [p. 445, 536]

*Calamovilfa gigantea* grows on sand dunes, prairies, river banks, and flood plains in the Rocky Mountains and central plains from Utah and Nebraska to Arizona and Texas.

2. *Calamovilfa longifolia* (Hook.) Scribn. PRAIRIE SANDREED [p. 445, 536]

*Calamovilfa longifolia* usually grows in sand or sandy soils, but is occasionally found in clay soils or loess. Two geographically contiguous varieties exist. They differ as shown in the following key; the differences between the two are more striking in the field.

- 1. Most spikelets overlapping no more than 1 other spikelet, usually with a brownish cast . . . . . var. *magna*
- 1. Most spikelets overlapping 2-3 other spikelets, usually without a brownish cast . . . . . var. *longifolia*

*Calamovilfa longifolia* (Hook.) Scribn. var. *longifolia* [p. 445]

*Calamovilfa longifolia* var. *longifolia* is a characteristic grass on the drier prairies of the interior plains, from southern Canada to northern New Mexico, with reports from southern Arizona. It also grows, as an adventive, in Washington, Wisconsin, Michigan, and Missouri.

*Calamovilfa longifolia* var. *magna* Scribn. & Merr. [p. 445]

*Calamovilfa longifolia* var. *magna* grows on dunes and sandy shores around lakes Superior, Michigan and Huron, with outlying stations in sand or sandy soils.

3. *Calamovilfa curtissii* (Vasey) Scribn. FLORIDA SANDREED [p. 445, 536]

*Calamovilfa curtissii* is a rare species, although sometimes locally common. It is restricted to two disjunct regions in Florida. Most Gulf Coast populations grow in moist flatwoods or adjacent to wet cypress depressions; Atlantic coast populations occur in interdune swales.

4. *Calamovilfa arcuata* K.E. Rogers CUMBERLAND SANDREED [p. 445, 536]

*Calamovilfa arcuata* is known only from a few scattered locations in the south-central United States. It grows along streams and rivers.

5. *Calamovilfa brevipilis* (Torr.) Scribn. PINE-BARREN SANDREED [p. 445, 536]

*Calamovilfa brevipilis* grows in moist to dry pine barrens, savannahs, bogs, swamp edges, and pocosins. It is a common grass on the New Jersey pine barrens and locally common across the coastal plain of North Carolina, but rare at present in Virginia and South Carolina.

16.33 MUHLENBERGIA Schreb.<sup>1</sup>

Pl ann or per; usu rhz, often csp, smt mat-forming, rarely stln. Clm 2-300 cm, erect, geniculate, or decumbent, usu hrb, smt becoming wd. Shth open; lig memb or hyaline (rarely firm or coriaceous), acuminate to truncate, smt minutely ciliolate, smt with lat lobes longer than the cent portion; bld narrow, flat, folded, or involute, smt arcuate. Infl tml, smt also ax, open to contracted or spikelike pan; dis usu above the glm, occ below the ped. Spklt with 1(2-3) flt. Glm usu (0)1(2-3)-veined, apc entire, erose, or toothed, truncate to acuminate, smt mucronate or awned; lo glm smt rdmt or absent, occ bifid; up glm shorter than to longer than the flt; cal poorly developed, glab or with hairs; lm glab, scabrous, or with short hairs, 3-veined (occ appearing 5-veined), apc awned, mucronate, or unawned; awns, if present, straight, flexuous, sinuous, or curled, smt

borne between 2 minute teeth; pal shorter than or equal to the lm, 2-veined; anth (1-2)3, purple, orange, yellow, or olivaceous. Car elongate, fusiform or elliptic, slightly dorsally compressed. Cleistogamous pan smt present in the axils of the lo cauline lvs, enclosed by a tightly rolled, somewhat indurate shth.

*Muhlenbergia* is primarily a genus of the Western Hemisphere. It has approximately 155 species. Sixty-nine of the 70 species treated here are native to the *Manual* region. The other species, *M. diversiglumis*, is included because it was recently reported from Texas, but no specimens supporting the report have been found. It may be based on a misidentification. Within the *Manual* region, *Muhlenbergia* is represented best in the southwestern United States.

In the key and descriptions, "puberulent" refers to having hairs so small that they can only be seen with a 10x hand lens.

- 1. Plants annual [for opposite lead, see p. 221].
- 2. Lemmas unawned or mucronate, the mucros to 1 mm long.
- 3. Glumes strigulose, at least on the margins or towards the apices, the hairs 0.1-0.3 mm long.
- 4. Pedicels of most spikelets strongly curved below the spikelets, often through 90° or more; anthers olivaceous, 0.6-1.2 mm long . . . . . 65. *M. sinuosa*
- 4. Pedicels of most spikelets straight to somewhat curved below the spikelets, rarely curved through 90°; anthers purplish, 0.2-0.7 mm long.
- 5. Sheaths and culm internodes strigulose; lemmas 1.3-2 mm long, the apices acute to acuminate, mucronate or shortly awned . . . . . 67. *M. texana* (in part)
- 5. Sheaths and culm internodes glabrous, sometimes scabridulous; lemmas 0.8-1.5 mm long, the apices obtuse to subacute, unawned . . . . . 66. *M. minutissima*
- 3. Glumes glabrous.
- 6. Panicles contracted, less than 0.5 cm wide; branches closely appressed at maturity; culms often rooting at the lower nodes . . . . . 38. *M. filiformis* (in part)
- 6. Panicles open or diffuse, 0.6-11 cm wide; branches spreading at maturity; culms not rooting at the lower nodes.

<sup>1</sup>Paul M. Peterson

7. Primary panicle branches 0.5–3.2 cm long; pedicels stout, 1–3 mm long, 0.5–1.5 mm thick; lemmas mottled, with greenish-black and greenish-white areas . . . . . 70. *M. ramulosa*
7. Primary panicle branches 0.4–6.2 cm long; pedicels delicate, 0.2–10 mm long, about 0.02 mm thick; lemmas not mottled, purplish, plumbeous, or brownish.
8. Primary panicle branches diverging 80–100° from the rachises; branches not developing below the lower leaf nodes; ligules with lateral lobes (vertical extensions of the sheath margins); plants truly annual . . . . . 69. *M. fragilis*
8. Primary panicle branches diverging less than 80° from the rachises; branches developing below the lower leaf nodes; ligules without lateral lobes; plants perennial but often appearing annual . . . . . 42. *M. uniflora* (in part)
2. Lemmas awned, the awns 1–32 mm long.
9. Upper glumes 2- or 3-veined, apices 2- or 3-toothed, not awned.
10. Lemma awns olive-green, sinuous to curled; lemmas widest near the middle, 1.7–2.2 mm long . . 47. *M. crispiseta*
10. Lemma awns purplish, flexuous; lemmas widest near the base, 1.4–4.2 mm long . . . . . 48. *M. peruviana*
9. Upper glumes 1-veined or veinless, entire, erose, or awned.
11. Lower glumes 2-veined, minutely to deeply bifid, the teeth aristate or with awns to 1.8 mm long; spikelets often in sessile-pedicellate pairs; disarticulation at the base of the pedicels.
12. Glumes subequal to the lemmas; lemmas 2.5–4.5 mm long, those of the upper spikelets with awns 6–15 mm long . . . . . 63. *M. depauperata*
12. Glumes up to  $\frac{2}{3}$  as long as the lemmas; lemmas 3.5–6 mm long, those of the upper spikelets with awns 10–20 mm long . . . . . 64. *M. brevis*
11. Lower glumes, if present, veinless or 1-veined, not bifid, unawned or with a single awn; spikelets borne singly; disarticulation above the glumes.
13. Lemma awns 1–5 mm long.
14. Glumes 0.1–0.3 mm long, the lower glumes often almost absent; ligules 0.2–0.5 mm long . . . . . 13. *M. schreberi* (in part)
14. Glumes 0.8–1.8 mm long; lower glumes 0.8–1.6 mm long; ligules 0.9–2.5 mm long.
15. Pedicels 2–7 mm long, usually longer than the florets, usually divergent; lemmas 1.3–2 mm long; lemma awns 0.1–1(2) mm long; caryopses 0.8–1 mm long; paleas minutely appressed-pubescent on the lower  $\frac{1}{2}$ , 1.3–2 mm long . . . . . 67. *M. texana* (in part)
15. Pedicels 1–2(3) mm long, usually shorter than the florets and appressed to the branches; lemmas (1.7)1.9–2.5 mm long; lemma awns 1.2–3.5 mm long; caryopses 1.3–2.3 mm long; paleas glabrous, 1.8–2.4 mm long . . . . . 68. *M. eludens*
13. Lemma awns 10–32 mm long.
16. Panicles secund; primary branches with 2–5 spikelets; secondary branches not developed; spikelets dimorphic with respect to the glumes, the glumes of the proximal spikelet on each branch subequal, to 0.7 mm long, orbicular and unawned, those of the distal spikelets evidently unequal, the lower glumes to 8 mm long and usually awned, the upper glumes orbicular, sometimes awned . . . . . 18. *M. diversiglumis*
16. Panicles not secund; primary branches always with more than 2 spikelets, usually with more than 5; secondary branches well-developed; spikelets monomorphic with respect to the glumes.
17. Ligules 0.3–0.9 mm long, membranous and ciliate; distal portion of the sheath margins with hairs to 1 mm long; lemmas subulate to lanceolate, with a scabrous line between the midvein and lateral veins, giving the lemmas a 5-veined appearance . . . . . 17. *M. pectinata*
17. Ligules 1–3(5) mm long, hyaline to membranous, often lacerate; sheath margins glabrous, even distally; lemmas lanceolate, smooth over most of their length, scabridulous to scabrous distally, not appearing 5-veined.
18. Cleistogamous panicles not present in the axils of the lower cauline leaves; upper glumes 1.5–2.8 mm long, acute . . . . . 14. *M. tenuifolia* (in part)
18. Cleistogamous panicles of 1–3 florets present in the axils of the lower cauline leaves; upper glumes 0.6–2 mm long, obtuse to subacute.
19. Lemmas 2.5–3.8(5.3) mm long; glumes 0.4–1.3 mm long; ligules 1–2 mm long . . . . . 15. *M. microsperma*
19. Lemmas 4–6.2(7.5) mm long; glumes 1–2 mm long; ligules 1.5–3 mm long . . . . . 16. *M. appressa*

1. Plants perennial [for opposite lead, see p. 219].
20. Plants rhizomatous, usually not cespitose; rhizomes scaly and creeping [for opposite lead, see p. 223].
21. Panicles open, (2)4–20 cm wide; panicle branches capillary (0.05–0.1 mm thick), diverging 30–100° from the rachises at maturity.
22. Lemmas awned, awns 1–12(20) mm long.
23. Blades stiff and pungent; lemma awns 1–1.5(2) mm long, straight; primary branches of the panicles appearing fascicled in immature plants . . . . . 32. *M. pungens*
23. Blades not stiff and pungent; lemma awns 4–12(20) mm long, flexuous; primary branches of the panicles not appearing fascicled . . . . . 24. *M. arsenei* (in part)
22. Lemmas unawned, sometimes mucronate with mucros to 0.3 mm long.
24. Culms compressed-keeled; blades conduplicate; panicles cylindrical, 4–8 cm wide . . . . . 39. *M. torreyana*
24. Culms terete to somewhat compressed-keeled near the base; blades usually flat, occasionally conduplicate; panicles ovoid, 4–16 cm wide.
25. Ligules 0.5–2 mm long, hyaline, with well-developed lateral lobes; blade margins and midveins prominent, white, thick . . . . . 41. *M. arenacea*
25. Ligules 0.2–1 mm long, ciliate, without lateral lobes; blade margins and midveins not prominent, greenish, not particularly thick . . . . . 40. *M. asperifolia*
21. Panicles contracted, 0.1–2(3) cm wide; panicle branches more than 0.1 mm thick, appressed or diverging up to 30(40)° from the rachises at maturity.
26. Culms 100–300 cm tall, 3–6 mm thick, woody and bamboolike . . . . . 33. *M. dumosa*
26. Culms 4–100(140) cm tall, 0.5–2(3) mm thick, herbaceous, not bamboolike.
27. Blades 0.2–2(2.6) mm wide, flat, involute, or folded at maturity.
28. Lemmas awned, the awns 1–2.5 mm long.
29. Lemmas pubescent for  $\frac{3}{4}$  their length, the hairs about 1.5 mm long . . . . . 21. *M. curtifolia*
29. Lemmas scabridulous or pubescent for no more than  $\frac{1}{2}$  their length, the hairs often less than 1.5 mm long.
30. Lemma awns generally less than 4(6) mm long . . . . . 19. *M. glauca* (in part)
30. Lemma awns 4–25 mm long.
31. Lemmas and paleas mostly glabrous, the calluses with a few short hairs; ligules with lateral lobes, the lobes 1.5–3 mm longer than the central portion; culms erect; plants tightly cespitose at the base; sheaths and blades commonly with dark brown necrotic spots . . . . . 22. *M. pauciflora* (in part)
31. Lemma midveins and margins and paleas appressed-pubescent on the lower  $\frac{1}{3}$ – $\frac{2}{3}$ ; ligules without lateral lobes or with lobes less than 1.5 mm longer than the central portion; culms decumbent; plants loosely cespitose at the base; sheaths and blades without necrotic spots.
32. Anthers orange, 1.5–2 mm long; lemmas elliptic, 2–3.5 mm long, the awns 10–20(25) mm long; panicles 0.3–1.8 cm wide . . . . . 23. *M. polycaulis* (in part)
32. Anthers purple, 1.3–3 mm long; lemmas lanceolate, 3.5–5 mm long, the awns 4–12(20) mm long; panicles 1–3(5) cm wide . . . . . 24. *M. arsenei* (in part)
28. Lemmas unawned, mucronate, or shortly awned, the awns to 1 mm long.
33. Lemmas and paleas pubescent, the hairs 0.4–1.2 mm long.
34. Glumes acuminate, usually awned, the awns to 1.5 mm long; anthers orange; blades flat to involute distally, never arcuate . . . . . 19. *M. glauca* (in part)
34. Glumes acute, neither mucronate nor awned; anthers yellow, dark green, or purple; blades tightly involute, often arcuate.
35. Lemmas 2.6–4 mm long; glumes nearly as long as the lemmas; anthers 2.1–2.3 mm long . . . . . 20. *M. thurberi*
35. Lemmas 1.4–2.5 mm long; glumes  $\frac{1}{2}$ – $\frac{2}{3}$  as long as the lemmas; anthers 0.9–1.4 mm long . . . . . 34. *M. villiflora*
33. Lemmas and paleas scabrous, glabrous, or with hairs less than 0.3 mm long.
36. Glumes more than  $\frac{1}{2}$  as long as the lemmas; lemmas 2.6–4.2 mm long, attenuate . . . . . 35. *M. repens*

36. Glumes  $\frac{1}{2}$  as long as the lemmas or less; lemmas 1.3–3.1 mm long; not attenuate.
37. Ligules 0.2–0.8 mm long; panicles usually partially included, the rachises usually visible between the branches ..... 36. *M. utilis*
37. Ligules 0.8–3 mm long; panicles exerted, the rachises usually hidden by the branches ..... 37. *M. richardsonis* (in part)
27. Blades (1.5)2–15 mm wide, flat at maturity.
38. Glumes awn-tipped, 3–8 mm long (including the awns), about 1.3–2 times longer than the lemmas.
39. Internodes dull, puberulent, usually terete, rarely keeled; culms seldom branched above the base; ligules 0.2–0.6 mm long; anthers 0.8–1.5 mm long ..... 2. *M. glomerata*
39. Internodes smooth and polished for most of their length, elliptic in cross section and strongly keeled; culms much branched above the base; ligules 0.6–1.7 mm long; anthers 0.4–0.8 mm long ..... 1. *M. racemosa*
38. Glumes unawned or awn-tipped, 0.4–4 mm long (including the awns), from shorter than to about 1.2 times longer than the lemmas.
40. Lemmas usually completely glabrous, rarely with a few appressed hairs.
41. Culms 30–100 cm tall, bushy and much branched above; axillary panicles common, partly included or exerted from the sheaths; lemmas shiny, stramineous or purplish, not mottled; anthers 0.3–0.5 mm long ..... 5. *M. glabrifloris*
41. Culms 5–30 cm tall, often mat-forming; axillary panicles not present; lemmas dark greenish or plumbeous, sometimes mottled; anthers 0.9–1.6 mm long ..... 37. *M. richardsonis* (in part)
40. Lemmas with hairs, these sometimes restricted to the callus.
42. Lemma bases with hairs about as long as the florets, usually 2–3.5 mm long ..... 6. *M. andina*
42. Lemma bases glabrous or with hairs shorter than the florets, usually shorter than 1.5 mm.
43. Glumes unequal in length, the lower glumes 0.4–1.5 mm long, the upper glumes 0.8–1.9 mm long ..... 7. *M. xcurtisetosa* (in part)
43. Glumes subequal, 1–4 mm long.
44. Axillary panicles often present, always partly included in the sheaths; internodes smooth, shiny.
45. Ligules 0.2–0.6 mm long; leaves of the lateral branches often shorter and narrower than those of the main branches; glumes 1.4–2 mm long,  $\frac{1}{3}$ – $\frac{2}{3}$  as long as the lemmas ..... 8. *M. bushii*
45. Ligules 0.7–1.7 mm long; leaves of the lateral branches similar in length and width to those of the main branches; glumes 2–4 mm long, about as long as the lemmas ..... 9. *M. frondosa*
44. Axillary panicles, if present, exerted on elongated peduncles; internodes smooth, scabrous, or pubescent, sometimes smooth and shiny.
46. Glumes much shorter than the lemmas, acute.
47. Anthers 0.4–1 mm long; lemmas unawned, or with an awn less than 1 mm long; internodes and sheaths glabrous ..... 10. *M. sobolifera*
47. Anthers 1.1–2.2 mm long; lemmas usually awned, occasionally unawned, the awns to 12 mm long; internodes, and usually the base of the sheaths, pubescent ..... 11. *M. tenuiflora*
46. Glumes nearly as long as or longer than the lemmas, acuminate.
48. Anthers 1–1.7 mm long; sheaths scabrous; lemma awns 0.2–2.2 mm long; restricted to the Transverse Ranges of southern California ..... 4. *M. californica*
48. Anthers 0.3–0.8 mm long, sheaths smooth for most of their length; lemma awns to 18 mm long;



- widespread species, but not known from southern California.
49. Ligules 0.4–1 mm long; panicles dense; pedicels up to 2 mm long; anthers 0.3–0.5 mm long . . . . . 3. *M. mexicana*
49. Ligules 1–2.5 mm long; panicles not dense, pedicels 0.8–3.5 mm long; anthers 0.4–0.8 mm long . . . . . 12. *M. sylvatica*
20. Rhizomes absent; plants caespitose or bushy [for opposite lead, see p. 221].
50. Upper glumes usually 3-veined and 3-toothed; old sheaths flattened, ribbonlike or papery, sometimes spirally coiled.
51. Lemmas unawned, mucronate, or with awns to 5 mm long.
52. Lower glumes awned, the awns to 1.6 mm long; blades 2–6 cm long, filiform, tightly involute, sharp-tipped . . . . . 43. *M. filiculmis*
52. Lower glumes unawned; blades (5)6–12 cm long, flat or loosely involute to subfiliform, not sharp-tipped . . . . . 44. *M. jonesii*
51. Lemmas awned, the awns (2)6–27 mm long.
53. Upper glumes as long as or longer than the lemmas, the apices acuminate to acute, occasionally minutely 3-toothed; old sheaths conspicuously spirally coiled . . . . . 45. *M. straminea*
53. Upper glumes  $\frac{1}{2}$ – $\frac{2}{3}$  as long as the lemmas, the apices truncate to acute, 3-toothed; old sheaths occasionally spirally coiled . . . . . 46. *M. montana*
50. Upper glumes usually 1-veined, (rarely 2- or 3-veined), rounded, obtuse, acute, or acuminate, entire or erose; old sheaths not flattened or papery, never spirally coiled.
54. Panicles loosely contracted, open, or diffuse, (1)2–40 cm wide; panicle branches usually not appressed at maturity, often naked basally [for opposite lead, see p. 225].
55. Culms arising from the bases of old depressed culms; plants loosely matted, delicate; lemmas 1.2–2 mm long, unawned . . . . . 42. *M. uniflora* (in part)
55. Culms not arising from the bases of old depressed culms; plants caespitose, not delicate; lemmas 2–5 mm long, awned or unawned.
56. Lemmas unawned or with awns to 4(6) mm long.
57. Basal sheaths laterally compressed, usually keeled.
58. Glumes longer than the lemmas; ligules 10–25 mm long, membranous throughout; lemmas 2–3 mm long, usually awned, the awns to 15 mm long, occasionally unawned . . . . . 49. *M. emersleyi* (in part)
58. Glumes shorter than the lemmas; ligules 3–12 mm long, firm and brown near the base, membranous distally; lemmas 3–4.2 mm long, awned, the awns 0.5–4 mm long . . . . . 50. *M. xinvoluta*
57. Basal sheaths rounded to somewhat flattened, not keeled.
59. Culms 10–60(70) cm tall, somewhat decumbent; blades 0.5–10(16) cm long.
60. Blade margins and midveins conspicuous, thick, white, and cartilaginous; ligules 1–2 mm long . . . . . 29. *M. arizonica*
60. Blade margins not conspicuously thickened, greenish; ligules 2–9 mm long.
61. Blades arcuate, 0.3–0.9 mm wide, 1–3(5) cm long; usually no culm nodes exposed; most leaf blades reaching no more than  $\frac{1}{2}$  of the plant height . . . . . 30. *M. torreyi*
61. Blades not arcuate, 1–2.2 mm wide, 4–10(16) cm long; 1 or more culm nodes exposed; leaf blades reaching  $\frac{1}{4}$ – $\frac{1}{2}$  of the plant height . . . . . 31. *M. arenicola*
59. Culms 40–160 cm tall, erect from the base; blades (8)10–100 cm long.
62. Pedicels 0.1–2.5 mm long, usually shorter than the florets; glumes usually longer than the florets; ligules 10–30 mm long; panicle branches not capillary, appressed or spreading up to 60° from the rachises, the lower branches with 30–60 spikelets . . . . . 51. *M. longiligula* (in part)
62. Pedicels 3–50 mm long, longer than the florets; glumes usually shorter than the florets; ligules 1.8–10 mm long; panicle branches capillary, spreading 30–100° from the rachises, the lower branches with 5–20 spikelets.

63. Panicles about as long as wide, not diffuse, 10–20(30) cm long; branches and pedicels stiff or flexible . . . . . 55. *M. reverchonii* (in part)
63. Panicles longer than wide, diffuse, 15–60 cm long; branches and pedicels flexible.
64. Glumes more than  $\frac{1}{2}$  as long as the lemmas; lemmas usually unawned, if awned, the awns no more than 3 mm long . . . . . 52. *M. expansa*
64. Glumes less than  $\frac{1}{2}$  as long as the lemmas; lemmas usually awned, the awns to 18 mm long . . . . . 53. *M. capillaris* (in part)
56. Lemma awns 6–35 mm long.
65. Plants conspicuously branched, bushy in appearance; culms wiry, with geniculate, stiff, widely divergent branches . . . . . 26. *M. porteri*
65. Plants not conspicuously branched, not bushy in appearance, usually typical bunchgrasses; culms not wiry, when branched, the branches not both geniculate and widely divergent.
66. Basal sheaths laterally compressed, commonly keeled; glumes (excluding any awns) exceeding the florets; culms (50)80–150 cm tall . . . . . 49. *M. emersleyi* (in part)
66. Basal sheaths rounded; glumes (excluding any awns) exceeded by the florets; culms 30–160 cm tall.
67. Glume apices puberulent or scabridulous, acuminate to acute; lemmas long-acuminate, the demarcation of the lemma body and awn not evident . . . . . 57. *M. elongata*
67. Glume apices glabrous or sparsely hirtellous, obtuse to acute, sometimes awned; lemmas acute to acuminate, the demarcation of the lemma body and awn evident.
68. Glumes neither awned nor mucronate; spikelets dark purple; lemmas scabrous distally.
69. Panicles 8–41 cm wide, open, diffuse, the branches strongly divergent; pedicels 10–40(50) mm long; in the *Manual* region, restricted to the eastern United States, growing from Connecticut south to Kansas, Oklahoma, eastern Texas, and Florida . . . . . 53. *M. capillaris* (in part)
69. Panicles 2–5 (12) cm wide, loosely contracted to open, most branches appressed to ascending, occasionally a few diverging up to 80°; pedicels 1–10 mm long; in the *Manual* region, restricted to the southwestern United States, growing from Arizona to western Texas . . . . . 56. *M. rigida*
68. Glumes usually awn-tipped or mucronate; spikelets stramineous, brown, or purplish; lemmas smooth or scabrous distally.
70. Lemmas shiny, smooth; blades tightly involute, 0.2–1.2 mm wide; panicles 2–5 cm wide, loosely contracted; branches diverging up to 70° from the rachises . . . . . 58. *M. setifolia*
70. Lemmas not shiny, usually scabrous, at least distally; blades flat or involute, 1–4 mm wide; panicles 5–40 cm wide, loosely contracted to open; branches diverging 30°–100° from the rachises.
71. Panicles 10–20(30) cm long, about equally wide, not diffuse; branches spreading up to 80° from the rachises at maturity; spikelets stramineous, brownish or purple-tinged; lemmas awned, the awns 0.5–6 mm long . . . . . 55. *M. reverchonii* (in part)
71. Panicles 15–50(60) cm long, narrower than long, diffuse; branches spreading 30–100° from the rachises at maturity; spikelets usually purplish; lemmas unawned or, if awned, the awns to 35 mm long.
72. Upper glumes unawned or with awns to 5 mm long; lemmas without setaceous teeth or the

- teeth no more than 1 mm long; lemma awns 2–13(18) mm long . . . . . 53. *M. capillaris* (in part)
72. Upper glumes awned, the awns 2–25 mm long; lemmas with setaceous teeth 1–5 mm long; lemma awns 8–35 mm long . . . . . 54. *M. sericea*
54. Panicles narrow, 0.2–3(5) cm wide; branches appressed to ascending at maturity, usually spikelet-bearing their whole length [for opposite lead, see p. 223].
73. Panicles spikelike, 0.1–1.2 cm wide, sometimes interrupted near the base; branches appressed, 0.3–1.2(4) cm long.
74. Culms 3–20(35) cm tall, often decumbent and rooting at the lower nodes; blades 1–4(6) cm long . . . . . 38. *M. filiformis* (in part)
74. Culms (15)20–150 cm tall, stiffly erect, not rooting at the lower nodes; blades 1.4–50 cm long, at least some more than 6 cm long.
75. Lemmas awned, awns 3–10 mm long; lemmas scabridulous, the veins and margins glabrous . . . . . 59. *M. palmeri* (in part)
75. Lemmas unawned, sometimes mucronate, the mucros up to 1 mm long; lemmas with hairs on the lower  $\frac{1}{6}$ , the hairs sometimes extending to  $\frac{3}{4}$  of the lemma length over the midvein and margins.
76. Basal leaf sheaths rounded on the back; panicles 15–60 cm long . . . . . 62. *M. rigens*
76. Basal leaf sheaths compressed, the backs keeled; panicles 4–16 cm long.
77. Ligules 0.2–0.8 mm long; paleas glabrous; glume apices gradually acute to acuminate, mucronate, the mucros to 0.3 mm long . . . . . 27. *M. cuspidata*
77. Ligules 1–3(5) mm long; paleas pubescent between the veins; glumes abruptly narrowed, acute or obtuse, awned, the awns 0.5–1 mm long . . . . . 28. *M. wrightii*
73. Panicles not spikelike, 0.6–5 cm wide; branches appressed, ascending, or diverging up to 70°, 0.2–13 cm long.
78. Ligules 10–35 mm long, firm and brown basally, membranous distally; glumes as long as or longer than the florets.
79. Basal sheaths rounded; lemmas unawned or with awns to 2 mm long; plants of Arizona and New Mexico . . . . . 51. *M. longiligula* (in part)
79. Basal sheaths compressed-keeled, at least basally; lemmas unawned or with awns to 4 mm long; endemic to south central Texas, sometimes grown as an ornamental . . . . . 60. *M. lindheimeri*
78. Ligules 0.2–10 mm long, usually membranous throughout, sometimes firmer basally, never brownish; glumes shorter than the florets.
80. Lemma awns 0.5–6 mm long.
81. Blades 10–60 cm long.
82. Glumes acute, unawned; ligules 4–10 mm long, acute, lacerate; spikelets grayish-green . . . . . 61. *M. dubia*
82. Glumes acute to acuminate, awned, the awns to 1.5 mm long; ligules 1–3 mm long, truncate, ciliolate; spikelets yellowish-brown to purplish . . . . . 59. *M. palmeri* (in part)
81. Blades to 10 cm long.
83. Glumes 2–4 mm long; lemmas 3.5–5 mm long, the awns flexuous; ligules 1–2 mm long, with lateral lobes less than 1.5 mm longer than the central portion; anthers 1.3–3 mm long, purple . . . . . 24. *M. arsenei*
83. Glumes less than 2 mm long; lemmas 1.8–3(3.4) mm long, the awns straight; ligules 0.2–1.1 mm long, without lateral lobes; anthers 0.2–0.9 mm long, yellow.
84. Upper glumes veinless, 0.1–0.3 mm long; lower glumes rudimentary or lacking, veinless . . . . . 13. *M. schreberi* (in part)
84. Upper glumes 1(2)-veined, 0.8–1.9 mm long; lower glumes 0.4–1.5 mm long, veinless or 1-veined . . . . . 7. *M. ×curtisetosa* (in part)
80. Lemma awns 6–40 mm long.
85. Glumes 0.3–1 mm long, obtuse to acute, sometimes erose, not awned; anthers 0.9–1.6 mm long . . . . . 25. *M. spiciformis*
85. Glumes (1)1.2–3.5 mm long, acute to acuminate, usually awn-tipped; anthers 0.9–3 mm long.

86. Blades 15–50 cm long; lemma awns 3–10 mm long; plants of southern Arizona and Chihuahua, Mexico . . . . . 59. *M. palmeri* (in part)
86. Blades 1–15 cm long; lemma awns 4–30 mm long; plants of the southwestern United States, including southern Arizona.
87. Lemmas and paleas almost glabrous, with only a few short hairs on the calluses; ligules with lateral lobes, the lobes 1.5–3 mm longer than the central portion; culms erect and plants tightly cespitose at the base; sheaths and blades usually with dark brown necrotic spots . . . . . 22. *M. pauciflora* (in part)
87. Lemmas and paleas pubescent on the lower  $\frac{1}{3}$ – $\frac{2}{3}$  of the midveins and margins; ligules without lateral lobes or with lobes less than 1.5 mm longer than the central portion; culms decumbent and plants loosely cespitose; sheaths and blades without necrotic spots.
88. Anthers 0.9–1.5 mm long, yellowish; panicles usually 7–20 cm long . . . . . 14. *M. tenuifolia* (in part)
88. Anthers 1.3–2 mm long, purplish or orange; panicles 2–13 cm long.
89. Anthers orange, 1.5–2 mm long; lemmas elliptic, 2–3.5 mm long, with awns 10–20(25) mm long; panicles 0.3–1.8 cm wide . . . . . 23. *M. polycaulis* (in part)
89. Anthers purple, 1.3–3 mm long; lemmas lanceolate, 3.5–5 mm long, with awns 4–12(20) mm long; panicles 1–5 cm wide . . . . . 24. *M. arsenei* (in part)

1. *Muhlenbergia racemosa* (Michx.) Britton, Sterns & Poggenb. MARSH MUHLY [p. 445, 536]

*Muhlenbergia racemosa* grows on rocky slopes, beside irrigation ditches, in seasonally wet meadows, on the margins of cultivated fields, railways and roadsides, in prairies, on sandstone outcrops, on stream banks, and in forest ecotones at elevations of 30–3400 m. It is most common in the north-central United States, but can be found at scattered locations throughout the western United States, and extends into northern Mexico.

2. *Muhlenbergia glomerata* (Willd.) Trin. SPIKE MUHLY, MUHLENBERGIE AGGLOMÉRÉE [p. 445, 536]

*Muhlenbergia glomerata* grows in meadows, marshes, bogs, alkaline fens, lake margins, stream banks, beside irrigation ditches and hot springs, and on gravelly slopes, in many different plant communities, at elevations of 30–2300 m. It is most common in southern Canada and the northeastern United States, but grows sporadically throughout the western United States. It is not known from Mexico.

3. *Muhlenbergia mexicana* (L.) Trin. WIRESTEM MUHLY, MUHLENBERGIE DU MEXIQUE, MUHLENBERGIE MEXICAINE [p. 445, 536]

*Muhlenbergia mexicana* usually grows in mesic to wet areas such as moist prairies and woodlands, stream banks, roadsides, ditch banks, lake margins, swamps, bogs, and hot springs, at elevations 50–3300 m, and is found in many different plant communities. Despite its name, *M. mexicana* grows only in Canada and the United States.

Plants with awns 3–10 mm long belong to *Muhlenbergia mexicana* var. *filiformis* (Torr.) Scribn., and those without an awn or with awns less than 3 mm long to *Muhlenbergia mexicana* (L.) Trin. var. *mexicana*. Early in the flowering season, *M. mexicana* may be confused with plants of *M. bushii* in which the axillary panicles are poorly developed, but they differ in their dull internodes and the fact that the blades on the secondary branches are usually similar in length and width to those of the main branches.

4. *Muhlenbergia californica* Vasey CALIFORNIA MUHLY [p. 446, 536]

*Muhlenbergia californica* grows in canyons, along moist ditches, and on sandy slopes, at elevations of 100–2150 m. It is endemic to the Transverse Ranges of southern California.

5. *Muhlenbergia glabrifloris* Scribn. INLAND MUHLY [p. 446, 536]

*Muhlenbergia glabrifloris* grows at the edge of dry forests, in prairies, thickets, and along roadsides in pine and oak associations, at elevations of 20–400 m. It is restricted to the southern portion of the central contiguous United States. It differs from *M. frondosa* in its glabrous lemmas and shorter caryopses (1.2–1.4 mm rather than 1.6–1.9 mm).

6. *Muhlenbergia andina* (Nutt.) Hitchc. FOXTAIL MUHLY [p. 446, 536]

*Muhlenbergia andina* grows in damp places such as stream banks, gravel bars, marshes, lake margins, damp meadows, around springs, and in canyons, at elevations of 700–3000 m. It grows only in the western part of southern Canada and the contiguous United States.

7. *Muhlenbergia ×curtisetosa* (Scribn.) Bush [p. 446, 536]

*Muhlenbergia ×curtisetosa* grows in abandoned fields and forest openings, often near bogs, at elevations of 20–300 m. It may be a hybrid between *M. schreberi* (which contributes the short glumes) and either of two rhizomatous species, *M. frondosa* and *M. tenuiflora*.

8. *Muhlenbergia bushii* R.W. Pohl NODDING MUHLY [p. 446, 536]

*Muhlenbergia bushii* grows in sandy alluvium, open thickets, dry woodlands, and flood plains, at elevations of 10–250 m in the central portion of the contiguous United States. Early season plants, in which the axillary panicles are poorly developed, can be distinguished from those of *M. mexicana* by their shiny internodes and the tendency of the blades on the secondary branches to be shorter and narrower than those on the main branches.



9. *Muhlenbergia frondosa* (Poir.) Fernald WIRESTEM  
MUHLY, MUHLENBERGIE FEUILLÉE [p. 446, 536]

*Muhlenbergia frondosa* grows in forest borders, thickets, clearings, alluvial plains, and disturbed sites within deciduous forests, at elevations of 20–1000 m. It grows only in southern Canada and the contiguous United States. Plants with unawned lemmas or with awns shorter than 4 mm can be called *M. frondosa* forma: *frondosa*, and those with lemma awns 4–13 mm long, *M. frondosa* forma *commutata* (Scribn.) Fernald.

10. *Muhlenbergia sobolifera* (Muhl. ex Willd.) Trin.  
ROCK MUHLY [p. 446, 536]

*Muhlenbergia sobolifera* grows in dry upland forests, oak woodlands, and on rock outcrops of sandstone, chert, or limestone formations, at elevations of 0–1200 m. It is restricted to the *Manual* region.

11. *Muhlenbergia tenuiflora* (Willd.) Britton, Sterns & Poggenb. SLIMFLOWERED MUHLY, MUHLENBERGIE TÊNUE  
[p. 446, 536]

*Muhlenbergia tenuiflora* grows only in the *Manual* region, usually being found on sandy or rocky slopes derived from sandstone, chert, or limestone formations, in mixed hardwood and oak-hickory forests, at elevations of 40–1500 m.

12. *Muhlenbergia sylvatica* (Torr.) Torr. ex A. Gray  
WOODLAND MUHLY, MUHLENBERGIE DES BOIS [p. 446, 537]

*Muhlenbergia sylvatica* grows in upland forests, along creeks and hollows, on rocky ledges derived from sandstone, shale, or calcareous parent materials, moist prairies, and swamps, at elevations from 30–1500 m. It is restricted to the *Manual* region, its primary range being southeastern Canada and the midwestern and eastern United States.

13. *Muhlenbergia schreberi* J.F. Gmel. NIMBLEWILL [p. 446, 537]

*Muhlenbergia schreberi* grows in moist to dry woods and prairies on rocky slopes, in ravines, and along sandy riverbanks, at elevations of 60–1600 m. It is also common in disturbed sites near cultivated fields, pastures, and roads at these elevations. Its geographic range includes central, but not northern, Mexico. Records from the western United States probably reflect recent introductions. The species is considered a noxious, invasive weed in California.

14. *Muhlenbergia tenuifolia* (Kunth) Trin. SLENDER  
MUHLY [p. 446, 537]

*Muhlenbergia tenuifolia* grows in grama grasslands and pine-oak woodlands on rocky slopes, limestone rock outcrops, gravelly roadsides, and in sandy drainages, at elevations of 1200–2200 m. Its range extends through Mexico to northern South America.

15. *Muhlenbergia microsperma* (DC.) Trin. LITTLESEED  
MUHLY [p. 446, 537]

*Muhlenbergia microsperma* grows on sandy slopes, drainages, cliffs, rock outcrops, and disturbed roadsides, at elevations of 0–2400 m. It is usually found in creosote scrub, thorn-scrub forest, sarcocaulis desert, and oak-pinyon woodland associations. Its range extends from the southwestern United States through Central America to Peru and Venezuela. Morphological variation among and within its populations is marked.

16. *Muhlenbergia appressa* C.O. Goodd. DEVIL'S-  
CANYON MUHLY [p. 447, 537]

*Muhlenbergia appressa* grows in sandy drainages, canyon bottoms, rocky road cuts, and sandy slopes, at elevations of 20–1750 m. Its range extends from Arizona to Baja California, Mexico. It grows in grama grasslands, oak-juniper woodlands, and chaparral associations.

17. *Muhlenbergia pectinata* C.O. Goodd. COMBTOP  
MUHLY [p. 447, 537]

*Muhlenbergia pectinata* grows on rock outcrops, rocky cliffs, canyon walls, steep slopes, and road cuts, at elevations of 45–2400 m in thorn-scrub forests, grama grasslands, and pine-oak woodlands. It is almost entirely restricted to vertical surfaces that are seasonally wet. Its range extends from southeastern Arizona to Oaxaca, Mexico.

18. *Muhlenbergia diversiglumis* Trin. MIXEDGLUME  
MUHLY [p. 447, 537]

*Muhlenbergia diversiglumis* has been collected from Galveston County, Texas. The species is native from Mexico to Peru and Venezuela, where it grows on moist cliffs, along water courses, sandy slopes, and road cuts, primarily in moist shaded environments of broadleaf evergreen forests and pine-oak forests, at elevations of 600–2500 m.

19. *Muhlenbergia glauca* (Nees) B.D. Jacks. DESERT  
MUHLY [p. 447, 537]

*Muhlenbergia glauca* grows on calcareous rocky slopes, cliffs, canyon walls, table rocks, and volcanic rock outcrops, at elevations of 1200–2780 m. Its range extends from the southwestern United States to central Mexico. *M. glauca* resembles *M. polycaulis*, but differs in its shorter lemma awns and strongly rhizomatous habit.

20. *Muhlenbergia thurberi* (Scribn.) Rydb. THURBER'S  
MUHLY [p. 447, 537]

*Muhlenbergia thurberi* usually grows in moist soil in seeps near canyon cliffs, sandstone slopes, and rocky ledges, at elevations of 1350–2300 m. It appears to be restricted to the southwestern United States. It flowers from July to September. It resembles *M. curtifolia*, but differs in its tightly involute blades, and longer anthers and ligules. The two species have been found growing within 50 m of each other in Apache County, Arizona, but in different habitats, *M. curtifolia* growing in a damp drainage areas whereas *M. thurberi* grew near a moist but dryer canyon cliff.

21. *Muhlenbergia curtifolia* Scribn. UTAH MUHLY [p. 447, 537]

*Muhlenbergia curtifolia* grows on damp ledges and in rock crevices of vertical cliffs, and beneath large calcareous boulders above the canyon floor, at elevations of 1600–2750 m, in the southwestern United States. It resembles *M. thurberi*, differing in its flatter leaf blades and shorter ligules and anthers. It also tends to grow in more mesic habitats than *M. thurberi*.

22. *Muhlenbergia pauciflora* Buckley NEW MEXICAN  
MUHLY [p. 447, 537]

*Muhlenbergia pauciflora* grows in open or closed forests on rocky slopes, cliffs, canyons, and rock outcrops of granitic or calcareous origin, at elevations of 1200–2500 m. Its range extends from the southwestern United States to central Mexico.

23. *Muhlenbergia polycaulis* Scribn. CLIFF MUHLY [p. 447, 537]

*Muhlenbergia polycaulis* grows in open vegetation on steep rocky slopes, canyon walls, cliffs, table rocks, and volcanic rock outcrops, at elevations of 1200–2400 m. Its range extends from the southwestern United States to central Mexico. It differs from *M. glauca* in its longer lemma awns, shorter rhizomes, and loosely tufted habit.

24. *Muhlenbergia arsenei* Hitchc. NAVAJO MUHLY [p. 447, 537]

*Muhlenbergia arsenei* grows among granitic boulders, on rocky slopes, limestone rock outcrops, and in arroyos, at elevations of 1400–2850 m.

Its range extends from the southwestern United States into Baja California, Mexico. It flowers from August to September.

25. *Muhlenbergia spiciformis* Trin. LONGAWN MUHLY [p. 447, 537]

*Muhlenbergia spiciformis* grows on rocky slopes, cliffs, and calcareous rock outcrops, often in thorn-scrub and open woodland communities. Its elevational range is 450–2800 m; its geographic range extends from the southwestern United States to northern Mexico.

26. *Muhlenbergia porteri* Scribn. ex Beal BUSH MUHLY [p. 447, 537]

*Muhlenbergia porteri* grows among boulders on rocky slopes and on cliffs, and in dry arroyos, desert flats, and grasslands, frequently in the protection of shrubs, at elevations of 600–1700 m. Its geographic range extends from the southwestern United States to northern Mexico.

27. *Muhlenbergia cuspidata* (Torr. ex Hook.) Rydb. PLAINS MUHLY [p. 447, 537]

*Muhlenbergia cuspidata* grows in dry, gravelly prairies, on gentle rocky slopes, rocky limestone outcrops, and in sandy drainages, at elevations of 300–1400 m, primarily in the central portion of the *Manual* region. It flowers from June to October. It is often confused with *M. richardsonis*, but that species has rhizomes and longer ligules.

28. *Muhlenbergia wrightii* Vasey ex J.M. Coult. SPIKE MUHLY [p. 447, 537]

*Muhlenbergia wrightii* grows in gravelly prairies, on rocky slopes, and in meadows on granitic, sandstone, or limestone-derived soils, at elevations of 1100–3000 m. Its range extends from the southwestern United States to northern Mexico.

29. *Muhlenbergia arizonica* Scribn. ARIZONA MUHLY [p. 448, 537]

*Muhlenbergia arizonica* grows in sandy drainages and gravelly canyons, and on plateaus and rocky slopes in open desert grasslands, at elevations of 1220–2230 m. Its range extends from the southwestern United States into northwestern Mexico. Flowering is from August to October.

30. *Muhlenbergia torreyi* (Kunth) Hitchc. ex Bush RING MUHLY [p. 448, 537]

*Muhlenbergia torreyi* grows in desert grasslands and open woodlands on sandy mesas, calcareous rock outcrops, and rocky slopes, at elevations of 1000–2450 m. Its range extends from the southwestern United States to northern Mexico. It also grows, as a disjunct, in northwestern Argentina.

31. *Muhlenbergia arenicola* Buckley SAND MUHLY [p. 448, 537]

*Muhlenbergia arenicola* grows on sandy mesas, limestone benches, and in valleys and open desert grasslands, at elevations of 600–2135 m. Its range extends from the southwestern United States to central Mexico. It also grows, as a disjunct, in northwestern Argentina.

32. *Muhlenbergia pungens* Thurb. ex A. Gray SANDHILL MUHLY [p. 448, 537]

*Muhlenbergia pungens* grows in loose sandy soils near sand dunes to sandy clay loam slopes and flats in desert shrub and open woodlands, at elevations of 600–2500 m. It is known only from the western and central contiguous United States.

33. *Muhlenbergia dumosa* Scribn. ex Vasey BAMBOO MUHLY [p. 448, 537]

*Muhlenbergia dumosa* grows on rocky slopes, canyon ledges, and cliffs, in areas protected from grazing animals in oak-pine and thorn-scrub forests and oak-grama savannahs, at elevations of 600–1800 m, from Arizona to southern Mexico. It is also grown as an ornamental in the southwestern United States.

34. *Muhlenbergia villiflora* Hitchc. HAIRY MUHLY [p. 448, 537]

In the United States, *Muhlenbergia villiflora* grows in open ground with alkaline to calcareous soils and on gypsum rock flats, at elevations of 600–1200 m. It usually forms small, isolated populations. Plants in the United States belong to *Muhlenbergia villiflora* var. *villosa* (Swallen) Morden. This variety differs from *M. villiflora* Hitchc. var. *villiflora*, which grows in Mexico, in its longer spikelets (1.8–2.5 mm versus 1.4–2.3 mm) and preference for calcareous, rather than gypsiferous, soils.

35. *Muhlenbergia repens* (J. Presl) Hitchc. CREEPING MUHLY [p. 448, 537]

*Muhlenbergia repens* grows in open, sandy meadows, canyon bottoms, calcareous rocky flats, gypsum flats, and on rolling slopes and roadsides, at elevations of 100–3120 m. Its range extends from the southwestern United States to southern Mexico.

36. *Muhlenbergia utilis* (Torr.) Hitchc. APAREJOGRASS [p. 448, 537]

*Muhlenbergia utilis* grows in wet soils along streams, ponds, and depressions in grasslands and alkaline or gypsiferous plains, at elevations of 200–1800 m. Its range extends from the southern United States through Mexico to Costa Rica.

37. *Muhlenbergia richardsonis* (Trin.) Rydb. MAT MUHLY, MUHLENBERGIE DE RICHARDSON [p. 448, 538]

*Muhlenbergia richardsonis* grows in open sites in alkaline meadows, prairies, sandy arroyo bottoms, talus slopes, rocky flats and the shores of rivers, at elevations of 60–3300 m. It is the most widespread species of *Muhlenbergia* in the *Manual* region, extending from the Yukon Territory to Quebec in the north and to northern Baja California, Mexico, in the south. It is often confused with *M. cuspidata*, which differs in lacking rhizomes and having shorter ligules, and sometimes with *M. filiformis*, which differs in being a weak annual with glabrous internodes and obtuse, erose glumes.

38. *Muhlenbergia filiformis* (Thurb. ex S. Watson) Rydb. PULL-UP MUHLY [p. 448, 538]

*Muhlenbergia filiformis* grows in open, moist meadows, on gravelly lake shores, along stream banks, and in moist humus near thermal springs, at elevations of 1060–3050 m. It is usually associated with yellow pine forests, but also grows in many other plant communities. Its range extends into northern Mexico. It differs from *M. richardsonis* in having glabrous internodes and subacute apices.

39. *Muhlenbergia torreyana* (Schult.) Hitchc. NEW JERSEY MUHLY [p. 448, 538]

*Muhlenbergia torreyana* grows in perennially wet or moist, usually seasonally inundated habitats such as the sphagnous margins of shallow ponds and seasonally wet depressions, often within pine-oak or oak barrens and at elevations of 0–150 m. It is rare even in those states where it is still growing. It resembles the western *M. asperifolia* but differs in its strigose, strongly compressed, keeled culms and less strongly divergent panicle branches.



40. *Muhlenbergia asperifolia* (Nees & Meyen ex Trin.) Parodi SCRATCHGRASS [p. 448, 538]  
*Muhlenbergia asperifolia* grows in moist, often alkaline meadows, playa margins, and sandy washes, on grassy slopes, and around seeps and hot springs, at elevations of 55–3000 m. Its geographic range includes northern Mexico. It differs from the southeastern *M. torreyana* in having glabrous, weakly compressed culms and more widely divergent panicle branches.
41. *Muhlenbergia arenacea* (Buckley) Hitchc. EAR MUHLY [p. 449, 538]  
*Muhlenbergia arenacea* grows in sandy flats, plains, alluvial fans, washes, depressions, and alkaline mesas in open grasslands, at elevations of 1000–2200 m. Its range extends from the southwestern United States into northern Mexico.
42. *Muhlenbergia uniflora* (Muhl.) Fernald BOG MUHLY, MUHLENBERGIE UNIFLORE [p. 449, 538]  
*Muhlenbergia uniflora* grows in bogs, wet meadows, and lake shores in sandy or peaty, often acidic, soils, at elevations of 0–650 m. It is native to eastern North America, but was collected once in British Columbia, probably having been introduced from ship ballast, and was recently collected from a commercial cranberry bog in Oregon. The collection from Texas may also be an introduction.
43. *Muhlenbergia filiculmis* Vasey SLIMSTEM MUHLY [p. 449, 538]  
*Muhlenbergia filiculmis* grows on rocky slopes, dry meadows, and dry gravelly flats in forest openings and grasslands, at elevations of 2500–3500 m in the southern Rocky Mountains and northern Arizona. It differs from *M. montana* in its shorter spikelets and lemma awns and tightly involute or filiform, sharp blades.
44. *Muhlenbergia jonesii* (Vasey) Hitchc. MODOC MUHLY [p. 449, 538]  
*Muhlenbergia jonesii* is endemic to northern California. It grows on open slopes, pumice flats, and in openings in pine forests, at elevations of 1130–2130 m.
45. *Muhlenbergia straminea* Hitchc. SCREWLEAF MUHLY [p. 449, 538]  
*Muhlenbergia straminea* grows on rolling, rocky slopes, volcanic tuffs, canyon bottoms, and ridges, usually in open pine forests, at elevations of 1800–2600 m. It is known only from the southwestern United States.
46. *Muhlenbergia montana* (Nutt.) Hitchc. MOUNTAIN MUHLY [p. 449, 538]  
*Muhlenbergia montana* grows on rocky slopes and ridge tops and in dry meadows and open grasslands, at elevations of 1400–3500 m. Its range extends from the western United States to Guatemala. It differs from *M. filiculmis* in its longer spikelets and lemma awns, and flatter leaf blades that are not sharply tipped.
47. *Muhlenbergia crispiseta* Hitchc. MEXICALI MUHLY [p. 449, 538]  
*Muhlenbergia crispiseta* grows on rock outcrops, in rocky drainages, and on white tablelands, on soils derived from calcareous parent materials in pine-oak and pinyon-juniper woodlands, at elevations of 1900–2600 m. It is basically a Mexican species, with a disjunct population in Brewster County, Texas.
48. *Muhlenbergia peruviana* (P. Beauv.) Steud. PERUVIAN MUHLY [p. 449, 538]  
*Muhlenbergia peruviana* grows in open gravelly flats, meadows, rock outcrops, sandy washes, gravelly drainages, rocky slopes, disturbed road cuts, and volcanic flats, in yellow pine forest associations, at elevations of 2000–4600 m. Its primary distribution is to the south of the Manual region, extending from the southwestern United States through Mexico to Ecuador, Peru, Bolivia, and Argentina. As treated here, *Muhlenbergia peruviana* includes what are sometimes identified as *M. pulcherrima* Scribn. ex Beal, *M. pusilla* Steud., and *M. peruviana* s. s. There are, however, numerous intermediates among the three extremes represented by these names.
49. *Muhlenbergia emersleyi* Vasey BULLGRASS [p. 449, 538]  
*Muhlenbergia emersleyi* grows on rocky slopes, gravelly washes, canyons, cliffs, and arroyos, often in soils derived from limestone, at elevations of 1200–2500 m, and is also grown as an ornamental. Its range extends from the southwestern United States through Mexico to Panama. It differs from the closely related *M. longiligula* in its compressed-keeled sheaths, pubescent florets, and membranous ligules.
50. *Muhlenbergia xinvoluta* Swallen CANYON MUHLY [p. 449, 538]  
*Muhlenbergia xinvoluta* grows on rocky, calcareous slopes in openings and along canyons, at elevations of 150–500 m. It has only been found growing naturally in Texas, but it is also available commercially as an ornamental. *Muhlenbergia reverchonii* and *M. lindheimeri* may be its parents, but *M. rigida* is another plausible possibility.
51. *Muhlenbergia longiligula* Hitchc. LONGTONGUE MUHLY [p. 449, 538]  
*Muhlenbergia longiligula* grows on rocky slopes, canyons, and rock outcrops derived from volcanic or calcareous parent materials, at elevations of 1220–2500 m. It is a common species in Arizona and southwestern New Mexico, and extends into northwestern Mexico. It differs from *M. emersleyi* in its rounded basal leaf sheaths, glabrous lemmas, and panicle branches that are spikelet-bearing to the base. It differs from *M. lindheimeri* in its rounded basal sheaths.
52. *Muhlenbergia expansa* (Poir.) Trin. SAVANNAH HAIRGRASS [p. 449, 538]  
*Muhlenbergia expansa* grows in perennially moist to wet soils in pitcher plant bogs, pine savannahs, and flatwoods, usually in sandy soils and at elevations of 0–300 m. Its primary range is the coastal plain of the southeastern United States.
53. *Muhlenbergia capillaris* (Lam.) Trin. HAIRY-AWN MUHLY [p. 450, 538]  
In the southeastern United States, *Muhlenbergia capillaris* usually grows in rocky or clay soils in open woodlands and savannahs and on calcareous outcrops, at elevations of 0–500 m. In the northeastern states, it is also found on diabase and sandstone outcrops and ridges. Its native range includes the southeastern United States, Bahamas, and possibly various Caribbean islands. It is also grown as an ornamental. It differs from *M. reverchonii* in its dull, apically scabrous lemmas.
54. *Muhlenbergia sericea* (Michx.) P.M. Peterson DUNE HAIRGRASS, PURPLE MUHLY [p. 450, 538]  
*Muhlenbergia sericea* grows in sandy maritime habitats on the barrier islands and in coastal woodlands of the southeastern United States, at elevations of 0–50 m. It is available as an ornamental, sometimes under the name 'Purple Muhly'.
55. *Muhlenbergia reverchonii* Vasey & Scribn. SEEP MUHLY [p. 450, 538]  
*Muhlenbergia reverchonii* grows on calcareous rocky slopes, flats, and limestone rock outcrops, at elevations of 150–650 m. It is restricted to Oklahoma and Texas. It differs from *M. capillaris* in its smooth and shiny lemmas, and from *M. setifolia* in its wider panicles, spreading panicle branches, acute glumes, and more shortly awned lemmas.

56. *Muhlenbergia rigida* (Kunth) Trin. PURPLE MUHLY  
[p. 450, 538]

*Muhlenbergia rigida* grows on rocky slopes, ravines, and sandy, gravelly slopes derived from granitic and calcareous substrates, at elevations of 1200–2200 m, in two disjunct areas: the southwestern United States south to Chiapas, Mexico, and in Ecuador, Peru, Bolivia, and Argentina. It is often a common upland bunchgrass, and is also grown as an ornamental. It differs from *M. setifolia* and *M. reverchonii* in its purplish, scabridulous to scabrous lemmas.

57. *Muhlenbergia elongata* Scribn. ex Beal SYCAMORE MUHLY [p. 450, 538]

*Muhlenbergia elongata* grows on rock outcrops, cliffs, canyon walls, and moist rock walls, on rhyolitic and volcanic conglomerates, at elevations of 850–2100 m. It extends south from Arizona into northern Mexico.

58. *Muhlenbergia setifolia* Vasey CURLYLEAF MUHLY [p. 450, 538]

*Muhlenbergia setifolia* grows on calcareous rocky slopes, rock outcrops, and in desert grasslands, at elevations of 1000–2250 m. Its range extends from the southwestern United States into northern Mexico. It differs from *M. reverchonii* in its narrower panicles, less widespread panicle branches, truncate to obtuse glumes, and longer lemma awns.

59. *Muhlenbergia palmeri* Vasey PALMER'S MUHLY [p. 450, 538]

*Muhlenbergia palmeri* grows in rocky drainages and in sandy soil along creeks, at elevations of 1000–2100 m. Its range extends from southern Arizona into northern Mexico.

60. *Muhlenbergia lindheimeri* Hitchc. LINDHEIMER'S MUHLY [p. 450, 538]

*Muhlenbergia lindheimeri* grows in sandy draws to rocky, calcareous soils, generally in open areas, at elevations of 150–500 m. It is uncommon throughout its range, which includes northern Mexico in addition to southern Texas, but it is also grown as an ornamental. It differs from the closely related *M. longiligula* in its compressed-keeled basal sheaths, grayish spikelets, and, when present, bifid glume apices.

61. *Muhlenbergia dubia* E. Fourn. PINE MUHLY [p. 450, 538]

*Muhlenbergia dubia* grows on steep slopes, ridge tops, limestone rock outcrops, and along draws, at elevations of 1500–2300 m. Its range extends into northern Mexico. It resembles *M. rigens*, but differs in having looser, contracted (but not spikelike) panicles, longer ligules, olivaceous anthers, and generally longer lemmas.

62. *Muhlenbergia rigens* (Benth.) Hitchc. DEERGRASS [p. 450, 539]

*Muhlenbergia rigens* grows in sandy washes, gravelly canyon bottoms, rocky drainages, and moist, sandy slopes, often along small streams, at elevations of 90–2500 m. Its geographic range extends to central Mexico. It is available commercially as an ornamental. It differs from *M. dubia* in having tighter, spikelike panicles, shorter ligules, yellow or purplish anthers, and shorter lemmas.

63. *Muhlenbergia depauperata* Scribn. SIXWEEKS MUHLY [p. 450, 539]

*Muhlenbergia depauperata* grows in gravelly flats, rock outcrops, exposed bedrock, and sandy banks, in grama grassland associations, usually on soils derived from calcareous parent materials, at elevations of 1530–2400 m. Its range extends from the southwestern United States to southern Mexico. *Muhlenbergia depauperata* and *M. brevis* share several features with *Lycurus*: spikelets borne in pairs, 2-

veined and 2-awned lower glumes, 1-veined and awned upper glumes, acuminate, awned lemmas with short pubescence along the margins, and pubescent paleas.

64. *Muhlenbergia brevis* C.O. Goodd. SHORT MUHLY [p. 450, 539]

*Muhlenbergia brevis* grows on rocky slopes, gravelly flats, and rock outcrops, particularly those derived from calcareous parent materials, at elevations of 1700–2500 m, in grama grasslands, pinyon-juniper woodlands, and pine-oak woodlands. Its range extends from the southwestern United States to central Mexico. Like *Muhlenbergia depauperata*, *M. brevis* shares several features with *Lycurus*, notably the paired spikelets with 2-veined and 2-awned lower glumes, 1-veined and awned upper glumes, acuminate, awned lemmas with shortly pubescent margins, and pubescent paleas.

65. *Muhlenbergia sinuosa* Swallen MARSHLAND MUHLY [p. 451, 539]

*Muhlenbergia sinuosa* grows in sandy soil along washes, on open slopes and rocky ledges, and in roadside ditches, at elevations of 1650–2300 m. It is usually found in oak-pine forests, pinyon-juniper woodlands, oak-grama savannahs, and riverine woodlands. Its range extends from the southwestern United States into northern Mexico.

66. *Muhlenbergia minutissima* (Steud.) Swallen ANNUAL MUHLY [p. 451, 539]

*Muhlenbergia minutissima* grows in sandy and gravelly drainages, rocky slopes, flats, road cuts, and open sites. It is usually found in yellow pine and oak-pine forests, pinyon-juniper woodlands, thorn-scrub forests, and oak-grama savannahs, at elevations of 1200–3000 m. Its range extends from the western United States to southern Mexico.

67. *Muhlenbergia texana* Buckley TEXAS MUHLY [p. 451, 539]

*Muhlenbergia texana* grows on open slopes, in sandy, gravelly drainages, and on rock outcrops, at elevations of 1200–2750 m. Its range extends from the southwestern United States into northwestern Mexico.

68. *Muhlenbergia eludens* C. Reeder GRAVELBAR MUHLY [p. 451, 539]

*Muhlenbergia eludens* grows in open sandy gullies, washes, rocky slopes, and roadsides. It is found at elevations of 1700–2450 m in the southwestern United States and northwestern Mexico.

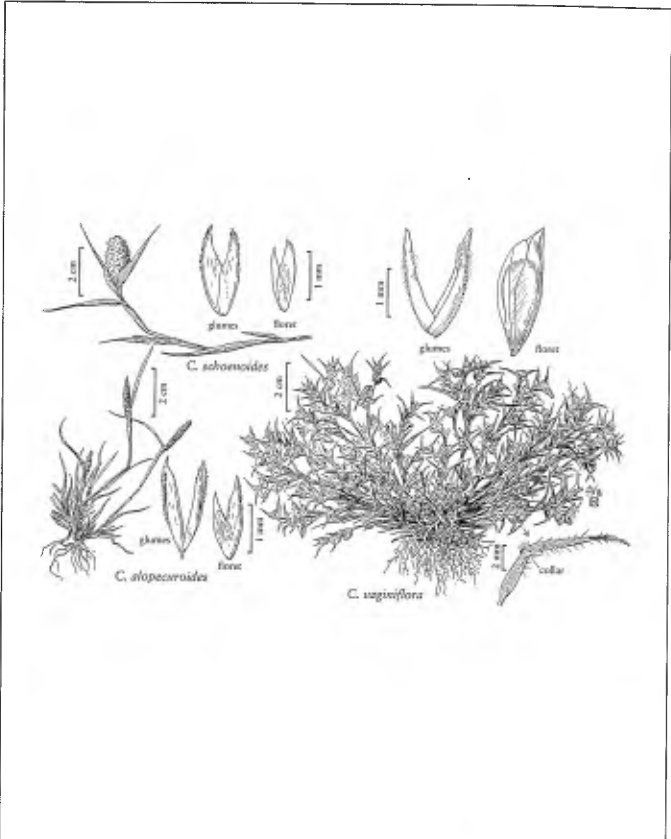
69. *Muhlenbergia fragilis* Swallen DELICATE MUHLY [p. 451, 539]

*Muhlenbergia fragilis* grows on rocky talus slopes, cliffs, canyon walls, road cuts, and sandy slopes, often over calcareous parent materials, at elevations of 480–2200 m. It is usually found in oak-grama savannahs, thorn scrub forests, oak-yellow pine forests, and pinyon-juniper woodlands. Its range extends from the southwestern United States to southern Mexico.

70. *Muhlenbergia ramulosa* (Kunth) Swallen GREEN MUHLY [p. 451, 539]

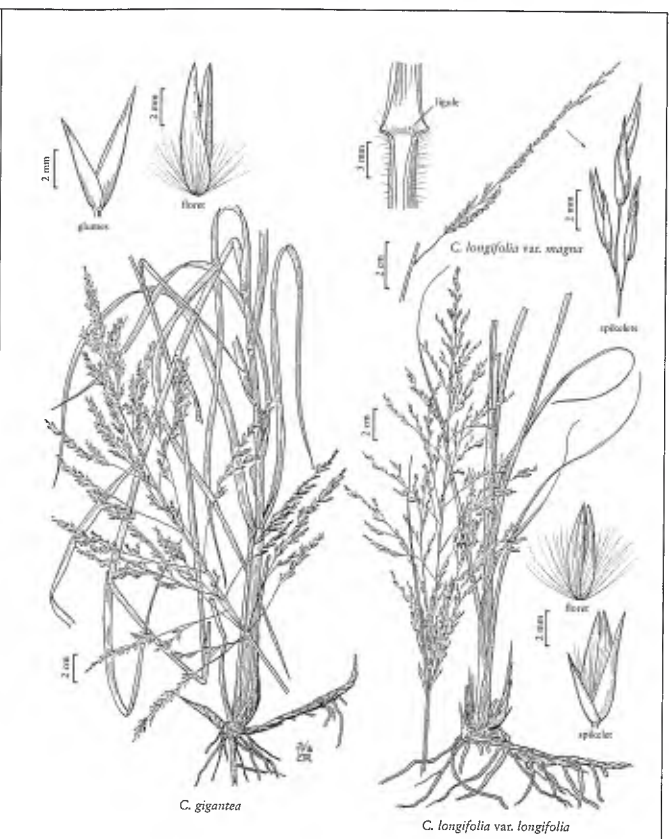
*Muhlenbergia ramulosa* grows in open, well-drained areas including slopes, sandy meadows, washes, gravelly road cuts, and rock outcrops in yellow pine-oak forests and in open meadows of pine-fir forests, at elevations of 2100–3500 m. Its range includes the southwestern United States, Mexico, Guatemala, Costa Rica, and Argentina.





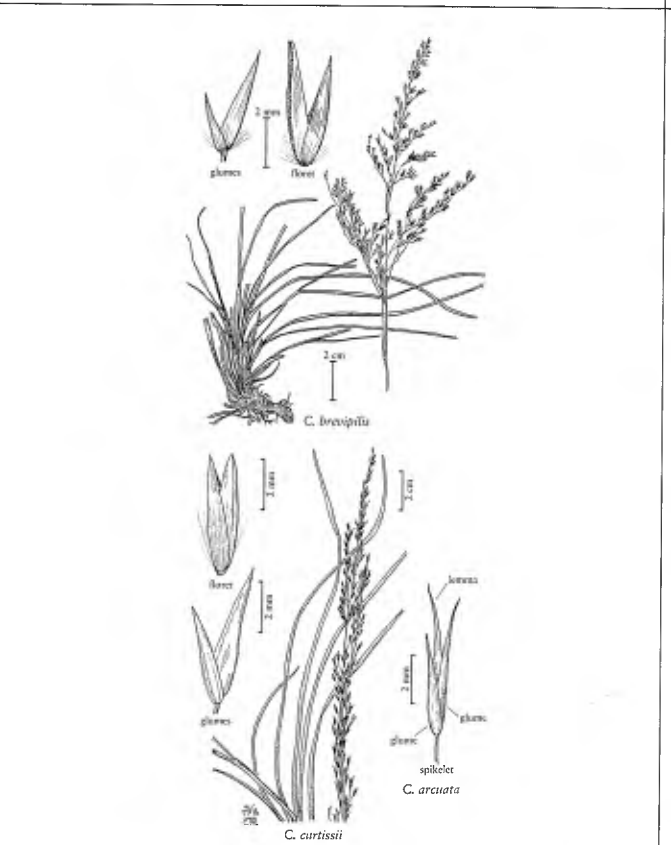
CRYPSIS

16.31.1-3



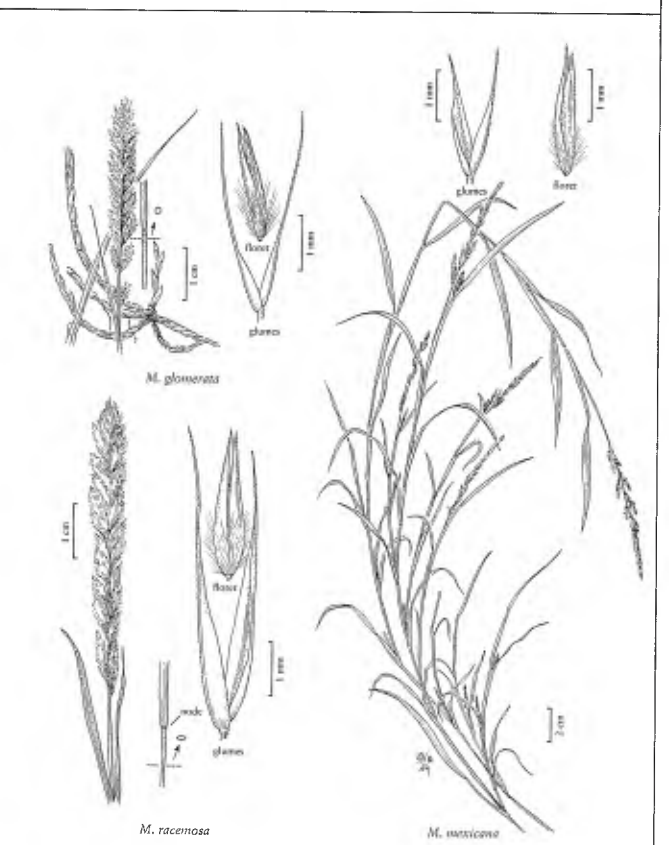
CALAMOVILFA

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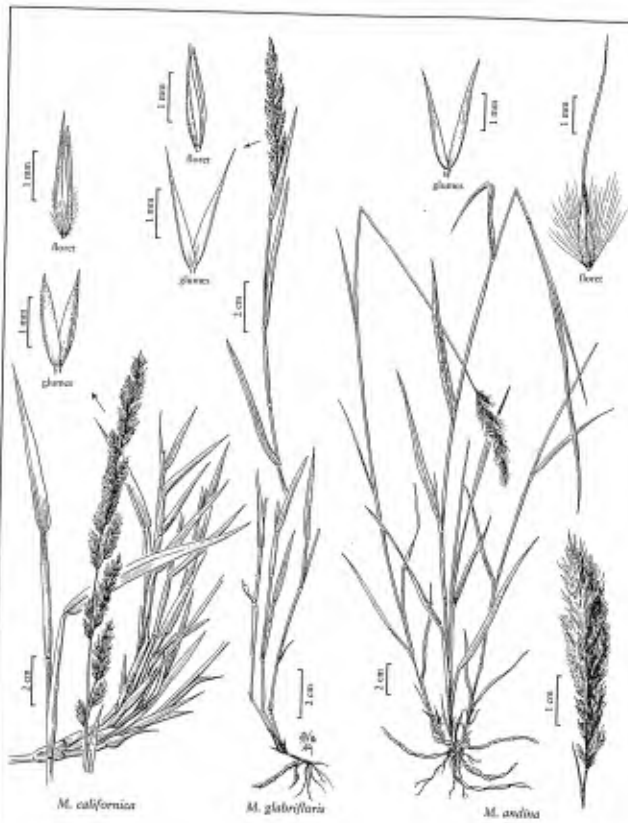
CALAMOVILFA

16.32.3-5



MUHLENBERGIA

16.33.1-3



MUHLENBERGIA

16.33.4-6



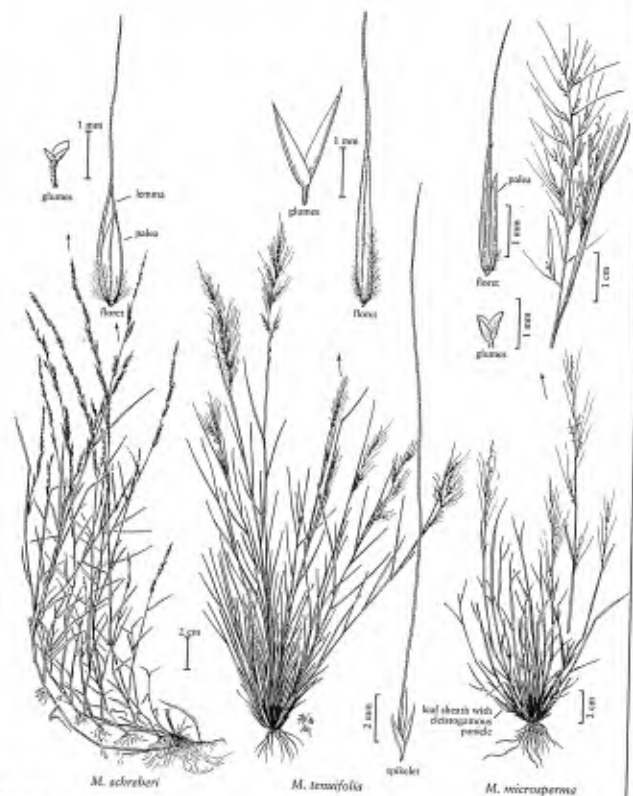
MUHLENBERGIA

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MUHLENBERGIA

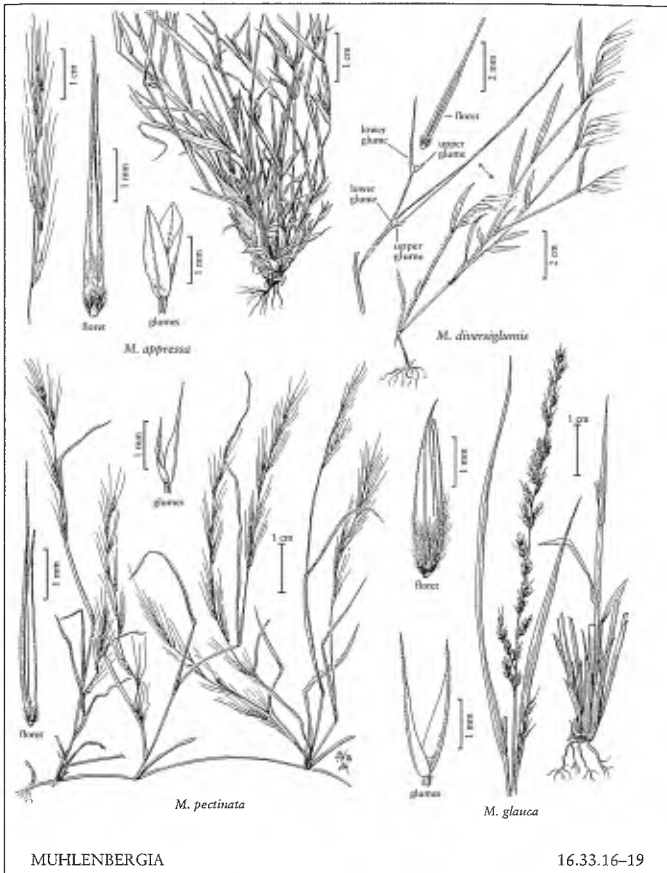
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MUHLENBERGIA

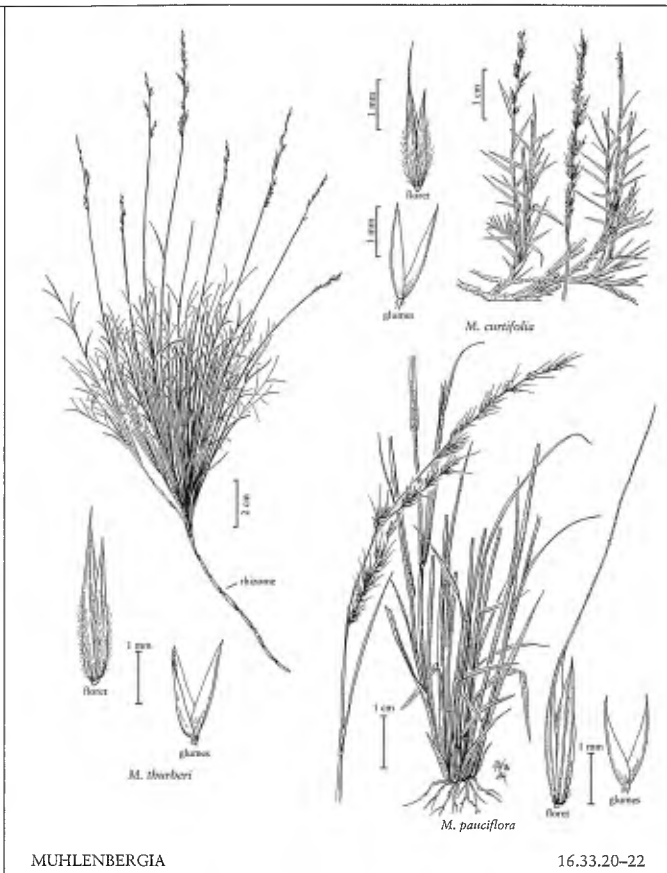
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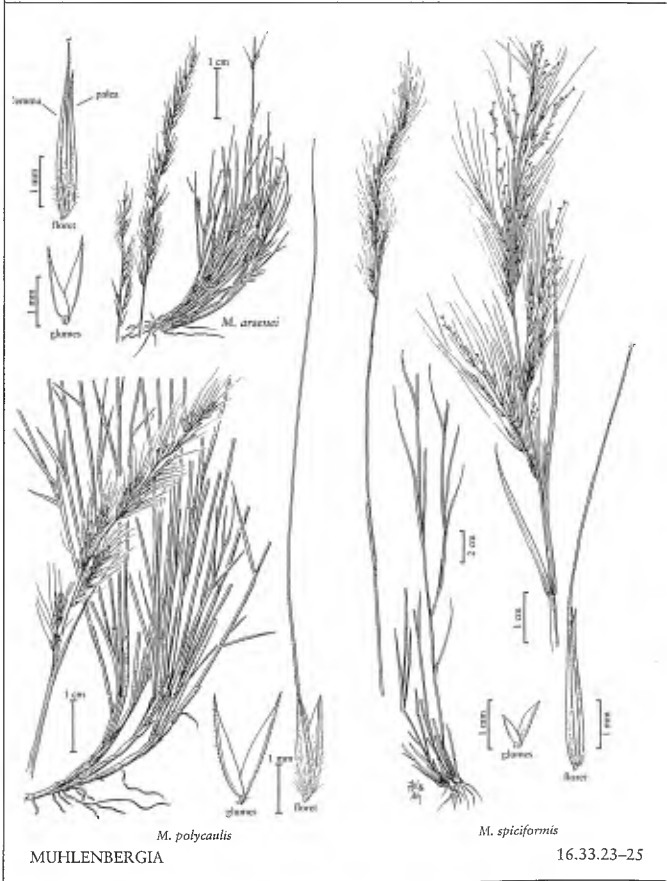
MUHLENBERGIA

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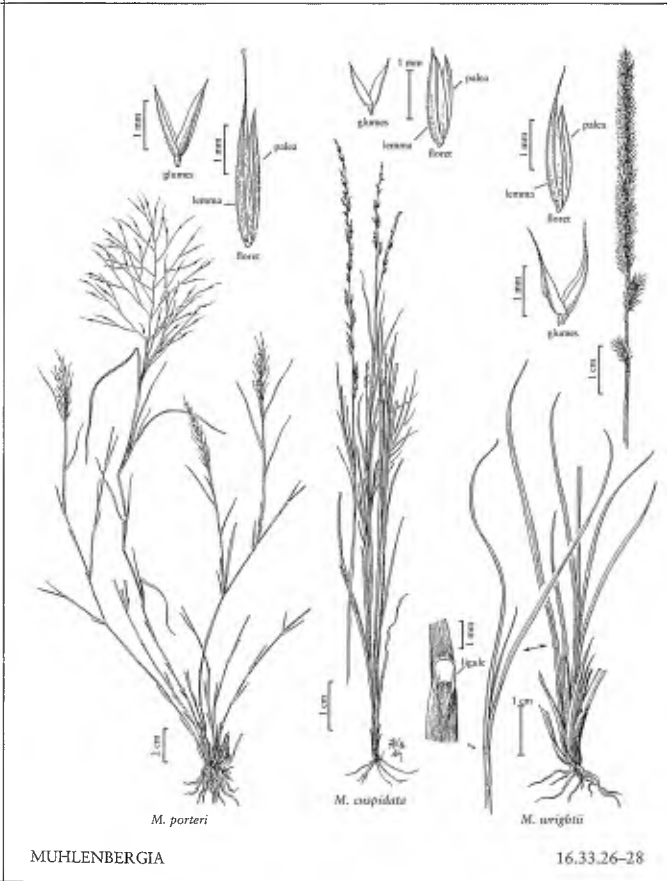
MUHLENBERGIA

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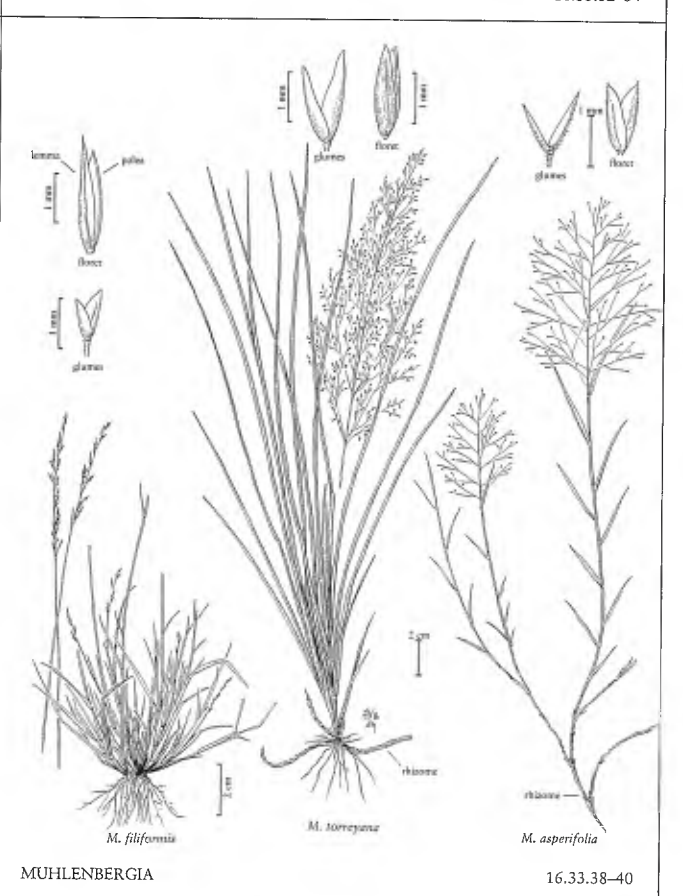
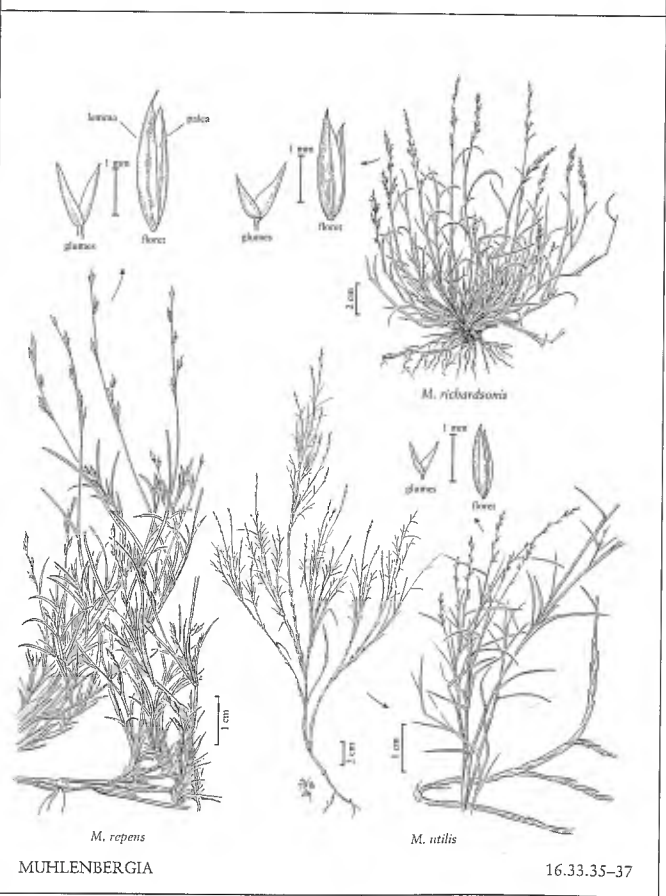
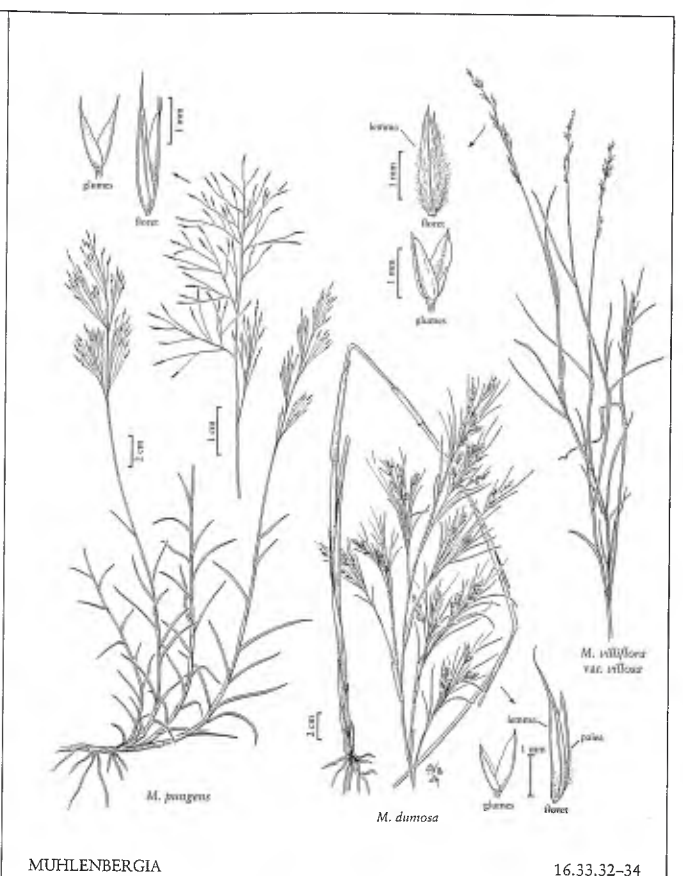
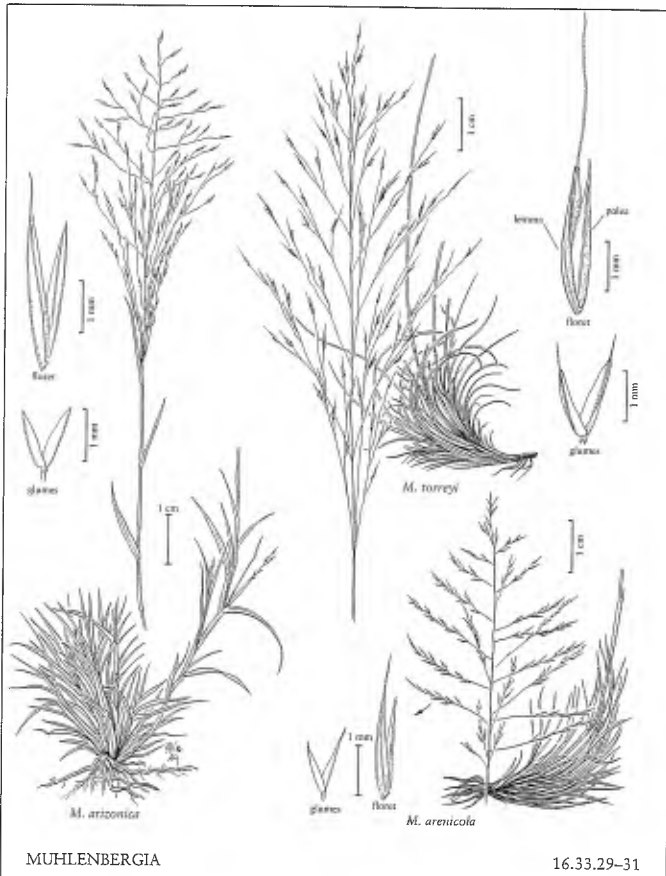
MUHLENBERGIA

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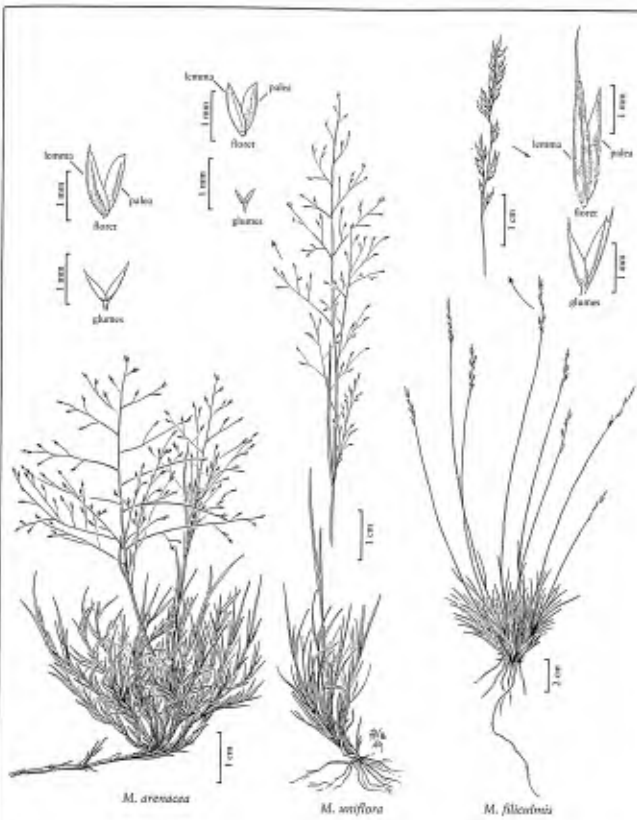


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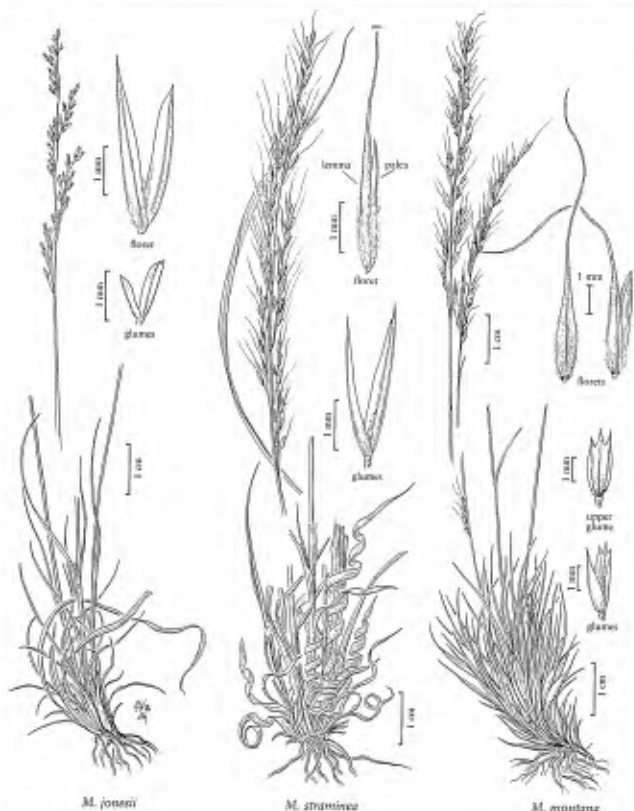






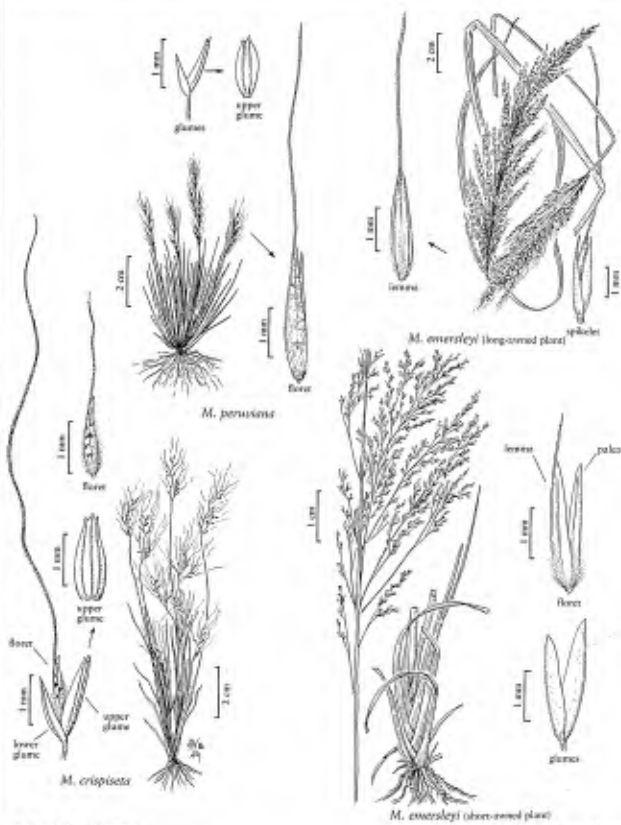
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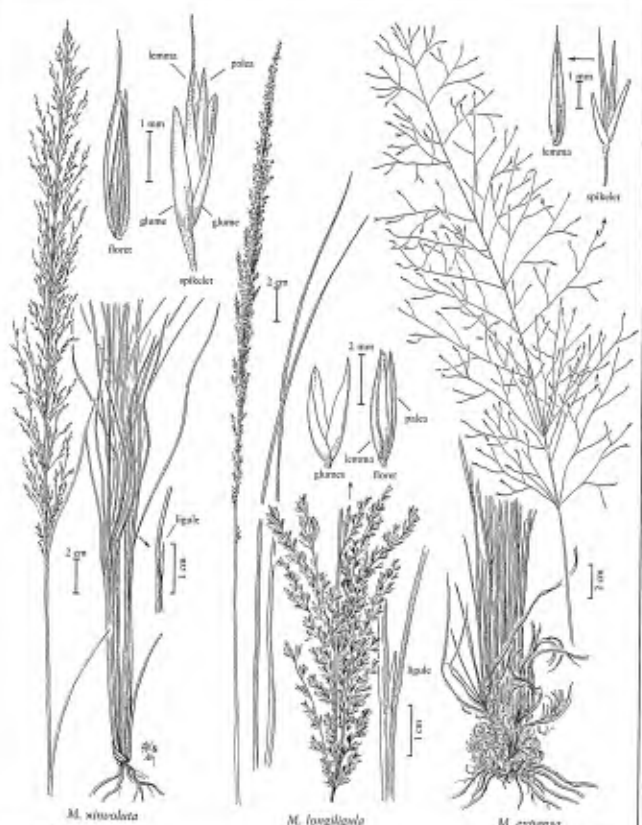
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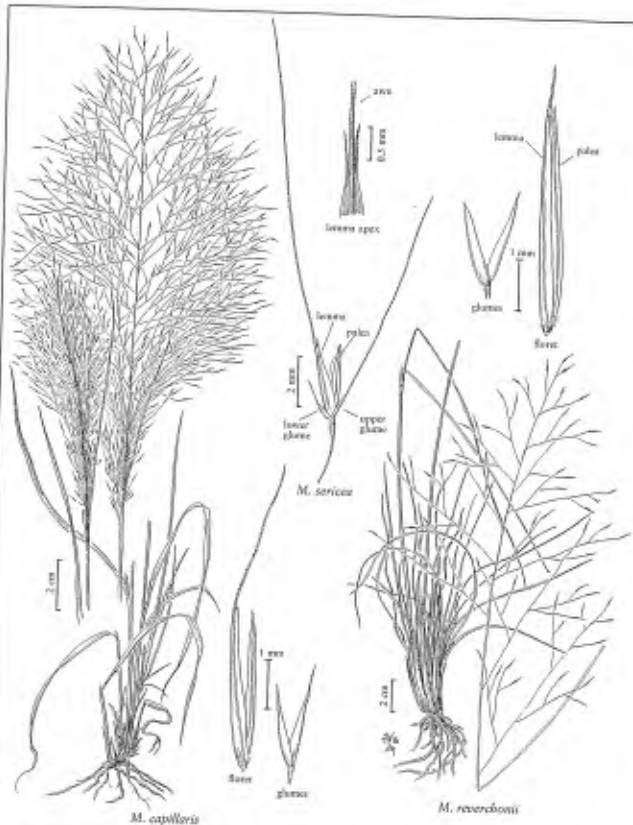
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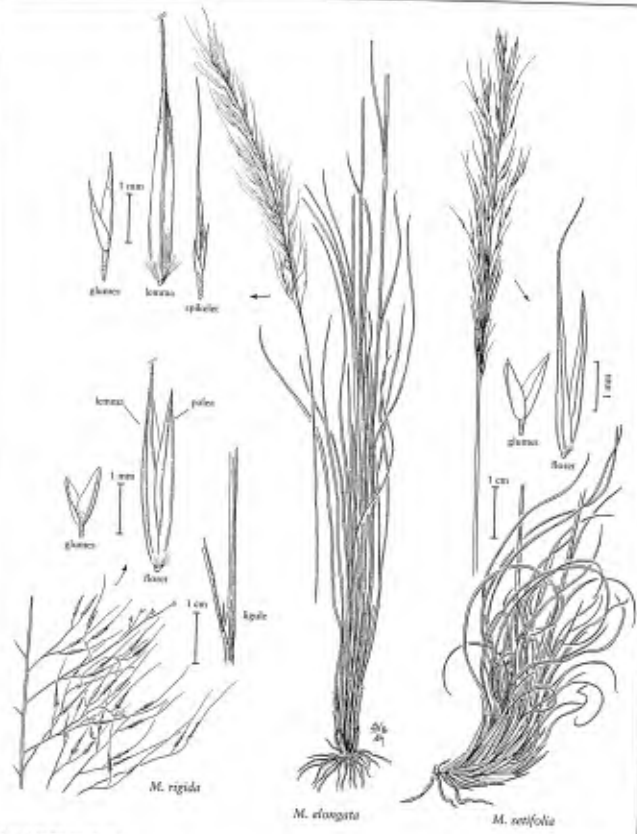
MUHLENBERGIA

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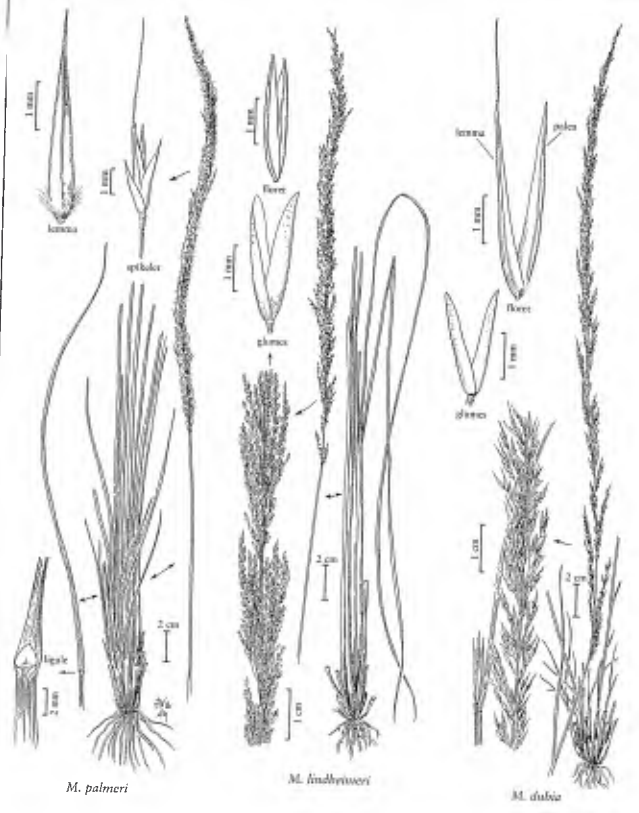
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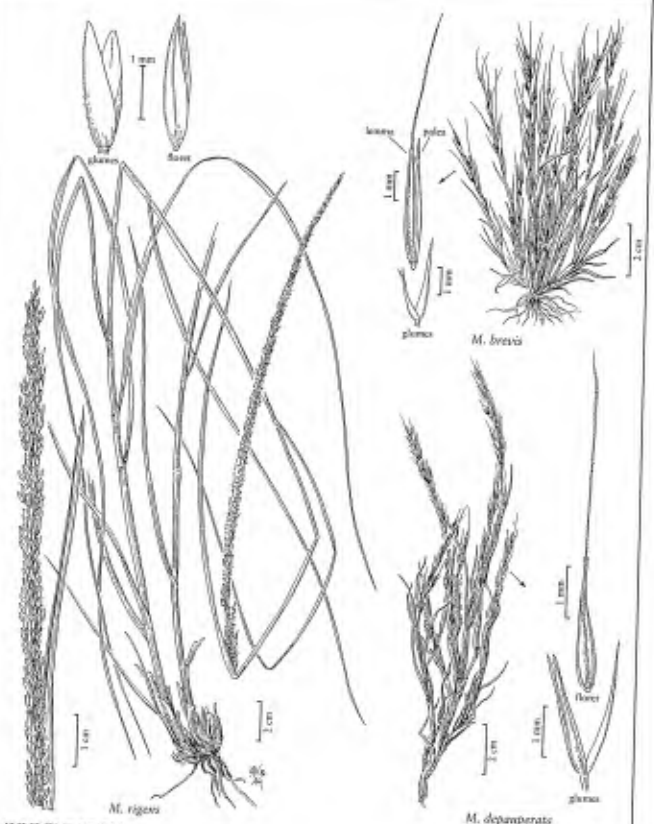
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MUHLENBERGIA

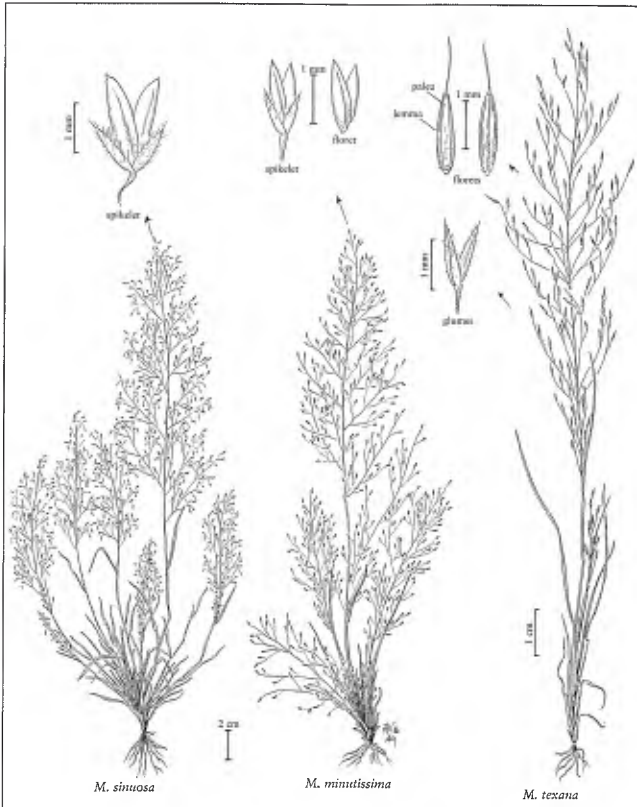
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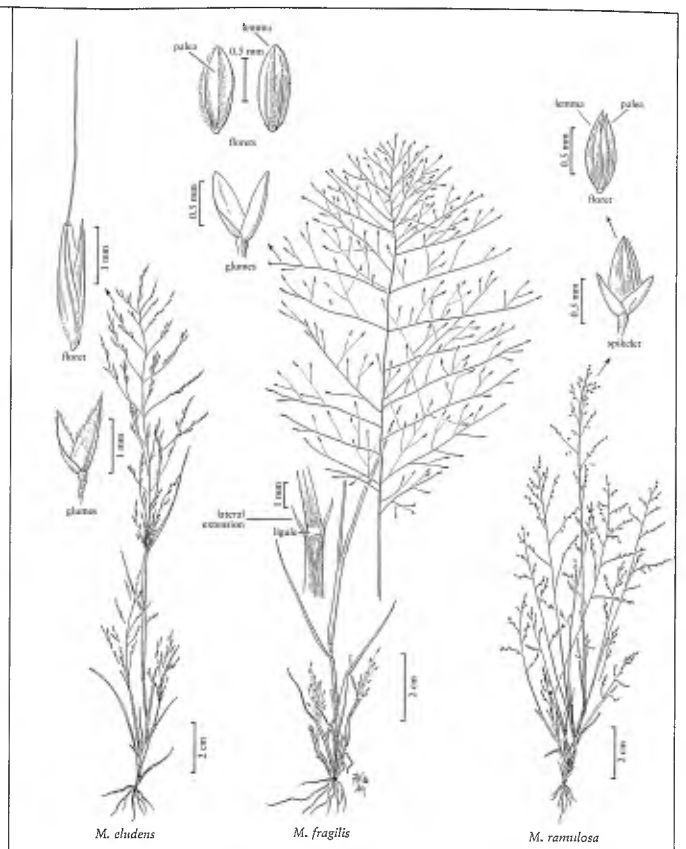
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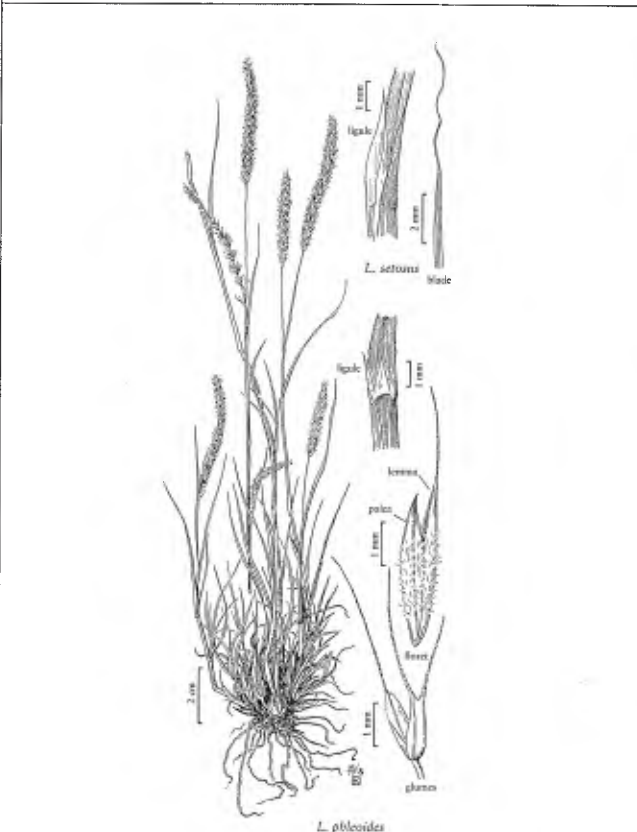
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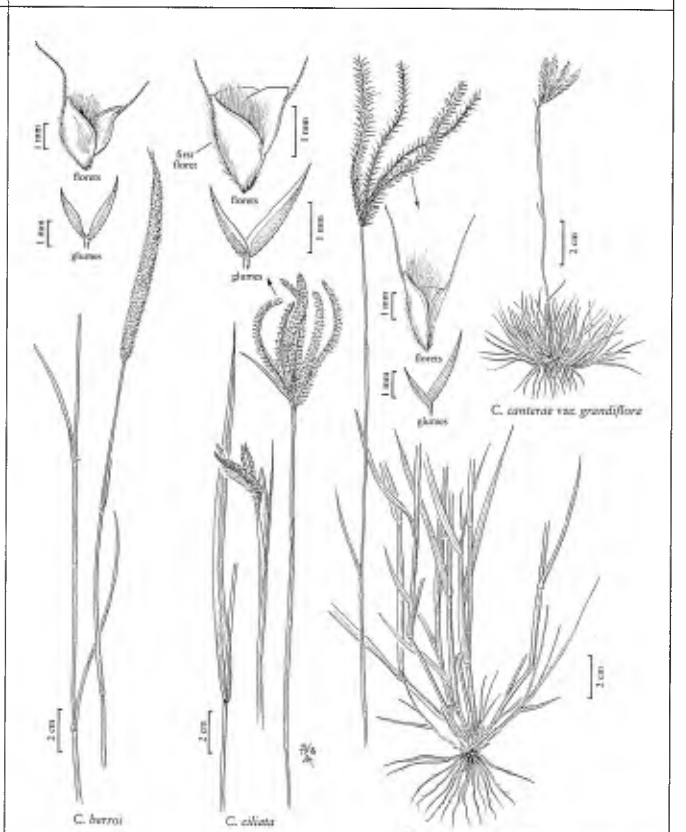
MUHLENBERGIA

16.33.68-70



LYCURUS

16.34.1-2



CHLORIS

16.35.1-3



*Sporobolus heterolepis*  
16.30.27



*Sporobolus teretifolius*  
16.30.28



*Sporobolus curtissii*  
16.30.29



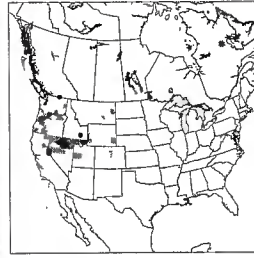
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*Sporobolus floridanus*  
16.30.31



*Sporobolus pinetorum*  
16.30.32



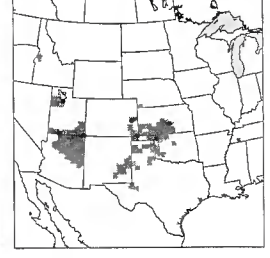
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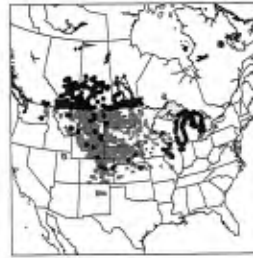
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*Crypsis vaginiflora*  
16.31.3



*Calamovilfa gigantea*  
16.32.1



*Calamovilfa longifolia*  
16.32.2



*Calamovilfa curtissii*  
16.32.3



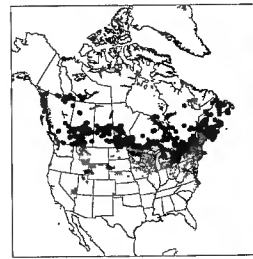
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16.32.4



*Calamovilfa brevipilis*  
16.32.5



*Muhlenbergia racemosa*  
16.33.1



*Muhlenbergia glomerata*  
16.33.2



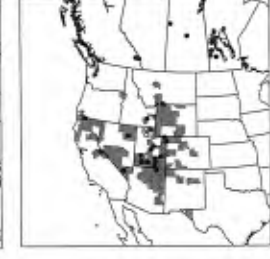
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*Muhlenbergia californica*  
16.33.4



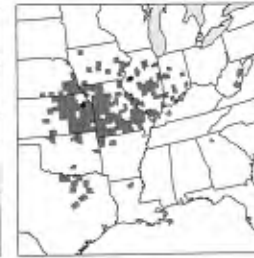
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*Muhlenbergia andina*  
16.33.6



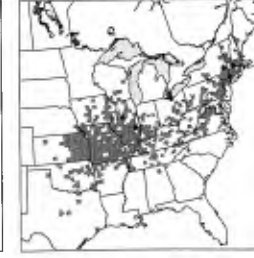
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*Muhlenbergia bushii*  
16.33.8



*Muhlenbergia frondosa*  
16.33.9



*Muhlenbergia sobolifera*  
16.33.10



*Muhlenbergia tenuiflora*  
16.33.11

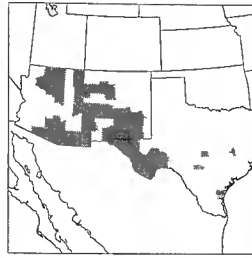




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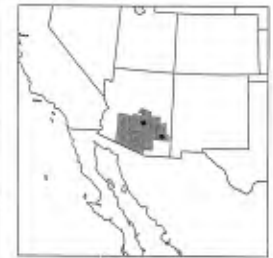
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*Muhlenbergia tenuifolia*  
16.33.14



*Muhlenbergia microsperma*  
16.33.15



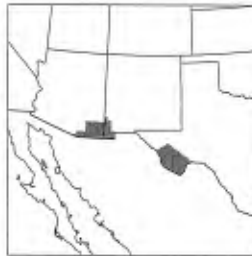
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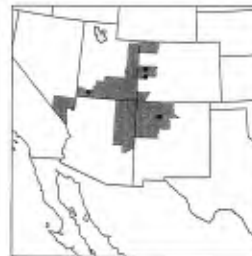
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*Muhlenbergia diversiglumis*  
16.33.18



*Muhlenbergia glauca*  
16.33.19



*Muhlenbergia thurberi*  
16.33.20



*Muhlenbergia curtifolia*  
16.33.21



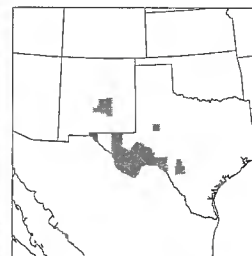
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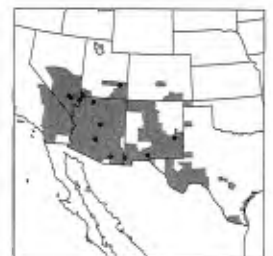
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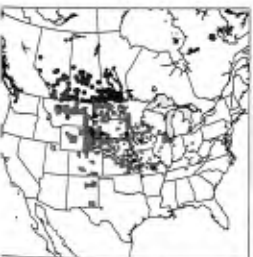
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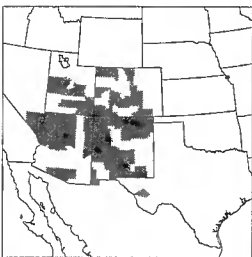
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*Muhlenbergia porteri*  
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*Muhlenbergia cuspidata*  
16.33.27



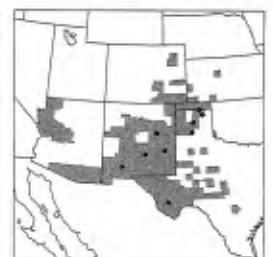
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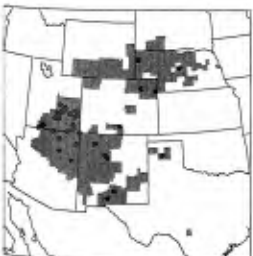
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*Muhlenbergia torreyi*  
16.33.30



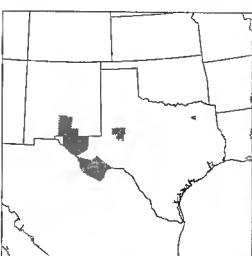
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16.33.31



*Muhlenbergia pungens*  
16.33.32



*Muhlenbergia dumosa*  
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*Muhlenbergia villiflora*  
16.33.34



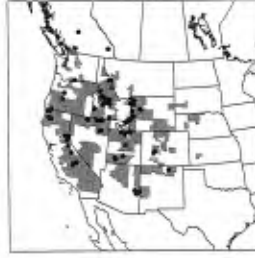
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*Muhlenbergia utilis*  
16.33.36



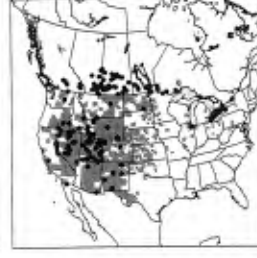
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*Muhlenbergia filiformis*  
16.33.38



*Muhlenbergia torreyana*  
16.33.39



*Muhlenbergia asperifolia*  
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*Muhlenbergia arenacea*  
16.33.41



*Muhlenbergia uniflora*  
16.33.42



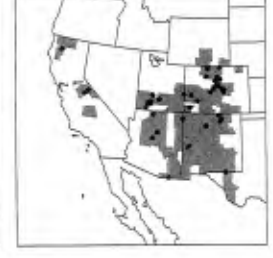
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*Muhlenbergia jonesii*  
16.33.44



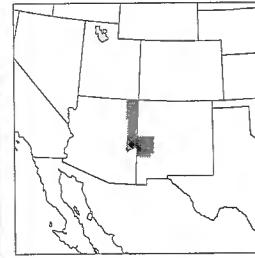
*Muhlenbergia straminea*  
16.33.45



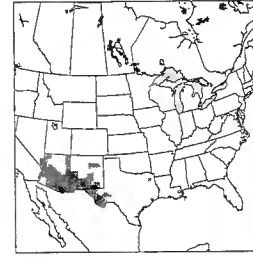
*Muhlenbergia montana*  
16.33.46



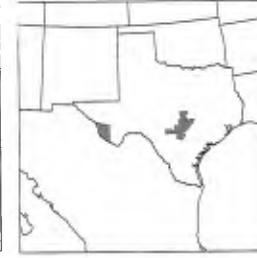
*Muhlenbergia crispiseta*  
16.33.47



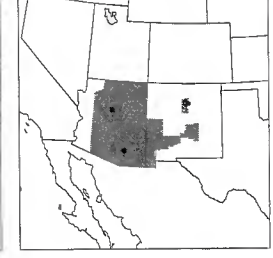
*Muhlenbergia peruviana*  
16.33.48



*Muhlenbergia emersleyi*  
16.33.49



*Muhlenbergia xinvoluta*  
16.33.50



*Muhlenbergia longiligula*  
16.33.51



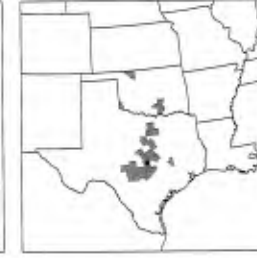
*Muhlenbergia expansa*  
16.33.52



*Muhlenbergia capillaris*  
16.33.53



*Muhlenbergia sericea*  
16.33.54



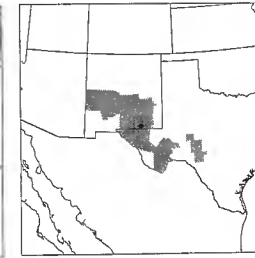
*Muhlenbergia reverchonii*  
16.33.55



*Muhlenbergia rigida*  
16.33.56



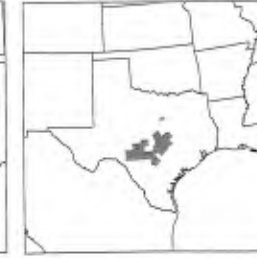
*Muhlenbergia elongata*  
16.33.57



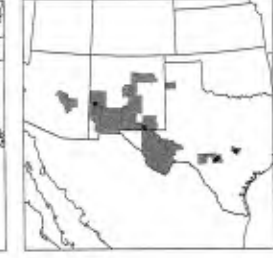
*Muhlenbergia setifolia*  
16.33.58



*Muhlenbergia palmeri*  
16.33.59

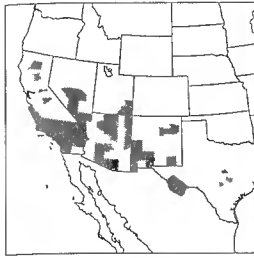


*Muhlenbergia lindheimeri*  
16.33.60

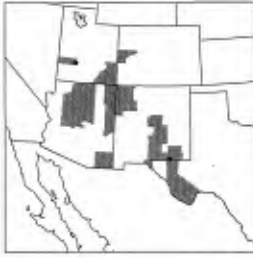


*Muhlenbergia dubia*  
16.33.61





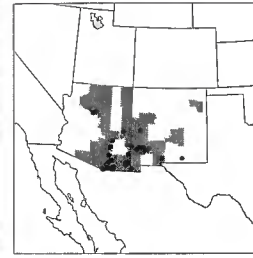
*Muhlenbergia rigens*  
16.33.62



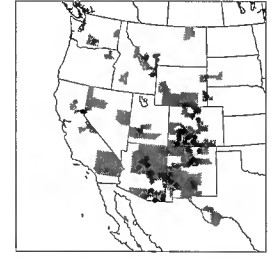
*Muhlenbergia depauperata*  
16.33.63



*Muhlenbergia brevis*  
16.33.64



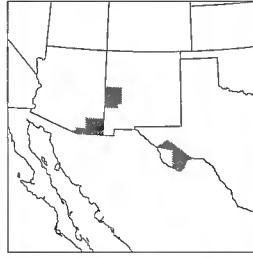
*Muhlenbergia sinuosa*  
16.33.65



*Muhlenbergia minutissima*  
16.33.66



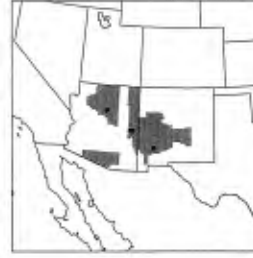
*Muhlenbergia texana*  
16.33.67



*Muhlenbergia eludens*  
16.33.68



*Muhlenbergia fragilis*  
16.33.69



*Muhlenbergia ramulosa*  
16.33.70



*Lycurus setosus*  
16.34.1



*Lycurus phleoides*  
16.34.2



*Chloris ciliata*  
16.35.2



*Chloris canterae*  
16.35.3



*Chloris elata*  
16.35.4



*Chloris barbata*  
16.35.5



*Chloris virgata*  
16.35.7



*Chloris gayana*  
16.35.8



*Chloris ventricosa*  
16.35.9



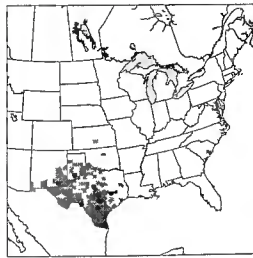
*Chloris truncata*  
16.35.10



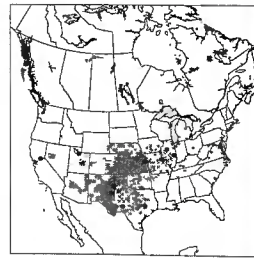
*Chloris divaricata*  
16.35.11



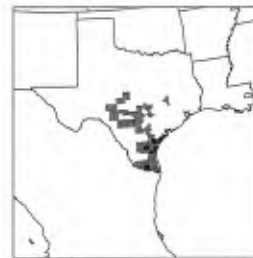
*Chloris pectinata*  
16.35.12



*Chloris cucullata*  
16.35.13



*Chloris verticillata*  
16.35.14



*Chloris andropogonoides*  
16.35.15



*Chloris texensis*  
16.35.16

# *Manual of Grasses for North America*

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and Michael B. Piep

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