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A Monographic Study of the Genus Aristida in New Mexico

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A MONOGRAPHIC STUDY OF THE

GENUS ARISTIDA IN NEW MEXICO

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A MONOGRAPHIC STUDY OF THE GENUS ARISTIDA IN NEW MEXICO

By

Raymond C. Krehoff

THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Biology

in the Graduate School of
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A MONOGRAPHIC STUDY OF THE GENUS *ARISTIDA* IN NEW MEXICO

By

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ABSTRACT OF THESIS

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ABSTRACT

Studies of collections of Aristida from New Mexico indicate that 16 species of this genus occur in the state. These are A. adscensionis L., A. oligantha Michx., A. orcuttiana Vasey, A. ternipes Cav., A. barbata Fourn., A. divaricata Humb. and Bonpl., A. hamulosa Henr., A. glauca (Nees) Walp., A. purpurea Nutt., A. roemeriana Scheele, A. wrightii Nash, A. pansa Woot. and Standl., A. longiseta Steud. (and 2 varieties), A. fendleriana Steud., A. parishii Hitchc., and A. arizonica Vasey.

These taxa are treated systematically from a morphological point of view and probable relationships among them are discussed. Distribution of each of the taxa is included along with a taxonomic key for the identification of the New Mexico species. The existence of certain taxa as distinct entities is questioned.

Further studies are proposed as means by which problem species may be better understood.

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INTRODUCTION

The genus Aristida based on Aristida adscensionis L., was established by Linnaeus in 1753 (Hitchcock, 1951). Linnaeus states that A. adscensionis is one of four specimens collected on the island of Adscension (Ascension), the other three specimens belonging to the unrelated genera Sherardia, Euphorbia, and Portulaca. The type specimen of A. adscensionis L. is in the Linnaean Herbarium, London.

Between 1812 and 1852 several species were described under the genera Streptachne, Ortachne, Chaetaria, Curtopogon, Trixostis, Moulinsia, and Muhlenbergia. At the time many new species were proposed by various authors, but most of these proved to be redescriptions of species previously named.

The genus Aristida, comprising a large group of grasses, belongs to the tribe Agrostideae, and together with Stipa and Oryzopsis constitutes the group (subtribe) Stipeae. Members of the Stipeae are distinguished by the hard, sharp-pointed fruit and the terete lemma which is convolute around both the palea and the fruit.

The genus is well distributed throughout tropical and temperate parts of the world, mostly on plains, prairies, and open ground. In general the species are erect bunch grasses with hard, wiry culms and strongly involute leaf blades in basal tufts.

Seed dissemination is aided by the awns and the sharp, needlelike, bearded and sometimes barbed callus at the base

of the lemma. The callus enables the fruit to penetrate clothing or the fur of animals and to be transported long distances. In such species as A. longiseta Steud. of our western plains, the long divergent awns, these commonly as long as 8 cm, are a distinct aid in the transportation of the fruit by the wind, a feature apparent in other species as well. The fruits are propelled through the air with the sharp callus forward and accumulate in large masses along fences and other obstructions.

The species of Aristida provide a large amount of forage, especially for cattle and horses, on the semiarid ranges of the southwest. Their palatability, however, is generally low and they are not accepted by livestock if better forage grasses are available. In addition, after the grains mature serious injury may be caused by the sharp-pointed, awned lemmas which work their way into eye and nose membranes.

In spite of their abundance, the species of Aristida have received no very distinctive common names. They are sometimes called variously spear grasses, needlegrasses, triple-awned grasses, or three-awned grasses; the first two names also are applied to species of the genus Stipa. Certain species of Aristida, especially A. longiseta Steud., are called dog-town grasses (Hitchcock, 1920) because of their tendency to become established in the new soil thrown up by prairie dogs. Because of the characteristic three-awned condition of the spikelet, it seems best to apply the name

three-awn grass to the species of Aristida and leave the names spear grass and needlegrass to the species of Stipa.

Most of the New Mexico species of Aristida belong to the section Chaetaria, in which the awns are all well developed and not articulated with the lemma. Two species belong to the section Streptachne, with the lateral awns minute or wanting.

In general, taxonomists have shown relatively little interest in Aristida, the last major work to appear in the literature being the monograph by Henrard (1926).

This study is concerned with the species of Aristida occurring in New Mexico, their identification, distribution, and possible inter- and intraspecific relationships.

MATERIALS AND METHODS

Plants used for this study included specimens from the University of New Mexico Herbarium, New Mexico State University Herbarium, Rocky Mountain Herbarium, Colorado State University Herbarium, Southern Colorado State College Herbarium, and the United States Department of Agriculture, Forest Service Herbarium in Albuquerque, New Mexico, as well as specimens collected by the author between June 1970 and October 1970 from various sites in New Mexico. All specimens examined for this study were collected in New Mexico.

The following publications were consulted in an attempt to determine the characteristics commonly used in delineating the various taxa within the genus: Wooton and Standley (1915), Hitchcock (1920), Fernald (1950), Gould (1951), Hitchcock (1951), Harrington (1964), Kearney and Peebles (1964), and Martin and Castetter (1970). Twenty-two characteristics common to all of the taxonomic treatments were selected for use in this study.

Observations and measurements of the above characteristics were utilized in the development of a dichotomous key as well as in descriptions of those taxa occurring in New Mexico.

The following is a list of the 22 characters determined to be of value in the delineation of the various taxa:

1. Length of the central awn
2. Length of the lateral awns
3. Barbed condition of the central awn

4. Barbed condition of the lateral awns
5. Length of the awn column
6. Degree of twist to the awn column
7. Length of the first glume
8. Length of the second glume
9. Awned condition of glumes
10. Number of nerves in lemma
11. Extent of the scaberulous condition of lemma
    a. Scaberulous at the tip only
    b. Scaberulous throughout the upper half
12. Leaf shape
    a. Involute
    b. Plane
    c. Revolute
13. Length of callus
14. Pubescent condition of callus
15. Pubescent condition of sheath
16. Distance from crown to first node
17. Height of culm
18. Outline shape of inflorescence
19. Branching habit
20. Habit
21. Length of spikelet
22. Length of panicle

DESCRIPTION OF THE GENUS ARISTIDA

Annual or perennial, mostly slender, tufted grasses; leaf blades involute or sometimes flat; inflorescence an open or contracted panicle; spikelets 1-flowered, the rachilla disarticulating above the glumes, leaving a sharp callus on the lemma; glumes glabrous, acuminate or awned, equal or unequal, 1-nerved or the first one sometimes with a second nerve on one side, rarely 3- or 5-nerved; lemma at maturity terete, convolute around the palea, disarticulating at the base and bearing a pointed, bearded callus as much as 1.5 mm long, the body of the lemma glabrous or sometimes scaberulous on the upper half or sometimes only at the apex, often narrowed above and tapering into the base of the awns; awns usually three, united at the base, the basal portion of the column usually elongated and sometimes twisted, the lateral awns sometimes reduced, the central awn sometimes twisted at the base; palea covered entirely by the edges of the lemma; styles distinct, the stigma plumose.

KEY TO THE SPECIES OF ARISTIDA IN NEW MEXICO

1. Plants annual.
   2. Central awn 21 mm long or less.....1. A. adscensionis
   2. Central awn more than 21 mm long.....2. A. oligantha
1. Plants perennial.
   3. Lateral awns wanting or, if present, less than 2 mm long.
      4. Awn column twisted at base.....3. A. orcuttiana
      4. Awn column not twisted at base.....4. A. ternipes
   3. Lateral awns more than 2 mm long.
      5. Panicle open, the branches spreading.
         6. Branchlets divaricate or implicate...5. A. barbata
         6. Branchlets appressed.
            7. Summit of lemma narrowed into a twisted neck 2 to 5 mm long.....6. A. divaricata
            7. Summit of lemma somewhat narrowed but not twisted. 7. A. hamulosa
      5. Panicle narrow, the branches ascending or appressed.
         8. First glume not more than 2/3 as long as the second.
            9. Beak of lemma 5 to 6 mm long.....8. A. glauca
            9. Beak of lemma not more than 4 mm long.
               10. Branches slender and flexuous.
                  11. Lemma 10 mm long, awns 3 to 5 cm long. 9. A. purpurea
                  11. Lemma 7 to 8 mm long, awns about 2 cm long. 10. A. roemeriana
               10. Branches stiff and appressed.
                  12. Panicle more than 15 cm long.

13. Second glume 11 mm long or longer.

11. A. wrightii

13. Second glume less than 11 mm long.

12. A. pansa

12. Panicle not exceeding 15 cm in length.

14. Lemma scarcely narrowed toward the apex, scaberulous only at the tip.

15. Panicles with less than 10 spikelets.

14. A. longiseta var. rariflora

15. Panicles with 10 spikelets or more.

16. Culms 20 to 30 cm tall.

13. A. longiseta var. longiseta

16. Culms 31 to 50 cm tall.

15. A. longiseta var. robusta

14. Lemma gradually narrowed toward the apex, scaberulous throughout the upper half.

16. A. fendleriana

8. First glume more than 2/3 as long as the second.

17. Awns 2.5 cm long.....17. A. parishii

17. Awns 1 to 2 cm long.

18. Awn column 2 cm long.....12. A. pansa

18. Awn column 3 to 5 cm long 18. A. arizonica

DESCRIPTION AND DISCUSSION OF THE SPECIES

1. Aristida adscensionis L., Sp. Pl. 82. 1753.

Aristida interrupta Cav., Icon. Pl. 5:45. 1799.

Chaetaria adscensionis Beauv., Ess. Agrost. 30, 151-158. 1812.

Aristida bromoides H.B.K., Nov. Gen. et Sp. 1:122. 1815.

Aristida coarctata H.B.K., Nov. Gen. et Sp. 1:122. 1815.

Chaetaria bromoides Roem. and Schult., Syst. Veg. 2:396. 1817.

Chaetaria coarctata Roem. and Schult., Syst. Veg. 2:396. 1817.

Aristida fasciculata Torr., Ann. Lyc. N.Y. 1:154. 1824.

Chaetaria fasciculata Schult., Mantissa 3 (Add. 1):578. 1827.

Aristida nigrescens Presl, Rel. Haenk. 1:223. 1830.

Aristida dispera Trin. and Rupr., Acad. St. Petersb. Mem. VI. Sci. Nat. 5[1]:129. 1842.

Aristida maritima Steud., Syn. Pl. Glum. 1:137. 1854.

Aristida schaffneri Fourn., Mex. Pl. 2:78. 1886.

Aristida grisebachiama Fourn., Mex. Pl. 2:78. 1886.

Aristida debilis Mez, Repert. Sp. Nov. Fedde 17:151. 1921.

Annual, the culms branching at the base, erect or spreading, 10 to 40 cm tall; panicle narrow and compact, 5 to 30 cm long; the first glume 5 to 8 mm long, the second 8 to 10 mm long; lemma 6 to 9 mm long, compressed toward a somewhat beaked summit, scaberulous on the keel above the middle;

awns about equal, mostly 10 to 12 mm long, flat and divergent, but not twisted.

Type locality: Adscension Island (Ascension Island).

Distribution: Missouri to southern Kansas and Texas, west to Nevada and southern California, and southward to Argentina. A common weed in the American tropics and warmer parts of the Old World.

New Mexico: Dry open ground, common throughout the drier portions of the state between 4,500 and 7,500 ft elevation. Flowering from August to October.

The above description is based on the examination of 137 specimens collected from various sites throughout the state (Fig. 1).

This taxon seems to be the most abundant of the aristidas in the state and is very variable in size, ranging from depauperate forms a few centimeters tall with shorter, contracted panicles (A. bromoides H.B.K.) to tall slender plants with large open panicles (A. fasciculata Torr.). Both of these extremes, along with many intermediate forms, occur in New Mexico. The smaller, depauperate plants are more prevalent in the lower and drier portions of the elevational range, while the more robust plants are more common at the higher elevations. This leads one to suspect that the variation in size within this taxon is merely an expression of environmental conditions rather than one of genetic difference. Further studies should be conducted to determine if this is truly an environmentally modified morphological variation or

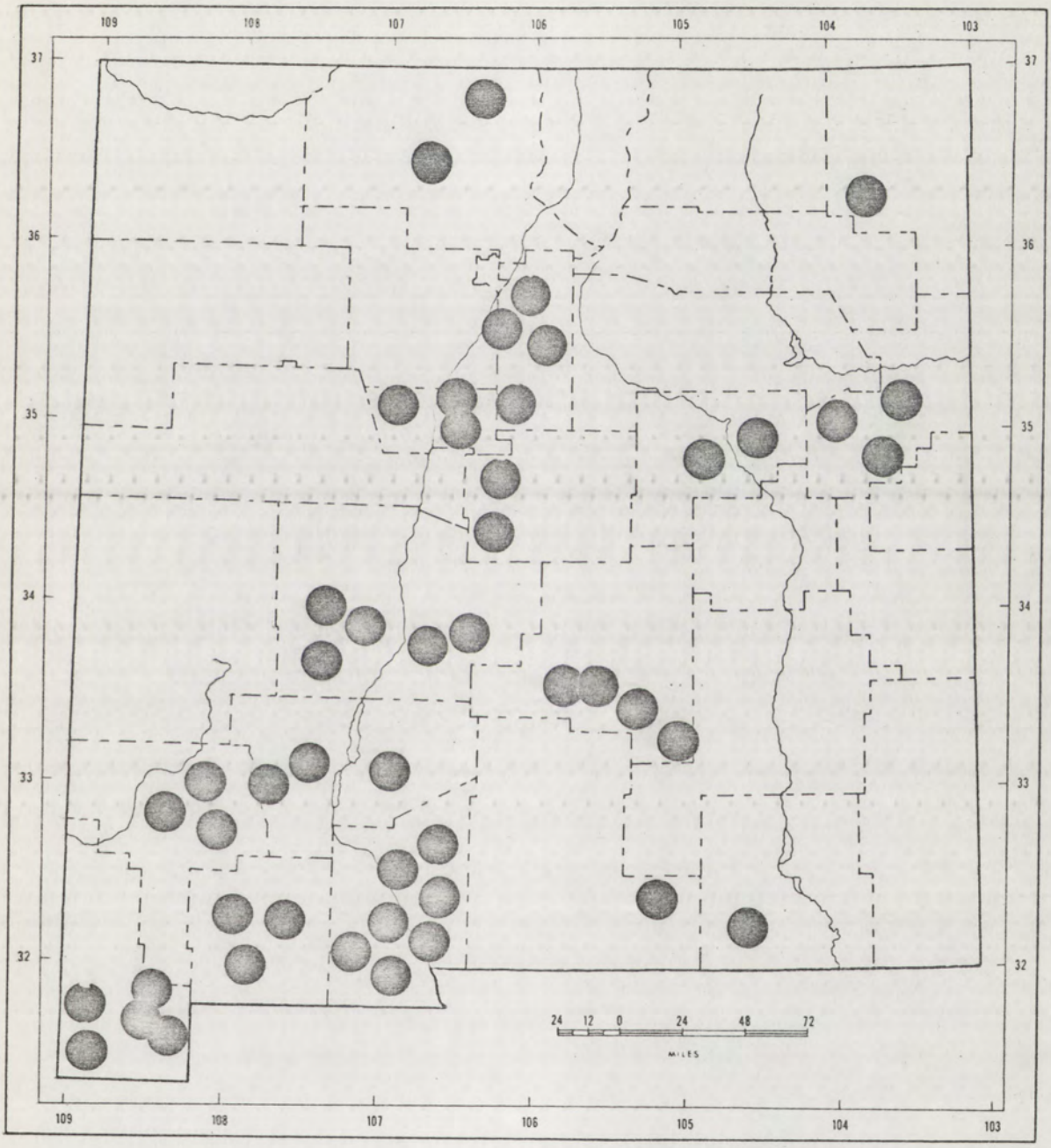

FIG. 1. Distribution of A. adscensionis.

if in fact there is a genetic basis for a possible division of this taxon into two separate varieties.

Aristida adscensionis is relatively easily separated from the other species of Aristida growing in New Mexico as it is one of only two annuals occurring in the state; the other annual is A. oligantha Michx. Aristida adscensionis differs from A. oligantha in having shorter awns and the first and second glumes of unequal length.

2. Aristida oligantha Michx., Fl. Bor. Amer. 1:41. 1803.

Chaetaria oligantha Beauv., Ess. Agrost. 30, 158. 1812.

Aristida pallens Nutt., Gen. Pl. 1:57. 1818.

Aristida micropoda Trin. and Rupr., Acad. St. Petersb. Mem. VI. Sci. Nat. 5':107. 1842.

Aristida macrochaeta Steud., Syn. Pl. Glum. 1:134. 1842.

Aristida pauciflora Buckl., Acad. Nat. Sci. Phil. Proc. 1862:92. 1862.

Annual, the culms much branched, 30 to 50 cm tall; leaf blades flat or loosely involute, usually not more than 1 mm wide; panicle loose, 10 to 20 cm long; spikelets short-pedicelled, the lower ones often in pairs; glumes about equal, 13 to 15 mm long, tapering into a short awn, the first glume 3- to 5-nerved; lemma about 2 cm long, the awns about equal, divergent, 2.5 to 3 cm long.

Type locality: Illinois, exact locality unknown.

Distribution: Massachusetts to South Dakota and Oregon, south to Florida, Texas, and Arizona.

New Mexico: Open dry ground, known only from the southwestern portion of the state at elevations of 5,000 to 7,500 ft. Flowering from August to October.

The above description is based on the examination of 12 specimens as well as on published descriptions (Hitchcock, 1951; Gould, 1951). The New Mexico specimens have shorter awns than indicated in the published descriptions.

There seems to be some confusion in the literature regarding the occurrence of A. oligantha in New Mexico. Hitchcock (1920, 1951) does not include New Mexico in the distribution maps for this taxon, although he does report it from Texas, Oklahoma, and Arizona. Gould (1951) states that this taxon ranges "throughout most of the United States except in the northern Rocky Mountains and the northern Pacific areas," thus implying its presence in New Mexico. Martin and Castetter (1970) state that A. oligantha is widespread in the state on open ground. Based on known collections it is postulated that A. oligantha occurs occasionally in New Mexico but is apparently more common in the southwestern portion of the state than elsewhere.

3. Aristida orcuttiana Vasey, Bull. Torrey Bot. Club 13:27. 1886.
Aristida hypomegas Mez, Repert. Sp. Nov. Fedde 17:146. 1921.

Perennial, culms erect, 30 to 60 cm tall; blades flat or the upper involute, 1 to 3 mm wide; panicle open, as much as 30 cm long, nodding or drooping, the branches few, distant,

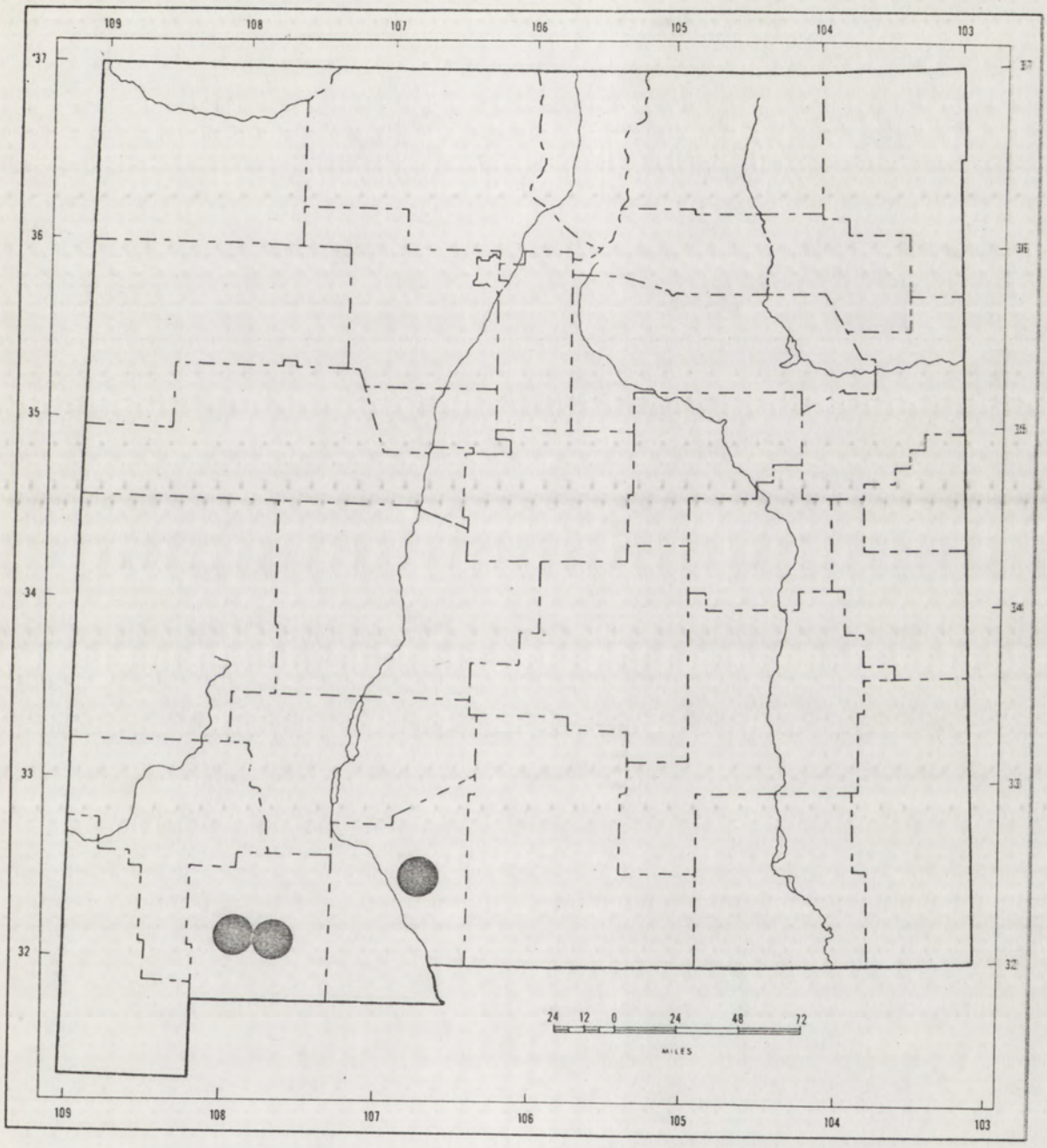

FIG. 2. Distribution of A. oligantha.

spreading or drooping, up to 20 cm long; glumes equal or nearly so, 10 to 15 mm long; lemma 8 to 10 mm long, gradually narrowed into a scabrous twisted column, the total length of the lemma and column 10 to 17 mm; central awn divergent, 5 to 10 mm long, the lateral awns erect and as much as 1 mm long, or sometimes obsolete.

Type locality: Hansen's Ranch, Baja California, Mexico.

Distribution: Texas to southern California and northwestern Mexico.

New Mexico: Rocky hills and plains, occurring only in the southwestern portion of the state at elevations of 4,000 to 7,000 ft. Flowering from May to September.

The above description is based on 21 specimens examined and on published material (Hitchcock, 1951; Gould, 1951).

This taxon is somewhat unique among the New Mexico species of Aristida in that it possesses very short (not exceeding 1 mm) lateral awns and a highly twisted awn column. Because of these two features this taxon is easily delineated from the other species. One other New Mexico species (A. ternipes Cav.) is also characterized by minute lateral awns but does not have the twisted awn column of A. orcuttiana.

A study of the distribution of this taxon (Fig. 3) indicates that A. orcuttiana is common to the warm temperatures of our southern foothills. It is difficult to determine why this taxon has not invaded the lower plains and foothills of the more northern parts of the state, but one might assume that it is not well adapted to the more severe winters in

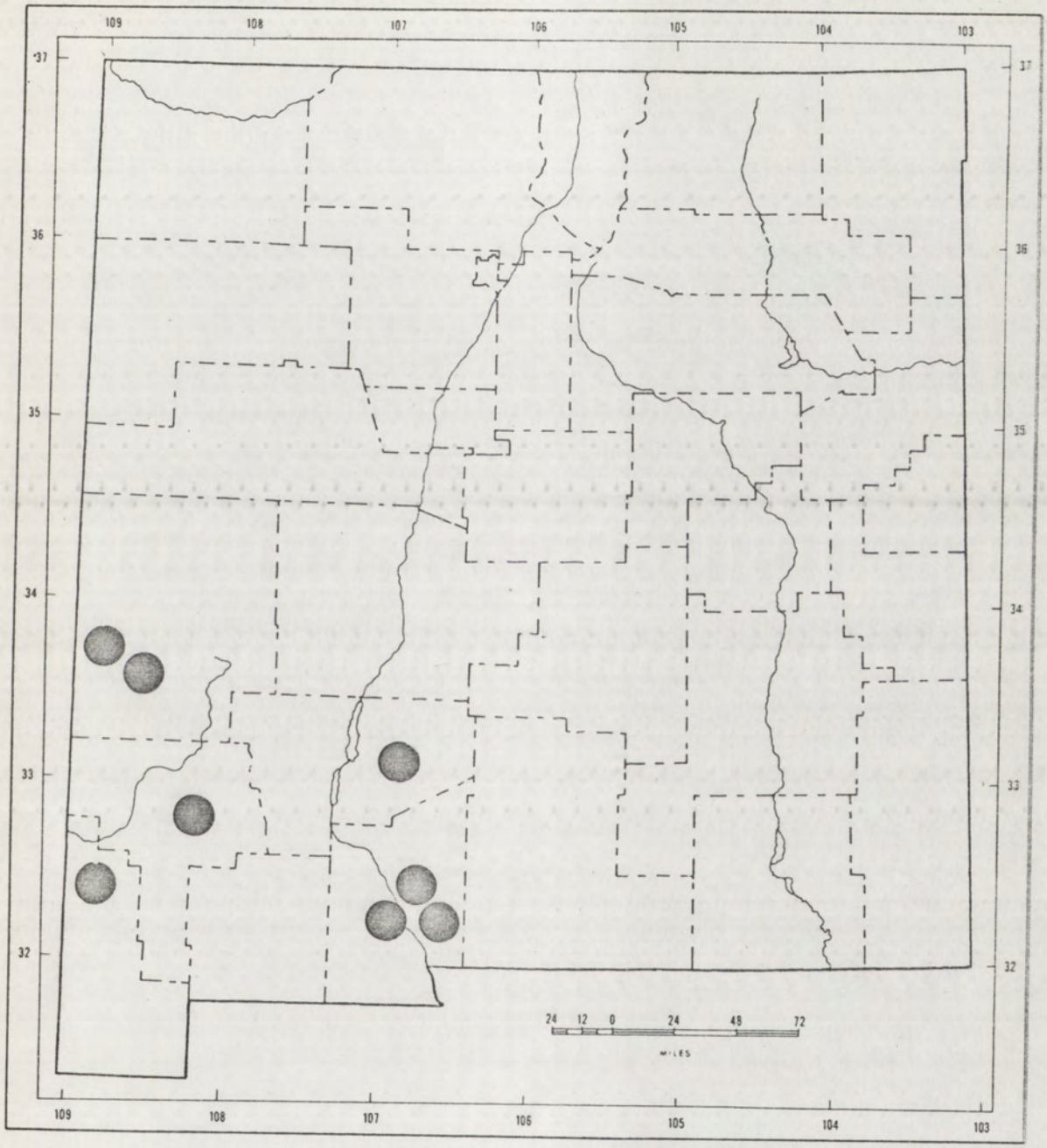

FIG. 3. Distribution of A. orcuttiana.

these northern areas.

4. Aristida ternipes Cav., Icon. Pl. 5:46. 1799

Streptachne scabra H.B.K., Nov. Gen. et Sp. 1:124. 1815.

Streptachne tenuis H.B.K., Nov. Gen. et Sp. 1:124. 1815.

Aristida scabra Kunth., Rev. Gram. 1:62. 1829.

Aristida tenuis Kunth., Rev. Gram. 1:62. 1829.

Stipa tunuis Willd. ex Steud., Nom. Bot. ed. 2. 2:643. 1841.

Muhlenbergia scabra Trin. and Rupr., Acad. St. Petersb. Mem. VI. Sci. Nat. 5':183. 1842.

Streptachne cubensis A. Rich in Saga, Hist. Cuba 11:311. 1850.

Ortachne scabra Fourn., Soc. Bot. France Bull. 27:295. 1880.

Ortachne tenuis Fourn., Soc. Bot. France Bull. 27:295. 1880.

Aristida divergens Vasey, Contrib. U.S. Nat. Herb. 3:48. 1892.

Aristida ternipes var. minor (Vasey) Hitchc., Wash. Acad. Sci. Jour. 23:453. 1933.

Perennial; culms erect, 50 to 100 cm tall; blades flat, as much as 40 cm long, 2 to 3 mm wide, involute toward the apex and tapering into a fine point, the branches few, distant, and spreading; spikelets appressed at the ends of the branches; glumes about equal, 8 to 10 mm long; lemma glabrous, often strongly scabrous on the keel, gradually narrowed into a

laterally compressed, scabrous, falcate beak, 3-nerved, the keel extending into a straight or divergent, scabrous, nearly terete awn, the minute lateral awns about 1 mm long, the central awn 10 to 15 mm long.

Type locality: Panama.

Distribution: Texas to New Mexico and Arizona, south to northern South America; Bahamas and Cuba.

New Mexico: Rocky hills and dry plateaus, apparently more common in the southwestern portion of the state than elsewhere, with one population known in the southeastern part of the state. Growing at elevations of 3,500 to 5,500 ft, and flowering mostly from August to November, but occasionally again in the spring.

The above description is based on an examination of 24 specimens as well as on published material (Hitchcock, 1951; Gould, 1951).

Aristida ternipes is closely related to A. orcuttiana with which it is sometimes sympatric. Aristida ternipes is distinguished from the latter mainly by the nontwisted awn column, the generally larger and coarser habit, and the tendency to grow at lower altitudes and under more arid conditions (Gould, 1951). A form described as var. minor (Vasey) Hitchc. has been reported by Hitchcock (1951) and Martin and Castetter (1970) as being more common in New Mexico than the typical variety. This form is characterized as being smaller, and having a relatively longer but less diffusely branched panicle. There seems to be little evidence from the specimens

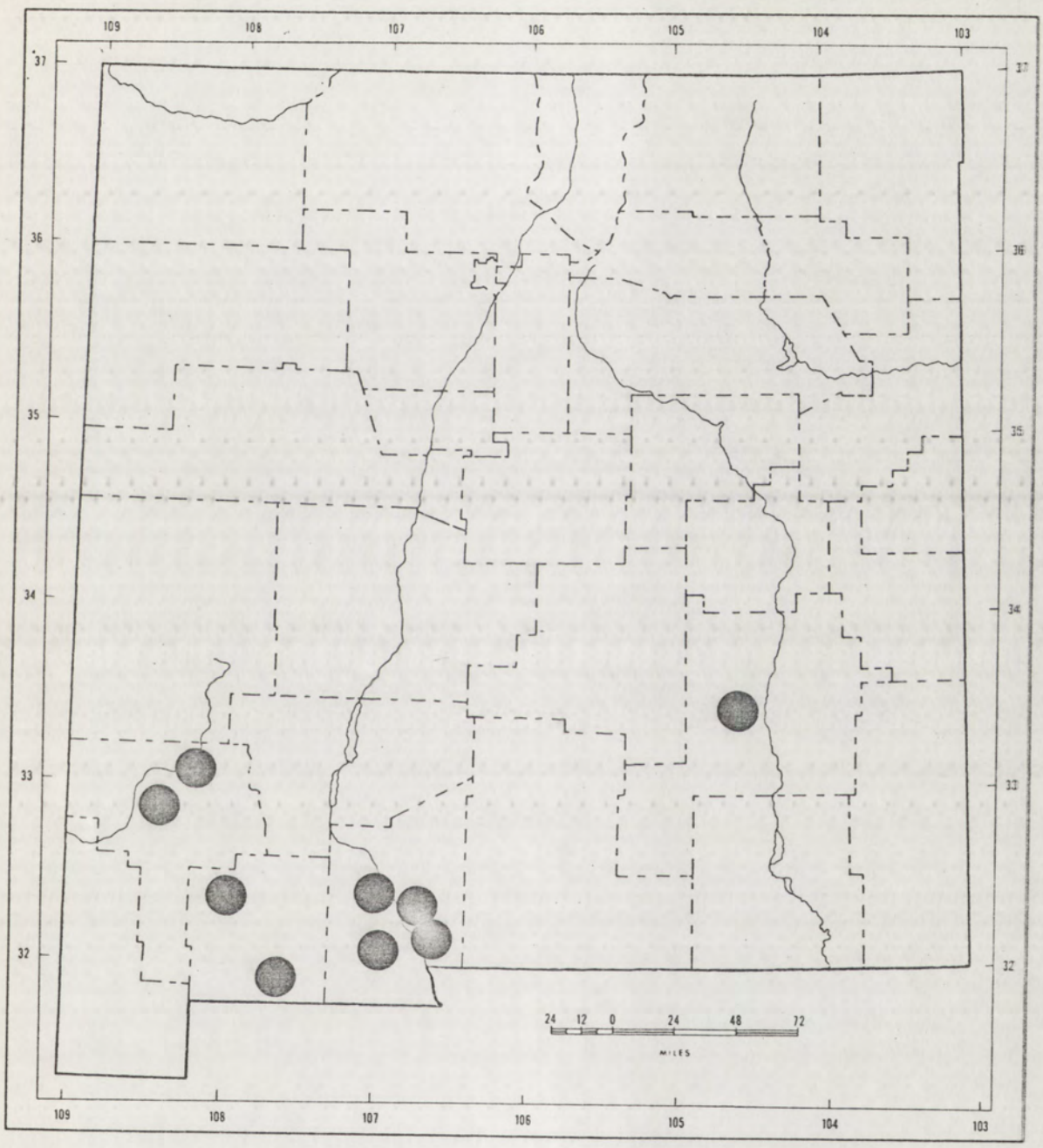

FIG. 4. Distribution of A. ternipes.

examined to warrant recognition of this form as a variety. In support of this decision, Gould (1951) reports that specimens of A. ternipes examined from Pima Co. in Arizona show fall-grown panicles as long as 55 cm with spreading branches, but on the same plants there are spring-grown panicles 12 to 25 cm long with very short, appressed branches. An intensive study of A. ternipes in relation to characters of panicle length and branching habit, throughout the range of this plant, may prove to be the only way to resolve the status of var. minor.

5. Aristida barbata Fourn., Mex. Pl. 2:78. 1886.

Aristida havardii Vasey, Bull. Torrey Bot. Club 13:27. 1886.

Perennial; forming hemispherical tufts as much as 30 cm in diameter; the culms rather stiffly radiating in all directions, 15 to 30 cm long; leaf blades closely involute, mostly less than 10 cm long and about 0.5 mm wide; panicle about half the entire length of the plant, open, the branches divaricately spreading or somewhat reflexed, mostly 3 to 6 cm long, in pairs or with short basal branchlets, but without elongate naked bases, the branchlets and panicle implicate or flexuous; glumes about equal, 1 cm long; lemma gradually narrowed into a straight or twisted scaberulous beak 8 to 10 mm long, awns somewhat divergent, nearly equal, 15 to 20 mm long.

Type locality: Valley of Mexico.

Distribution: Western Texas to Arizona and central Mexico.

New Mexico: Hills and plains, throughout the central

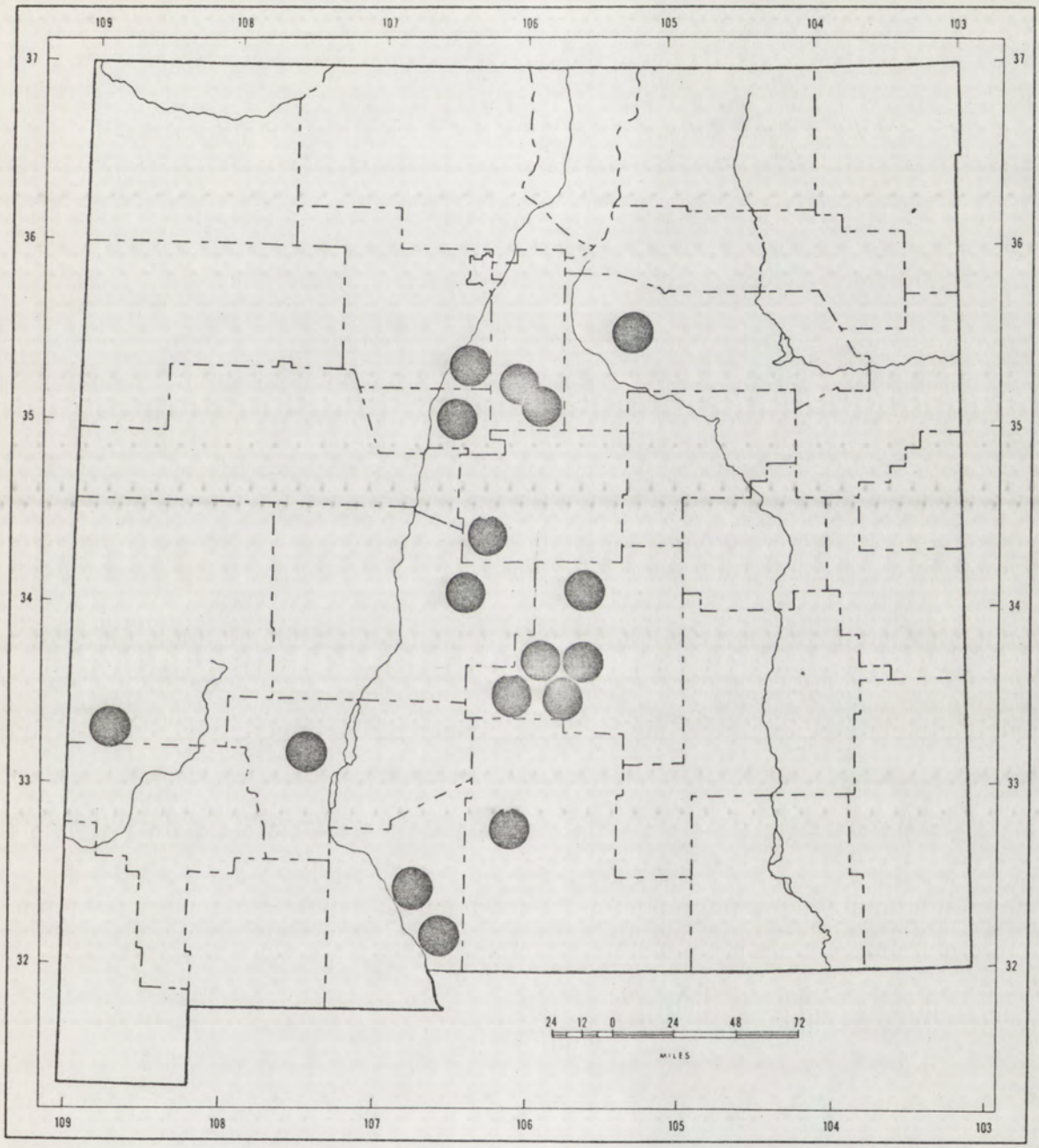

FIG. 5. Distribution of A. barbata.

portion of the state at elevations of 5,000 to 7,000 ft. Flowering from August to October.

The above description is based on the examination of 48 specimens.

Hitchcock (1935) states, "This species is closely allied to A. divaricata, but is distinguished by the hemispheric habit of growth and the flexuous or implicate branches and pedicels. In A. divaricata the culms are often prostrate or nearly so but do not form hemispheric tufts; the main branches are naked at the base and the pedicels appressed along the upper part of the branches. In A. barbata the branches are shorter and bear a basal branch, so that the spikelets are evenly distributed through the panicle." Evidence from this study tends to support Hitchcock's conclusions.

6. Aristida divaricata Humb. and Bonpl., ex Willd., Enum. Pl. 1:99. 1809.

Chaetaria divaricata Beauv., Ess. Agrost. 30, 158. 1812.

Aristida humboldtiana Trin. and Rupr., Acad. St. Petersb. Mem. Sci. Nat. 5':118. 1842.

Aristida palmeri Vasey, Bull. Torrey Bot. Club 10:42. 1883.

Aristida lemonii Scribn., N.Y. Acad. Sci. Trans. 14:23. 1894.

Perennial; culms erect or prostrate-spreading, usually 30 to 60 cm long; leaf blades flat or loosely involute, mostly less than 3 mm wide; panicle large, diffuse, usually as much as half the entire length of the culm, the branches spreading

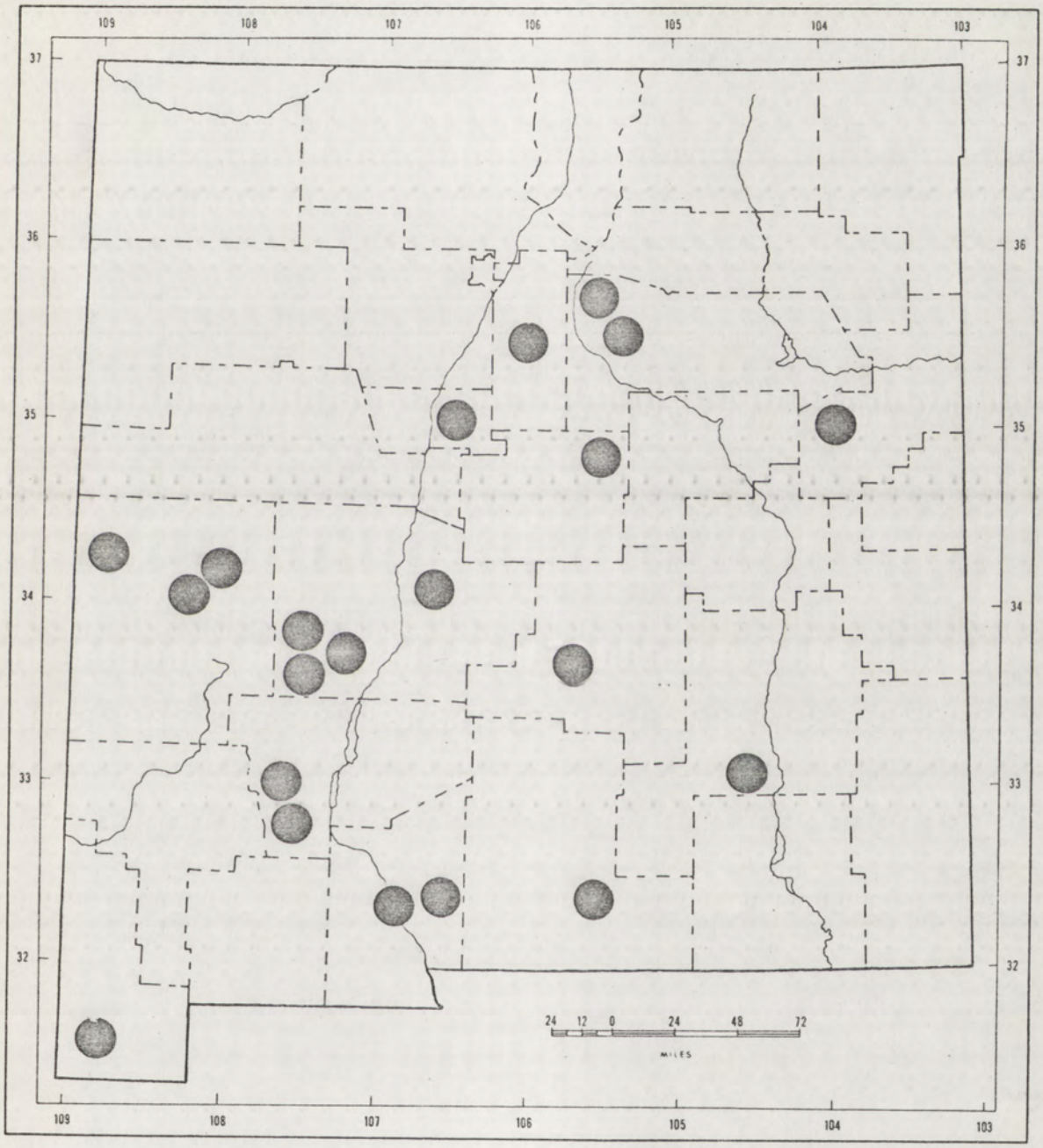

FIG. 6. Distribution of A. divaricata.

or reflexed, naked at the base; glumes nearly equal, 1 cm long; lemma 1 cm long, narrowed into a twisted beak 2 to 5 mm long; awns about equal, 10 to 15 mm long.

Type locality: Mexico.

Distribution: Kansas to southern California, south to Texas, Arizona, and Guatemala.

New Mexico: Dry hills and plains, in the southern two-thirds of the state at elevations of 5,000 to 7,500 ft. Flowering from July to October.

The above description is based on the examination of 89 specimens.

This species is closely related to A. barbata, differing from the latter in the features pointed out in the discussion of A. barbata.

7. Aristida hamulosa Henr., Med. Rijks Herb. Leiden 54:219. 1926.
Aristida imbricata Henr., Med. Rijks Herb. Leiden 54A:253. 1927.

Perennial; culms erect or prostrate-spreading, usually 25 to 55 cm tall, leaf blades flat or involute, less than 4 mm wide; panicle large and diffuse, as much as half as long as the culm, the branches spreading and naked at the base; glumes about equal, 1 cm long; lemma narrowed at the summit, but not forming a twisted column, central awn about 15 mm long, lateral awns about 11 mm long.

Type locality: Tucson, Arizona.

Distribution: Western Texas to southern California, south to Guatemala.

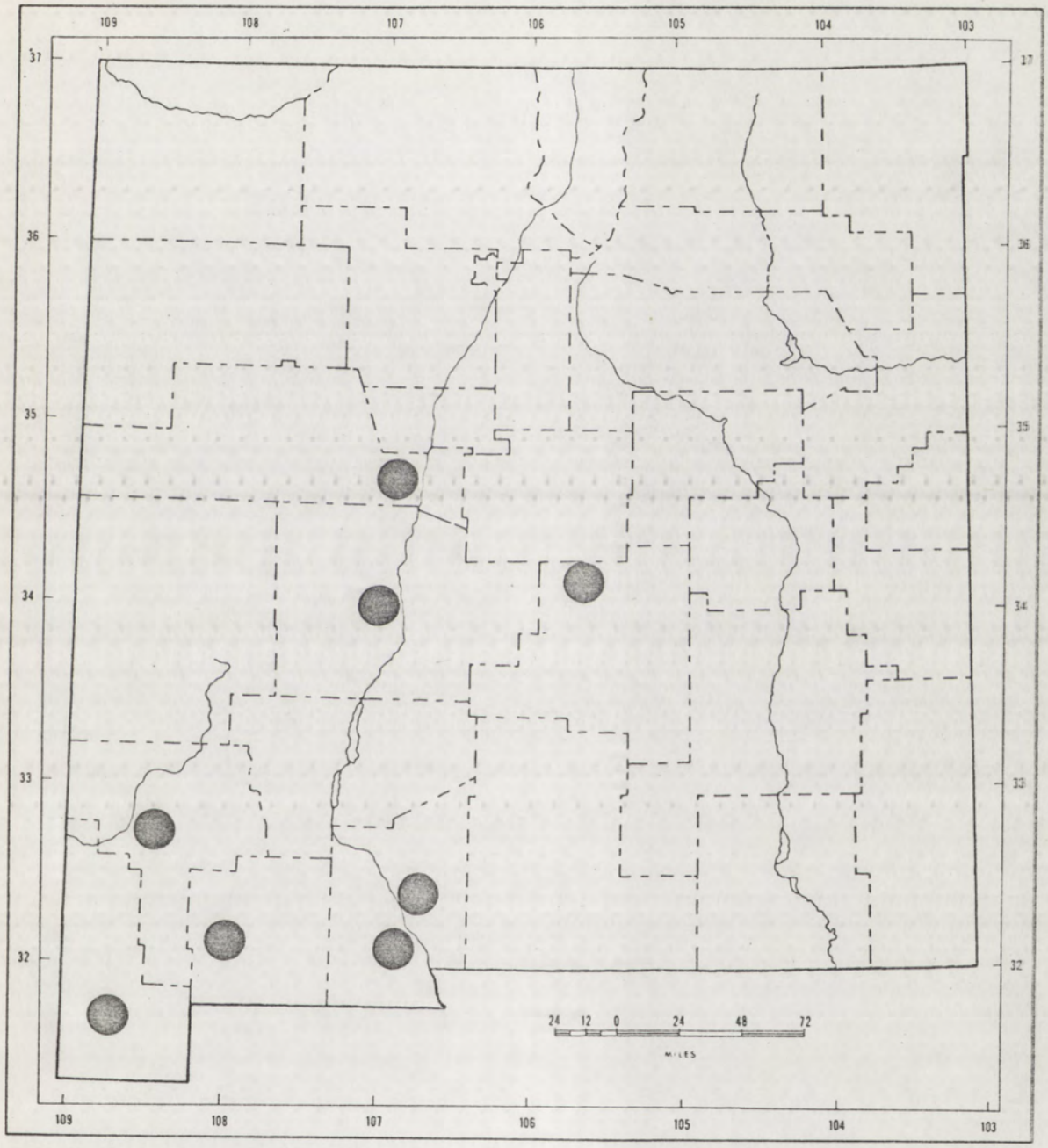

FIG. 7. Distribution of A. hamulosa.

New Mexico: Dry hills and plains in the central and southwestern portions of the state at elevations of 3,500 to 5,000 ft. Flowering mostly from August to October, but sometimes also during the winter and spring months.

The above description is based on the examination of 22 specimens as well as published material (Hitchcock, 1951; Gould, 1951).

Aristida hamulosa is similar to A. divaricata and A. ternipes. A. hamulosa differs from A. divaricata in having a short, thick nontwisted awn column, and the central awn longer than the lateral awns, and from A. ternipes in having the awns all well developed, the lateral awns only slightly shorter than the central one. In the type description Henrard (1926, p. 219-21) states, "A species with the habit of Aristida divaricata H. et B., but well distinguished by the wanting awn column and the curious tuberculate lemmas."

Aristida hamulosa is also closely linked with A. barbata, A. orcuttiana, and A. pansa Woot. & Standl. (Gould, 1951). This group of species, along with closely related species from Mexico, is greatly in need of further study and perhaps taxonomic revision.

8. Aristida glauca (Nees) Walp., Ann. Bot. (London) 1:925. 1849.

Chaetaria glauca Nees, Linnaea 19:688. 1847.

Aristida reverchoni Vasey, Bull. Torrey Bot. Club 13:52. 1886.

Aristida stricta var. nealleyi Vasey, Contrib. U.S. Nat. Herb. 1:55. 1890

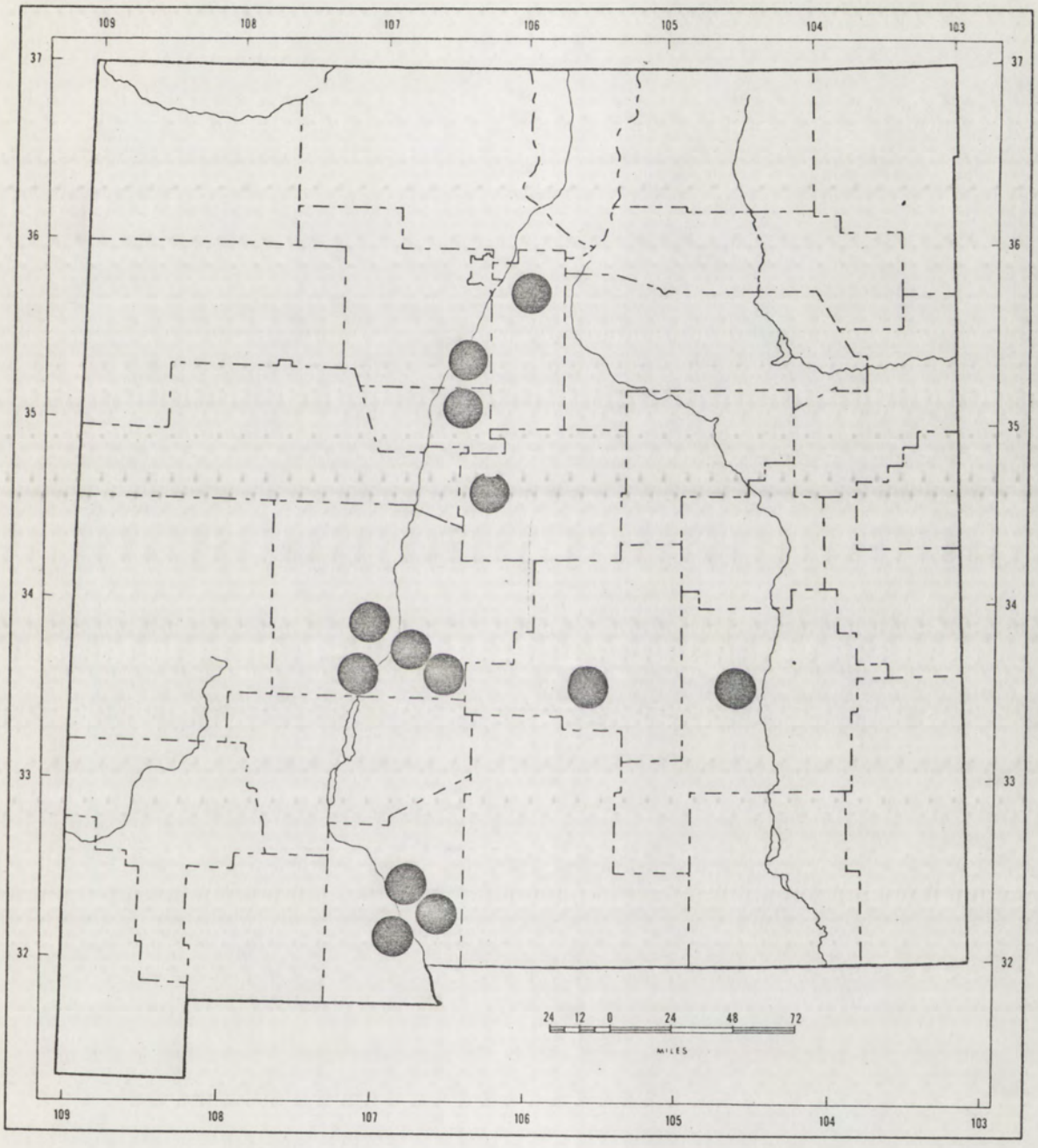

FIG. 8. Distribution of A. glauca.

Aristida nealleyi Vasey, Contrib. U.S. Nat. Herb. 3:45. 1892.

Aristida vaseyi Woot & Standl., New Mexico College Agr. Bull. 81:55. 1912.

Perennial; culms erect, 20 to 40 cm tall; leaf blades involute, mostly curved, 5 to 10 cm long, about 1 mm wide; panicle narrow, erect, rather few flowered, mostly 8 to 15 cm long, the branches stiffly appressed; the first glume 4 to 7 mm long, the second about twice as long; lemma 10 to 13 mm long, tapering at maturity into a slender somewhat twisted beak about half the total length of the lemma; awns equal, divergent or horizontally spreading, 1.5 to 2.5 cm long.

Type locality: Mexico.

Distribution: Texas to Utah, Nevada, and southern California, south to Mexico.

New Mexico: Dry, rocky hills and plains, throughout the central and southern portions of the state at elevations of 3,500 to 4,500 ft. Flowering throughout the year under favorable conditions.

The above description is based on examination of 54 specimens.

Gould (1951) reports a number of forms referable to Aristida glauca and states that these forms apparently link A. glauca with A. parishii Hitchc., A. fendleriana Steud., A. purpurea Nutt., and perhaps A. longiseta Steud. None of the specimens of A. glauca examined presented evidence in support of Gould's hypothesis. I can assume only that

instances of the apparent hybrid relationships must be very uncommon in New Mexico.

9. Aristida purpurea Nutt., Trans. Amer. Phil. Soc. (n.s.) 5:145. 1837.

Aristida acquiramea Scheele, Linnaea 22:343. 1849.

Aristida filipendula Buckl., Acad. Nat. Sci. Phil. Proc. 1862:93. 1862.

Aristida purpurea var. laxiflora Merr., U.S. Dep. Agr., Div. Agrost. Cir. 34:8. 1901.

Aristida berlandieri Hitchc., Contrib. U.S. Nat. Herb. 17:280. 1913.

Perennial, often in large tufts; culms 30 to 50 cm tall; leaf blades usually involute and less than 10 cm long, 1 to 1.5 mm wide when unrolled ; panicle narrow, nodding and rather lax, usually purplish, 10 to 20 cm long, the branches and longer pedicels capillary, more or less curved or flexuous; first glume 6 to 8 mm long, the second about twice as long; lemma about 1 cm long, the body tapering into a somewhat beaked summit; awns nearly equal, spreading, 3 to 5 cm long.

Type locality: Red River, Arkansas.

Distribution: Arkansas and Kansas to Utah, Texas, and southern California, south to Mexico.

New Mexico: Dry hills and plains, throughout the state except the extreme northern portion at elevations of 4,500 to 5,500 ft. Flowering from March to September.

The above description is based on the examination of 58 specimens.

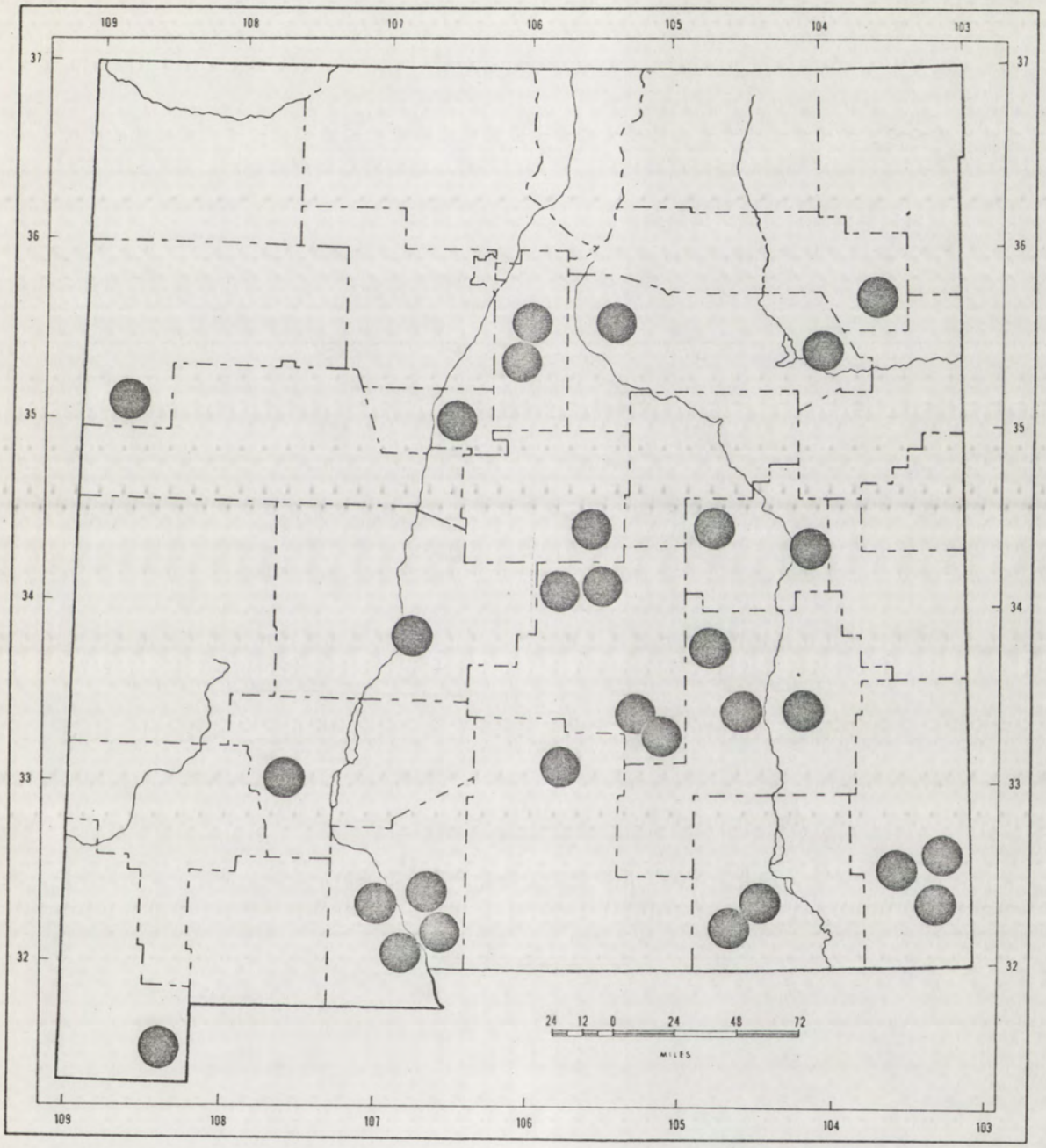

FIG. 9. Distribution of A. purpurea.

This taxon is easily separable from most of the other species of Aristida on the basis of awn length. Only three species have awns comparable in length to A. purpurea. These are A. oligantha, A. longiseta Steud., and A. fendleriana Steud. Aristida oligantha is an annual in contrast to the perennial habit of A. purpurea; A. longiseta has a stout awn column about 1 mm long while A. purpurea has a slender column about 3 mm long; A. fendleriana differs in the very contracted panicle as opposed to the open panicle of A. purpurea.

Although evidence for hybridization is apparently lacking among New Mexico populations, Gould (1951) reports a "puzzleing intermediate" between A. longiseta and A. purpurea at Tucson, Arizona. This putative hybrid is apparently very rare and has never been reported from New Mexico.

Only one variety of A. purpurea has been described, var. laxiflora Merr., characterized as having a relatively few-flowered panicle. I am dubious about retaining this taxon as a variety because it appears to be nothing more than a growth form. Although the number of spikelets per panicle is reduced, other morphological characters of this plant such as general size of the entire plant are also reduced. This leads me to believe that these plants are only showing an environmentally caused variation, possibly resulting from decreased moisture and generally impoverished soil.

10. Aristida roemeriana Scheele, Linnaea 22:343. 1849.
Aristida muhlenbergioides Fourn., Mex. Pl. 2:79. 1886.

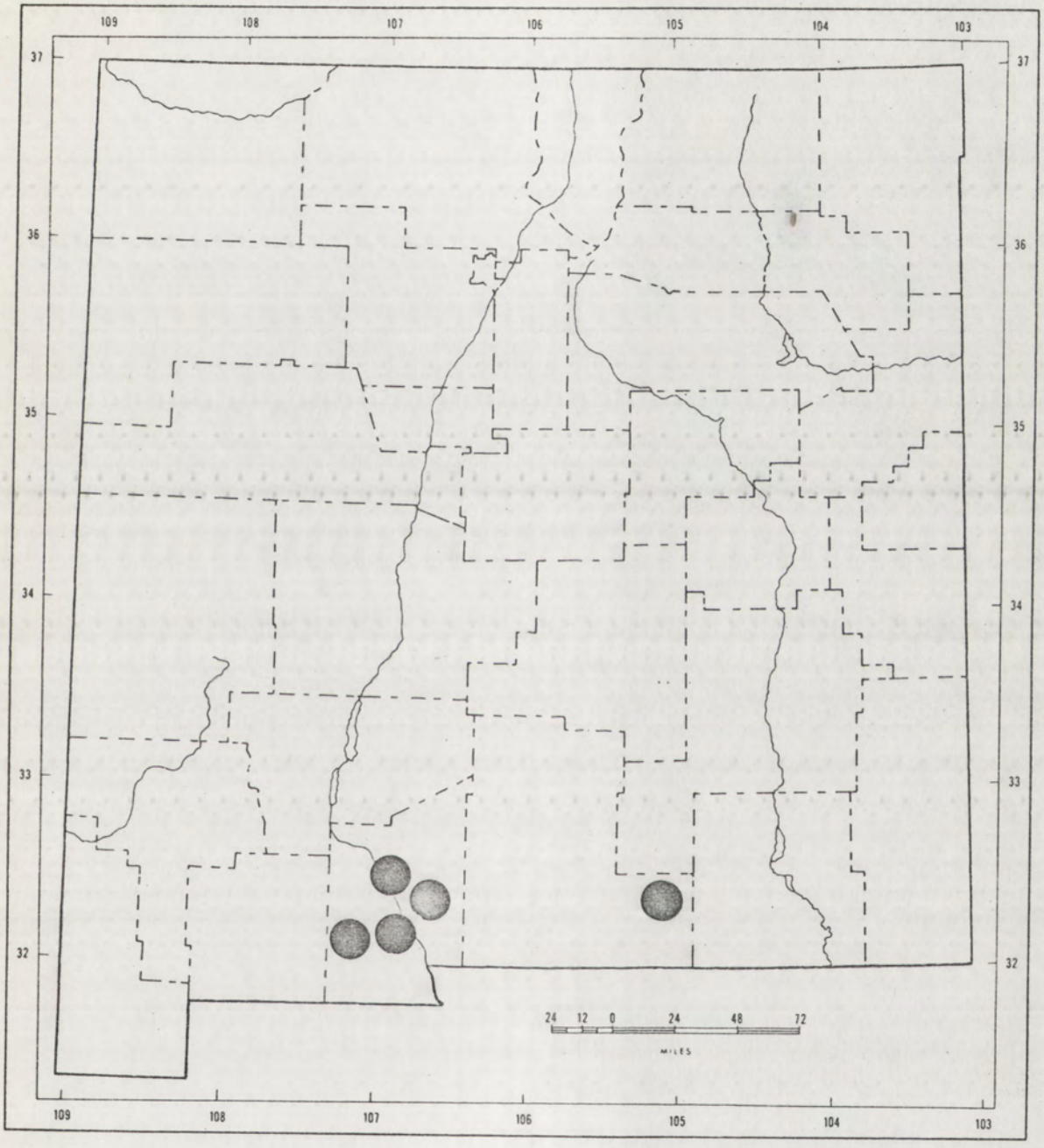

FIG. 10. Distirbution of A. roemeriana.

Aristida micrantha Nash in Small, Fl. Southeast. U.S. 117. 1903.

Perennial, often in large tufts; culms 30 to 50 cm tall; leaf blades usually involute and less than 10 cm long, 1 to 1.5 mm wide when unrolled, panicle narrow, nodding, usually purplish, 10 to 20 cm long, the branches and longer pedicels capillary, more or less curved; first glume 4 to 5 mm long, the second about twice as long; lemma about 7 mm long, the body tapering into a somewhat beaked summit; awns nearly equal, about 2 cm long.

Type locality: New Braunfels, Texas.

Distribution: Texas, New Mexico, and northern Mexico.

New Mexico: Open, dry ground, in the southcentral portions of the state but should be more widespread at elevations of 5,000 to 7,000 ft. Flowering from April to September.

The above description is based on the examination of 14 specimens as well as published material (Hitchcock, 1951).

Aristida roemeriana closely resembles A. purpurea but differs in having smaller spikelets with the first glume, the lemma, and the awns of the former obviously shorter than those of A. purpurea.

For the purposes of this study A. roemeriana is retained as a separate species, but I am inclined to relegate this species to the status of a variety of A. purpurea as proposed by Merrill (1892).

11. Aristida wrightii Nash in Small, Fl. Southeast. U.S. 116. 1903.

Perennial; culms tufted, erect, 30 to 60 cm tall; sheaths villous at the throat and with a more or less hispid or villous line across the collar; leaf blades involute, curved, or flexuous; panicle erect, narrow, 15 to 20 cm long; the first glume 6 to 7 mm long, the second about twice as long; lemma 10 to 12 mm long; awns nearly equal, about 2 cm long, divergent.

Type locality: Dallas, Texas.

Distribution: Oklahoma, Texas, Colorado, and Utah to southern California and central Mexico.

New Mexico: Dry hills and plains, common in the central and southwestern portions of the state at elevations of 3,500 to 6,000 ft with one isolated collection in the north at 6,000 ft. Flowering from December to May, but occasionally at any time of the year under favorable conditions.

The above description is based on the examination of 23 specimens as well as on published material (Hitchcock, 1951; Gould, 1951).

This species is morphologically similar to A. parishii Hitchc., but differs in having a less densely flowered panicle and distinctly unequal glumes, the first glume 6 to 7 mm long and the second about twice as long.

There is some indication in the literature that A. wrightii and A. parishii should be lumped (Gould, 1951) and given no more than varietal distinction. Other authors believe that there exists enough difference between the two taxa to retain them as separate species (Hitchcock, 1951; Kearney and Peebles, 1964; Martin and Castetter, 1970). In this paper I have decided

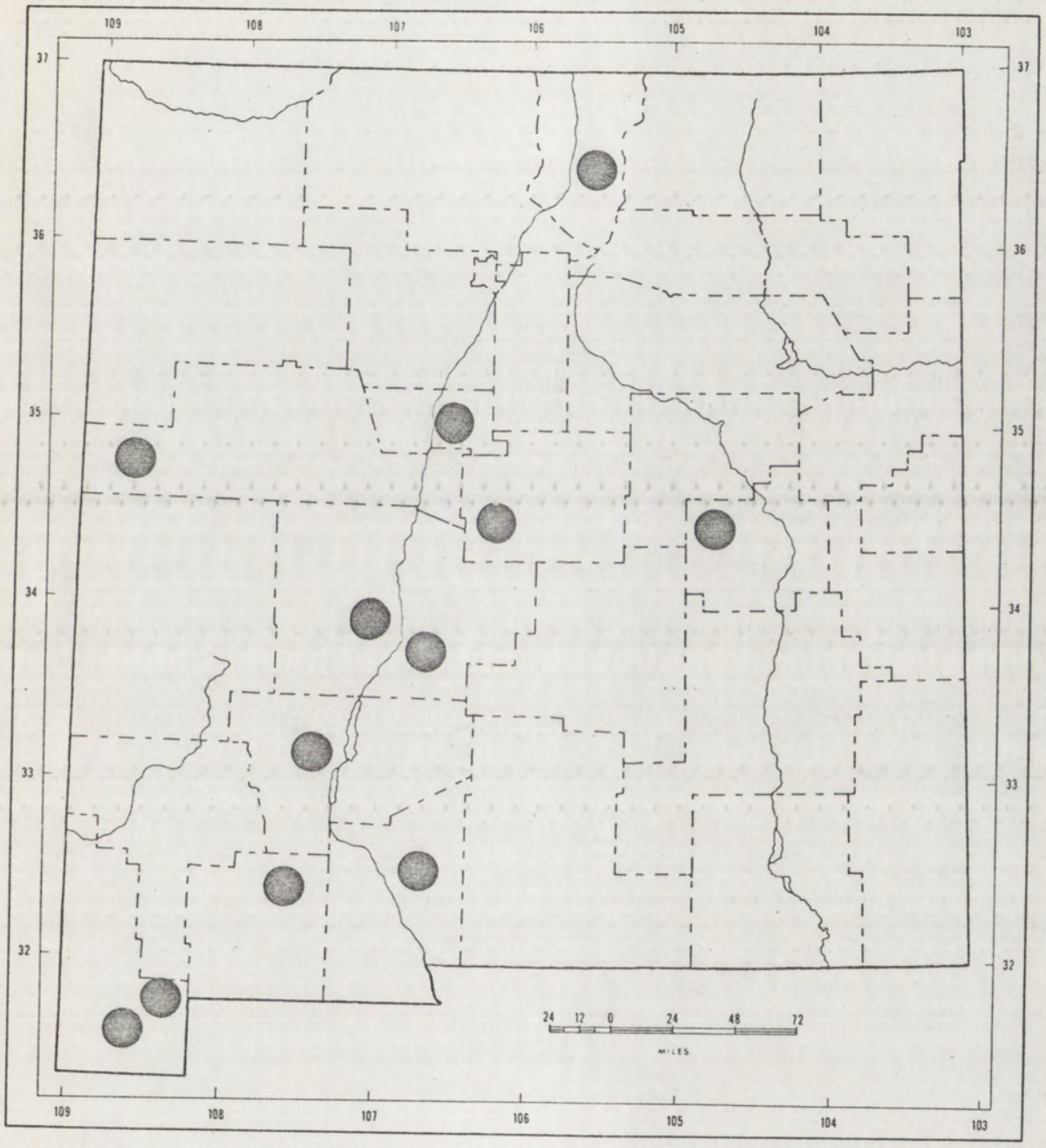

FIG. 11. Distribution of A. wrightii.

to follow the latter idea and keep them as separate species.

12. Aristida pansa Woot. & Standl., Contrib. U.S. Nat. Herb. 16:112. 1913.

Perennial; culms stiffly erect, slender, wiry, 20 to 40 cm tall; leaf blades involute, 0.5 mm wide, often flexuous; panicle narrow, open and often stiff, 10 to 20 cm long, the branches ascending, 4 to 8 cm long; spikelets erect or narrowly ascending on the branchlets; the first glume 5 to 7 mm long, the second 7 to 10 mm long; the lemma about as long as the second glume, or slightly longer, tapering into a scaberulous, slightly twisted beak about 2 mm long; awns about equal, divergent, 10 to 20 mm long.

Type locality: Tortugas Mountains, New Mexico.

Distribution: Western Texas to Arizona and northern Mexico.

New Mexico: Plains and open ground, often in rocky foothills, predominantly in the southern portion of the state at elevations of 3,500 to 5,000 ft. Flowering from July to October but also in the spring at lower elevations.

The above description is based on the examination of 21 specimens as well as on published material (Hitchcock, 1951; Gould, 1951).

This taxon is closely related to A. divaricata but differs in the ascending panicle branches and the usually less twisted awn column.

Aristida pansa is also similar to A. parishii and

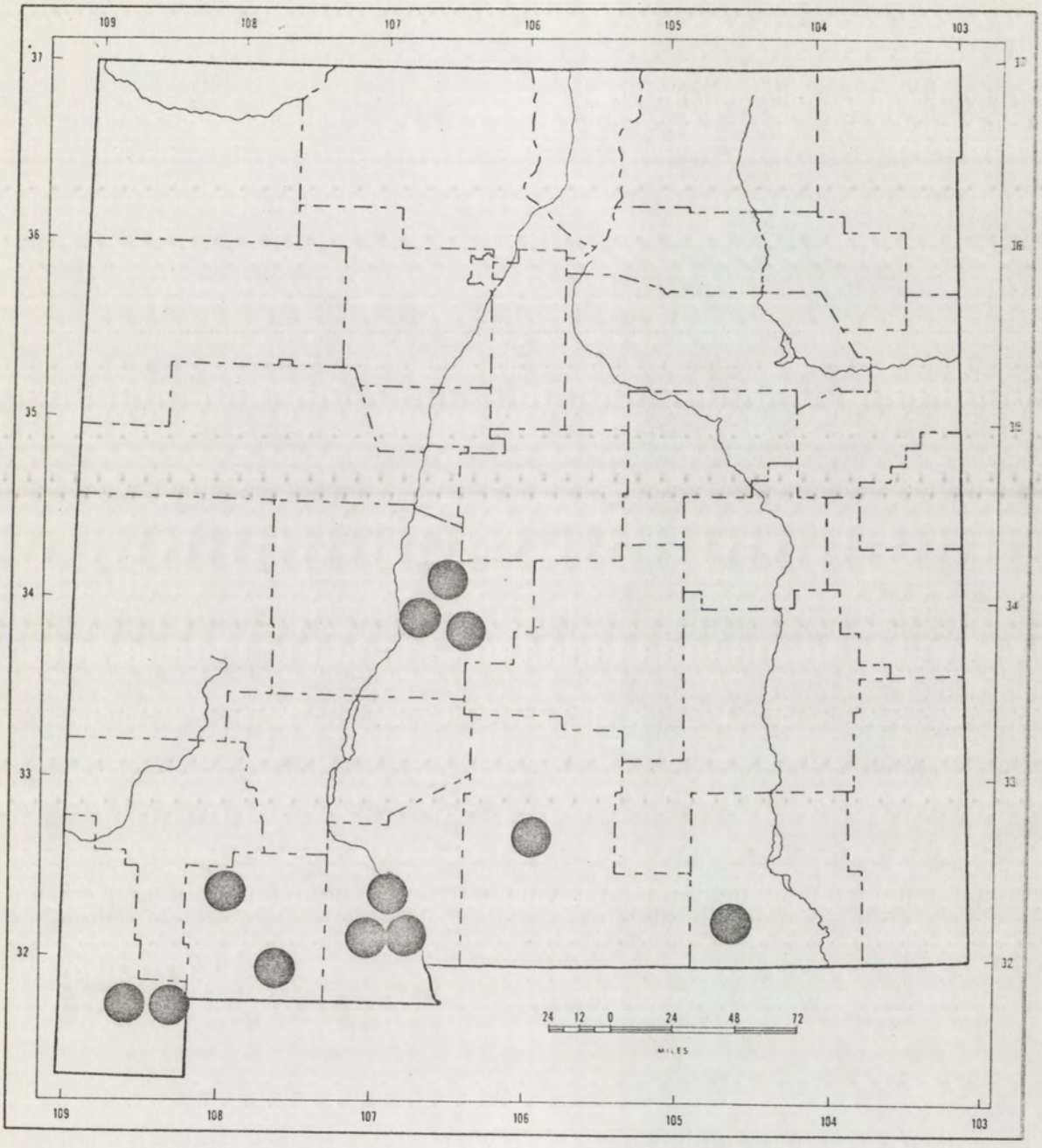

FIG. 12. Distribution of A. pansa.

A. wrightii which typically have more densely flowered and somewhat contracted panicles, as well as typically longer lemmas and glumes.

13. Aristida longiseta Steud. var. longiseta, Syn. Pl. Glum. 1:420. 1855.

Aristida curtiseta Buckl., Acad. Nat. Sci. Phil. Proc. 1862:92. 1862.

Aristida purpurea var. longiseta Vasey in Rothr. in Wheeler, U.S. Survey W. 100 Merid. Rep. 6:286. 1862.

Aristida fasciculata var. nuttallii Thurb. ex Beal, Grasses N. Amer. 2:208. 1896.

Perennial, often in large tufts; culms 20 to 30 cm tall; leaf blades involute, usually less than 15 cm long; panicle narrow, erect but not stiff, few flowered, the axis only a few cm long, the branches ascending or appressed, or the lower ones curved; the first glume 8 to 10 mm long, the second about twice as long; lemma 12 to 15 mm long, only slightly narrowed above, glabrous or the upper part scaberulous; awns about equal, divergent, 6 to 8 cm long.

Type locality: New Mexico.

Distribution: North Dakota and Iowa to Montana and British Columbia, south to Texas, Arizona, and northern Mexico.

New Mexico: Plains and foothills, throughout the state, with the exception of the southeastern portion, at elevations of 3,500 to 8,000 ft. Flowering from March to October.

The above description is based on the examination of 41 specimens.

This taxon is easily distinguished on the basis of awn length. Aristida longiseta is the only perennial species of Aristida with awns longer than 6 cm.

Two varieties have been proposed for this species and are retained in the present study. These varieties differ from the typical variety in plant height and the number of spikelets per panicle. Although some botanists consider these variations as nothing more than growth forms (Gould, 1951) not deserving of varietal rank, there is, nonetheless, some basis for retaining them as distinct entities. Aristida longiseta var. rariflora Hitchc. is characterized as consistently bearing fewer spikelets per panicle than the typical variety. If this were an environmentally caused variation, one would expect the rest of the plant to show signs of environmental stress and be reduced in other aspects. This does not seem to be the case with var. rariflora which is similar to the typical variety in all respects except the spikelet character. Aristida longiseta var. robusta Merr. is delineated on the basis of a general increase in size over the typical variety. It is perhaps more difficult to defend the varietal status of var. robusta than that of var. rariflora, but because there is no evidence, either in the literature or from this study, to indicate that this is not a distinct variety, I propose that the taxon should be kept as a variety until such time as there is some evidence to the contrary.

14. Aristida longiseta var. rariflora Hitchc., Contrib. U.S. Nat. Herb. 22:565. 1920.

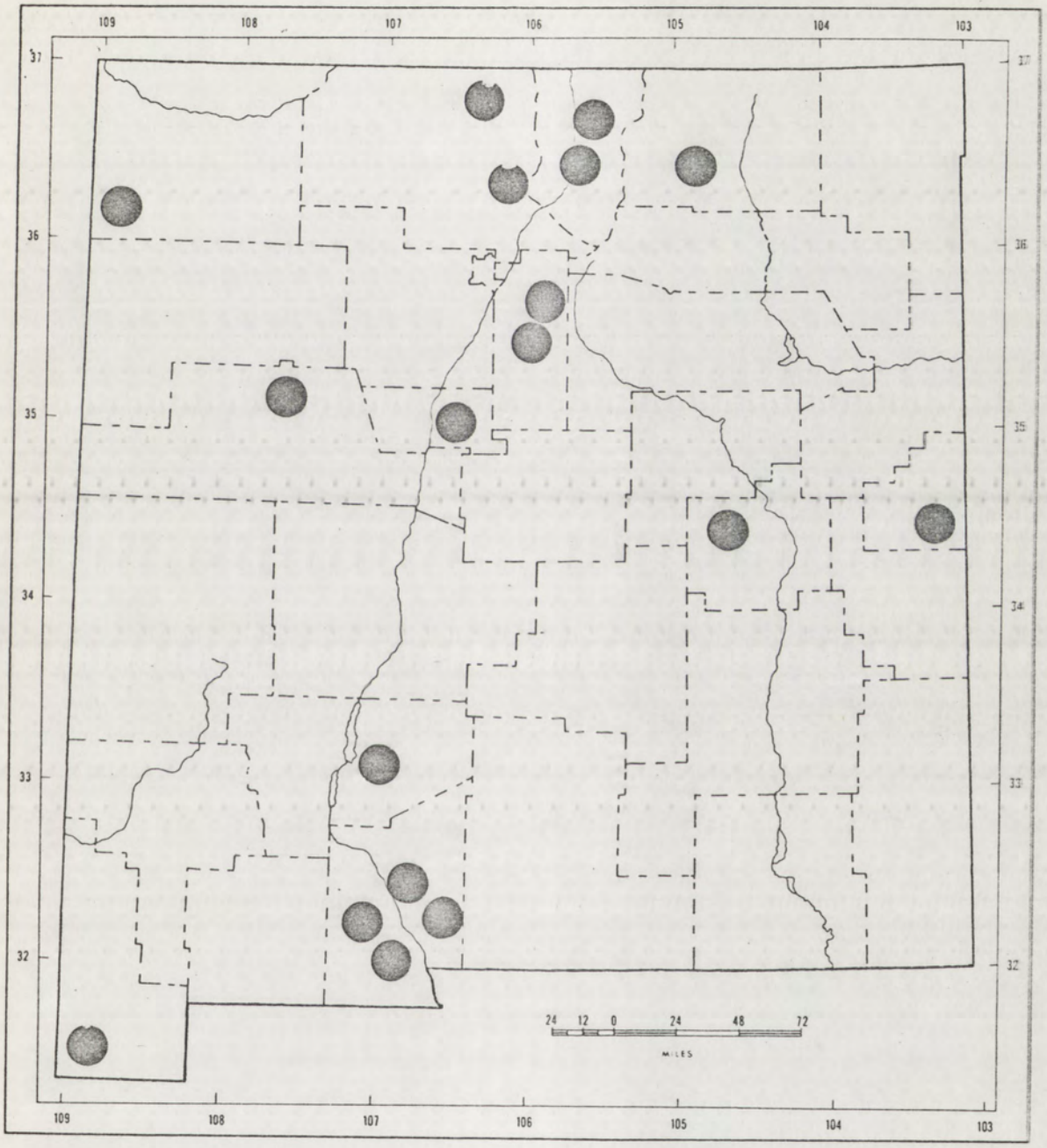

FIG. 13. Distribution of A. longiseta var. longiseta.

Aristida rariflora Henr., Med. Rijks Herb. Leiden 54A:314. 1927.

Perennial, often in large tufts; culms 20 to 30 cm tall; leaf blades involute, usually less than 15 cm long; panicle narrow, erect but not stiff, with 2 to 7 spikelets, the branches ascending or appressed, or the lower ones curved; the first glume 8 to 10 mm long, the second about twice as long; lemma 12 to 15 mm long, slightly narrowed above, glabrous or the upper part scaberulous; awns about equal, divergent, 6 to 8 cm long.

Type locality: Tom Green Co., Texas.

Distribution: Texas to Colorado and Arizona.

New Mexico: Plains and foothills, throughout the northern half of the state, with a few populations in the southern portion, at elevations of 4,000 to 7,000 ft. Flowering from March to October.

The above description is based on the examination of 29 specimens as well as on published material (Hitchcock, 1920).

This taxon differs from the typical variety in having considerably fewer flowers in the panicles.

15. Aristida longiseta var. robusta Merr., U.S. Dep. Agr., Div. Agrost. Cir. 34:5. 1901.

Aristida purpurea robusta Piper, Contrib. U.S. Nat. Herb. 11:107. 1906.

Perennial, not conspicuously tufted; culms 30 to 50 cm tall; leaf blades involute, usually more than 15 cm long; panicle narrow, erect and stiff, few-flowered, the axis about

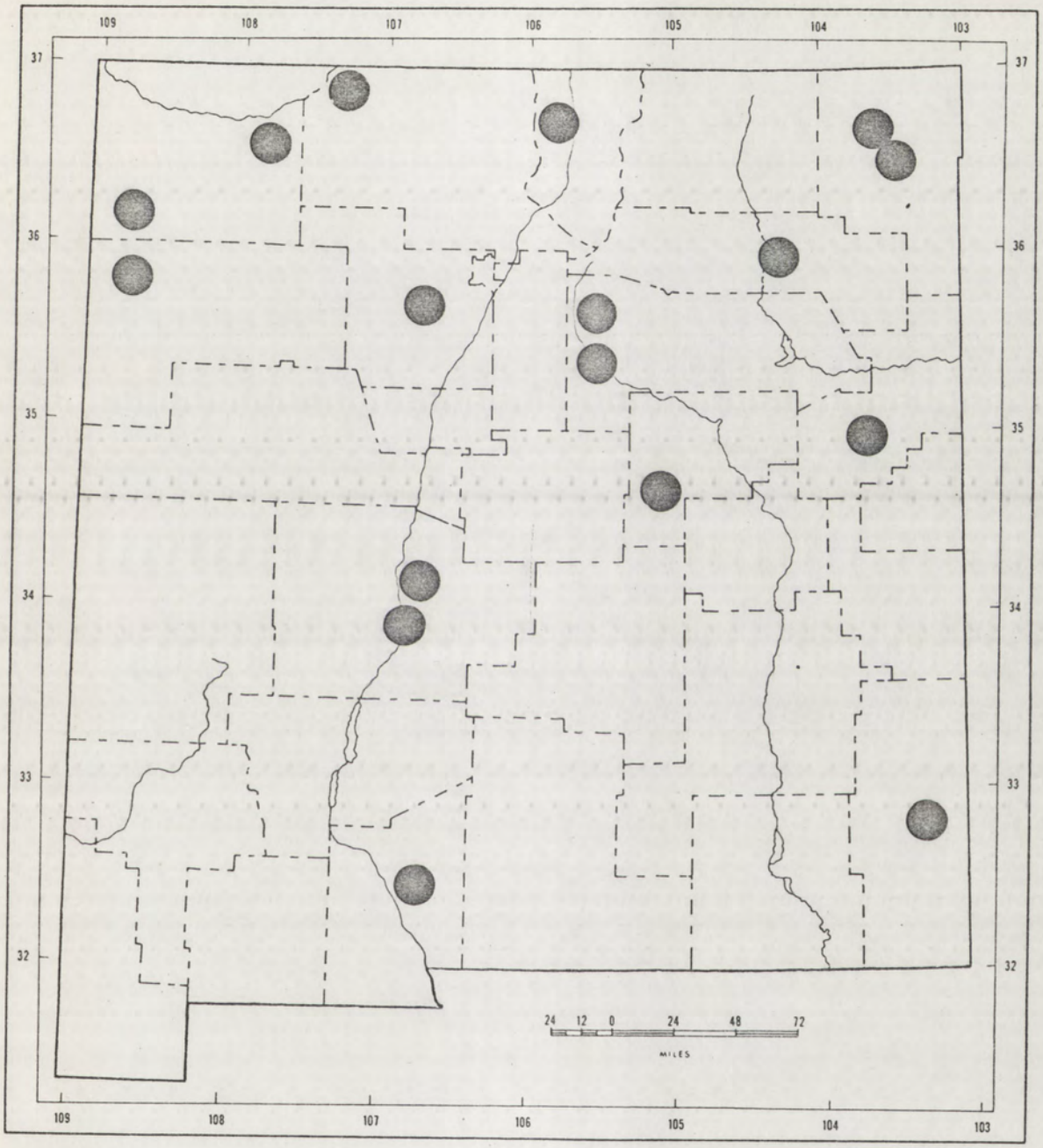

FIG. 14. Distribution of A. longiseta var. rariflora.

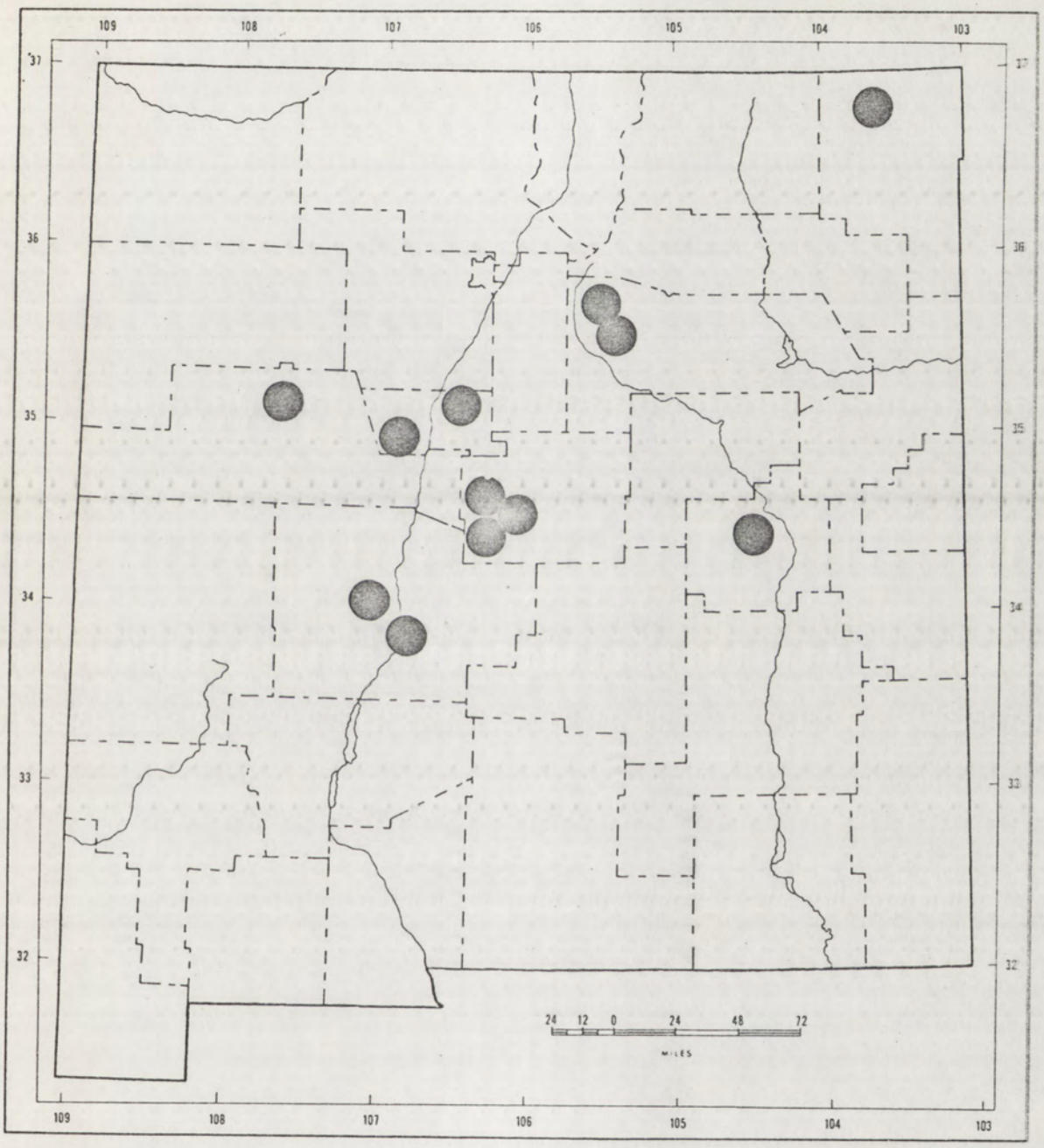

FIG. 15. Distribution of A. longiseta var. robusta.

11 cm long, the branches ascending or appressed; the first glume 10 to 11 mm long, the second about twice as long; lemma 13 to 17 mm long, slightly narrowed above and scaberulous on the upper half; awns about equal, divergent, 6 to 8 cm long.

Type locality: Indian Creek, Montana.

Distribution: Following the range of var. longiseta but more common northward, extending east to Minnesota and west to Washington and California.

New Mexico: Plains and foothills, throughout the north-central part of the state at elevations of 4,000 to 7,000 ft. Flowering from May to October.

The above description is based on the examination of 37 specimens as well as on published material (Hitchcock, 1951).

This taxon differs from the typical variety in being taller and more robust, the culms are 30 to 50 cm tall, and the leaf blades are longer and not in basal tufts. The panicle is also longer and stiffer.

16. Aristida fendleriana Steud., Syn. Pl. Glum. 1:420. 1855.

Aristida purpurea var. fendleri Vasey in Rothr., Cat. Pl. Survey W. 100 Merid. 55. 1874.

Aristida fasciculata var. fendleriana Vasey ex L. H. Dewey, Contrib. U.S. Nat. Herb. 2:515. 1894.

Aristida longiseta fendleriana Merr., U.S. Dep. Agr., Div. Agrost. Cir. 34:5. 1901.

Aristida subuniflora Nash in Small, Fl. Southeast. U.S. 116. 1903.

Perennial; culms erect 15 to 35 cm tall; leaf blades

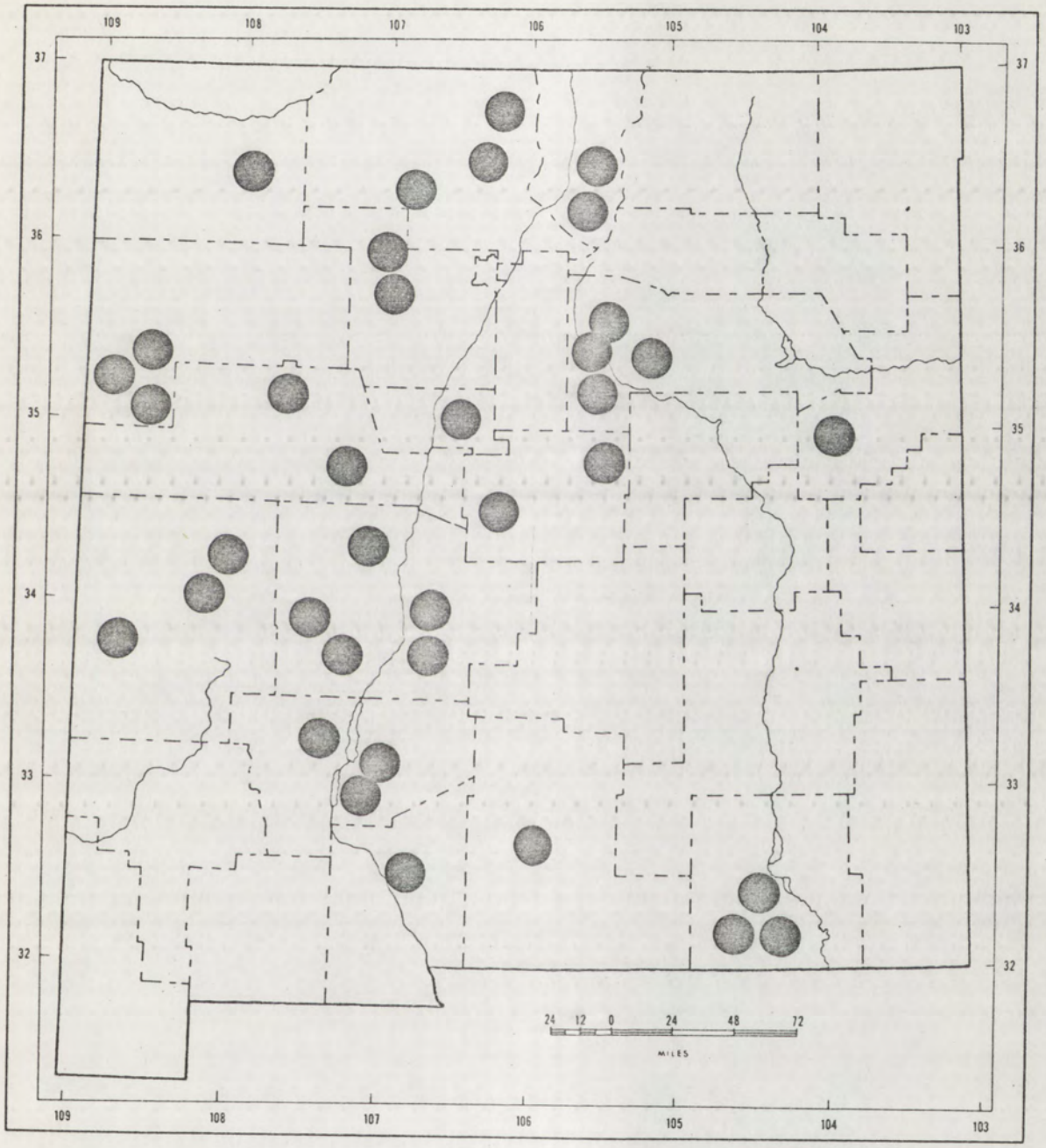

FIG. 16. Distribution of A. fendleriana.

involute 3 to 15 cm long, numerous and curly at the base of the plant; panicle narrow and erect, the branches appressed; the first glume 5 to 7 mm long, the second about twice as long; lemma narrowed into a column about 1 mm long, the lemma scaberulous on the upper half; awns about equal, divergent, 2 to 5 cm long.

Type locality: New Mexico.

Distribution: North Dakota and Montana, south to Texas, Nevada, and southern California; Mexico.

New Mexico: Dry plains and hills, throughout the state at elevations of 4,000 to 7,000 ft. Flowering from March to June.

The above description is based on the examination of 69 specimens.

Aristida fendleriana is similar to A. longiseta var. longiseta but differs in having numerous short curly leaf blades at the base of the plant, shorter glumes, and shorter awns. Aristida fendleriana is also closely related to A. glauca, A. purpurea, and A. parishii but is easily separable from these on the basis of several characteristics.

17. Aristida parishii Hitchc. in Jepson, F. Calif. 1:101. 1912.

Perennial; culms erect, 30 to 50 cm tall; leaf blades more or less involute, sometimes flat, 1 to 2 mm wide; panicle narrow, 15 to 30 cm long; glumes short-awned, the first glume 12 mm long, the second 1 or 2 mm longer; lemma about 12 mm long, tapering into a short, straight or slightly twisted beak;

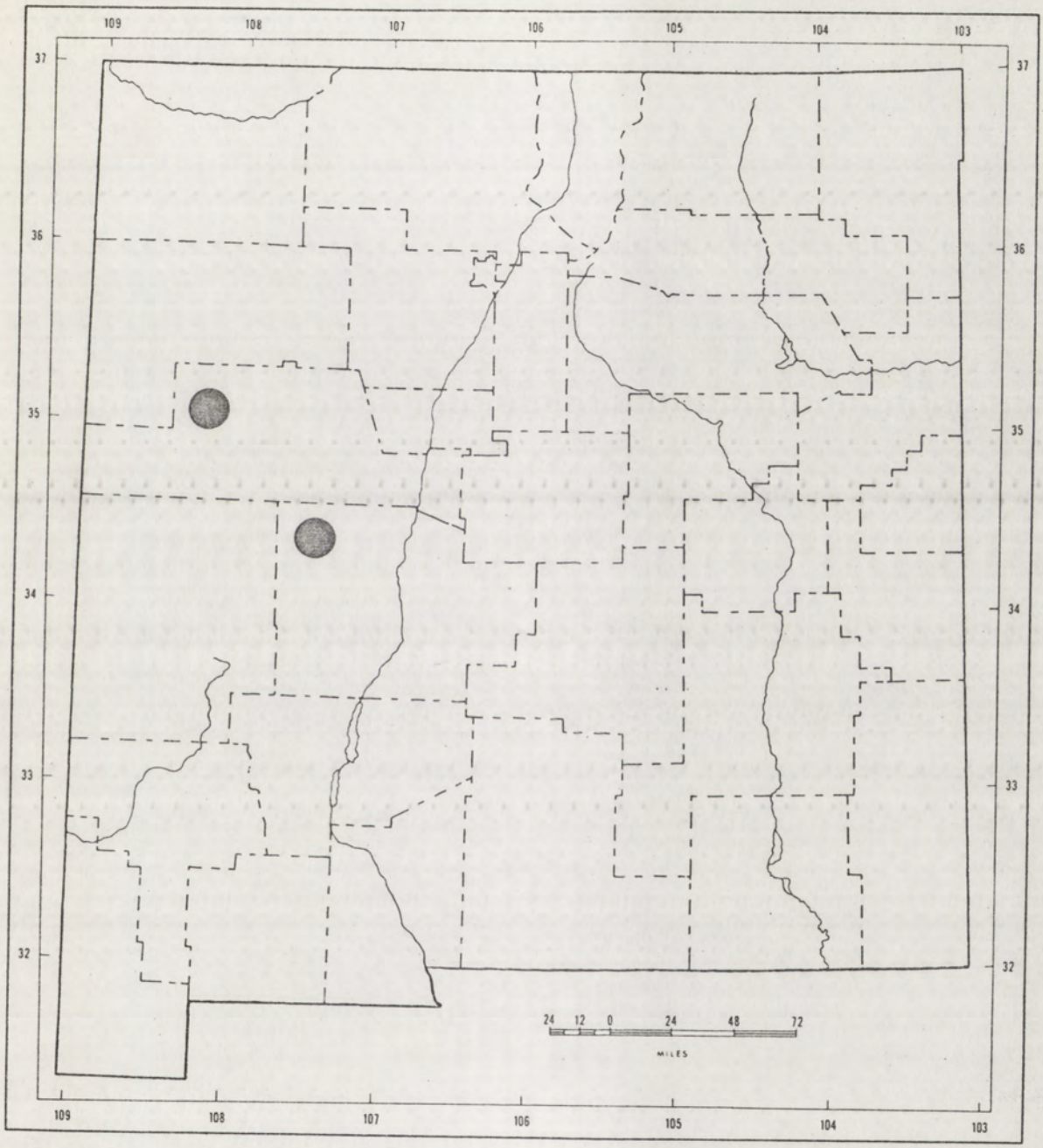

FIG. 17. Distribution of A. parishii.

awns about equal, divergent, 2 to 2.5 cm long.

Type locality: Agua Caliente, California.

Distribution: Nevada, New Mexico, and Arizona, to southern California.

New Mexico: Dry and rocky soil, apparently restricted to the western portion of the state at elevations of 3,500 to 5,500 ft. Flowering mostly from December to May but occasionally at any time of the year under favorable conditions.

The above description is based on the examination of 24 specimens as well as on published material (Hitchcock, 1951; Gould, 1951).

This taxon is closely related to A. wrightii but is distinguished by the more densely flowered panicles and the almost equal glumes. The relationship of this species with A. wrightii has previously been considered with the discussion of the latter species.

18. Aristida arizonica Vasey, Bull. Torrey Bot. Club 13:27. 1886.

Perennial; culms erect, 30 to 120 cm tall; leaf blades flat, narrowed to a fine involute point or some of them involute throughout, 1 to 4 mm wide, the old ones usually curled or flexuous; panicle narrow, erect, closely flowered, 10 to 25 cm long; glumes nearly equal, 10 to 15 mm long, awn tipped; lemma 1 to 1.5 cm long, including the twisted beak of about 3 to 5 mm; awns about equal, ascending, 1 to 2 cm long.

Type locality: Las Vegas, New Mexico.

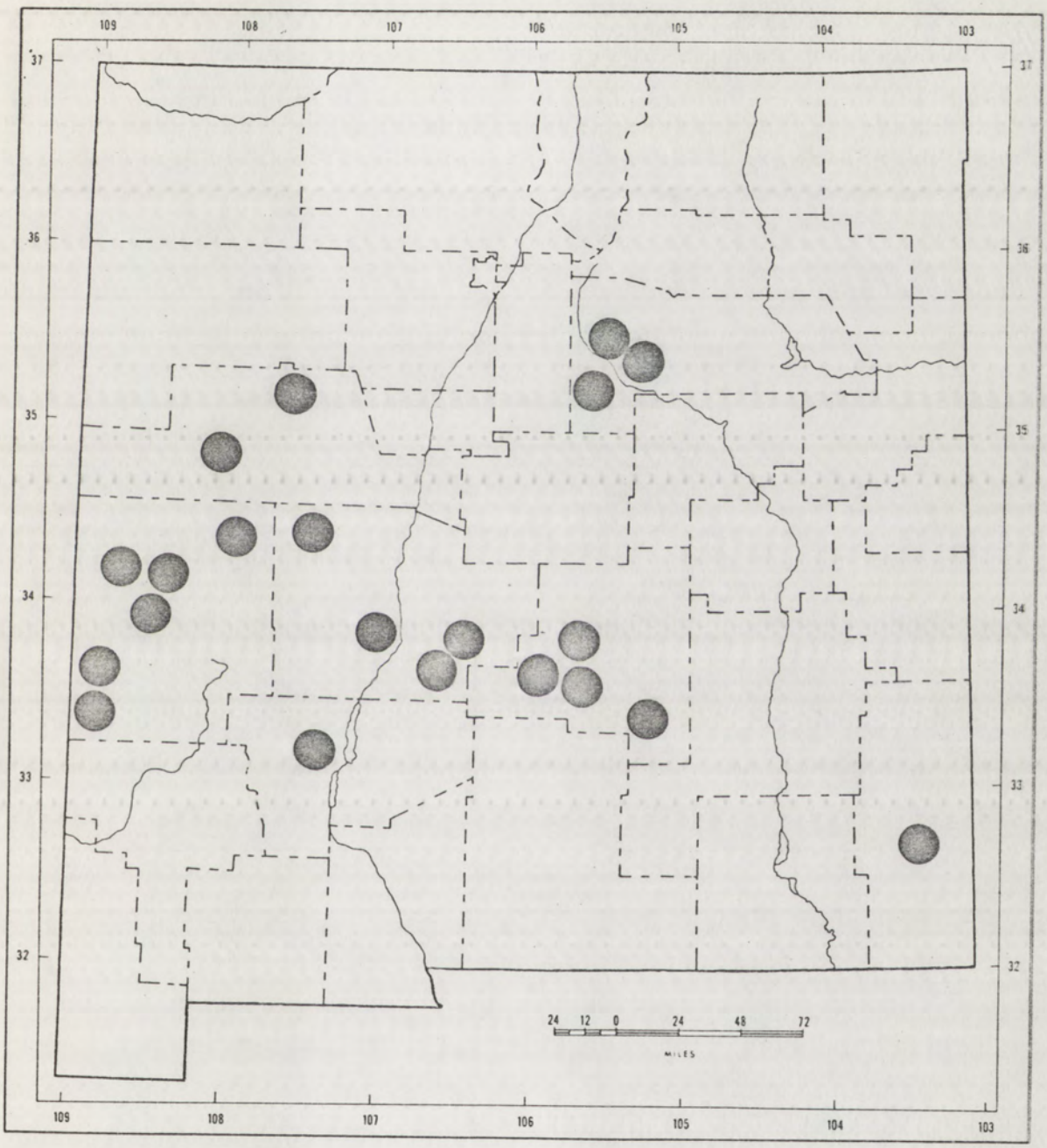

FIG. 18. Distribution of A. arizonica.

Distribution: Western Texas to southern Colorado and Arizona.

New Mexico: Dry plains, stony hillsides and open forests, mostly in the western portion of the state at elevations of 5,000 to 8,000 ft. Flowering from July to October.

The above description is based on the examination of 53 specimens.

This taxon appears to be a distinct species most closely related to A. glauca from which it differs in having longer, equal glumes. There is no evidence to show possible hybridization of A. arizonica with any of the other taxa of Aristida.

SUMMARY AND CONCLUSIONS

Aristida arizonica is the most distinct of the species, being most closely related to A. glauca but differing in several characteristics.

Aristida adscensionis and A. oligantha are closely related to one another but differ from the other aristidas in being annuals.

Aristida orcuttiana and A. ternipes are also closely related to each other but distinct from other aristidas in having minute lateral awns.

Aristida barbata and A. divaricata are closely allied and show some signs of being closely related to A. hamulosa and A. pansa.

Aristida glauca, A. parishii, A. fendleriana, A. purpurea, and A. longiseta are all closely related and hybrids of A. glauca with some of the above taxa have been reported.

Aristida longiseta and A. purpurea are related to each other and hybrids of the two have been reported from Arizona. Aristida purpurea is also closely related to A. roemeriana, from which it differs little, and several authors have combined the two species in one taxon.

Aristida wrightii is closely related to A. parishii and again some authors have combined the two in a single species.

Aristida pansa closely resembles both A. parishii and A. wrightii and may be related to them, hybrids have been reported involving all three of these taxa.

Aristida fendleriana, A. glauca, and A. purpurea are closely related but easily separable.

APPENDIX: CITATION OF SPECIMENS

Abbreviations used in the citation of specimens include:

UNM - University of New Mexico Herbarium, Albuquerque, New Mexico.

NMSU - New Mexico State University Herbarium, Las Cruces, New Mexico.

RMH - Rocky Mt. Herbarium, University of Wyoming, Laramie, Wyoming.

Aristida adscensionis L. Bernalillo Co.: Cibola National Forest, 9/24/60, Owen (UNM 28228). Dona Ana Co.: White Sands, 8/25/97, Wooton (NMSU 2201). Eddy Co.: Carlsbad Caverns, 7/28/50, Springfield (UNM 6340). Grant Co.: R. R. tank no. 6 31-N, 10/1/35, Anderson & Rhinehart (NMSU 38721). Guadalupe Co.: East of Santa Rosa, 8/29/54, Castetter (UNM 16362). Hidalgo Co.: 8 miles south of Hachita, 8/19/55, Castetter (UNM 20327). Lincoln Co.: White Mountains, 7/--/98, Townsend (NMSU 2203). Luna Co.: Demming, 8/12/97, Herrick (NMSU 2210). Quay Co.: Siphon no. 22, 7/27/42, Suggs (NMSU 38863). Rio Arriba Co.: Chama River, 8/19/04, Wooton (RMH 58325). Santa Fe Co.: Santa Fe, 1898, Cockerell (NMSU 2204). Sierra Co.: Range near Engle, 8/3/37, Thompson (UNM 4283). Socorro Co.: 2 miles east of Rosedale, 8/29/48, Dunn (UNM 13726). Torrance Co.: 5 miles northeast of Manzano, 9/13/59, Martin (UNM 24798). Union Co.: Pasamonte, 8/22/52, Roller (UNM 8286).

Aristida oligantha Michx. Dona Ana Co.: West of Las Cruces, 7/14/41, Kelly (RMH 108764). Luna Co.: Demming, 8/23/35, Whitfield & Collins (NMSU 38727).

Aristida orcuttiana Vasey. Catron Co.: Mogollon Mountains, 1903, Metcalfe (NMSU 2366). Dona Ana Co.: Organ Mountains, 10/21/06, Wooton & Standley (NMSU 2394). Grant Co.: Near Silver City, 9/15/03, Metcalfe (NMSU 2321). Hidalgo Co.: Little Hatchet Mountains, 7/31/40, Hershey (NMSU 40229). Sierra Co.: Range near Engle, 8/27/37, Thompson (UNM 4284).

Aristida ternipes Cav. Chaves Co.: 25 miles north of Roswell, 8/10/09, Wooton (NMSU 2383). Dona Ana Co.: Organ Mountains, 10/4/03, Wooton (RMH 58324). Grant Co.: 18 miles northwest of Silver City, 9/3/03, Metcalfe (NMSU 2370). Luna Co.: Tres Hermanas Mountains, 9/12/42, Clark UNM 23627).

Aristada barbata Fourn. Bernalillo Co.: Albuquerque, 9/4/84, Jones (NMSU 2317). Catron Co.: Glenwood, 8/13/35, Moeller (NMSU 38725). Dona Ana Co.: West of Organ Mountains, 10/25/04, Wooton (NMSU 2346). Lincoln Co.: White Mountains, 9/--/07, Wooton & Standley (NMSU 2386). Otero Co.: White Sands, 7/27/46, Berkmah, Lee, and Tharp (RMH 204645). Sandoval Co., 10/15/36, Solmon (UNM 5193). Santa Fe Co.: 5 miles south of Stanley, 8/24/04, Wooton (NMSU 2234). Sierra Co.: North of Hot Springs, 6/12/50, Clark (UNM 15400). Socorro Co.: 3 miles east of Bingham, 8/5/48, Dunn & Lint (UNM 16626). Torrance Co.: South of Stanley, 8/24/04, Wooton (RMH 224929).

Aristida divaricata Humb. & Bonpl. Bernalillo Co.: Albuquerque, 9/4/84, Jones (RMH 49360). Catron Co.: Jaramillo Allot., 10/11/60, Bilbrey (UNM 29589). Chaves Co.: Near Lake Arthur, 8/1/05, Wooton (NMSU 2258). Dona Ana Co.: West of

Organ Mountains, 8/26/99, Wooton (RMH 180644). Lincoln Co.: White Mountains, 9/13/99, Turner (NMSU 2255). Otero Co.: Guadalupe Mountains, 8/22/56, Castetter (UNM 22199). Quay Co.: Tucumcari, 8/20/54, Swallen (UNM 16317). San Miguel Co.: Santa Fe Forest, Weisserorn (UNM 30666). Sierra Co.: South end of the Black Range, 10/15/04, Metcalfe (NMSU 2257). Socorro Co.: 12 miles south of Magdalena, 10/4/55, Potter (UNM 20580). Torrance Co.: 20 miles east of Clines Corners, 8/29/54, Swallen (UNM 16375).

Aristida hamulosa Henr. Dona Ana Co.: West of the Organ Mountains, 9/6/08, Wooton & Standley (NMSU 2384). Grant Co.: 6 miles north of Red Rock, 6/24/35, Thornber (NMSU 38463). Hidalgo Co.: Little Hatchet Mountains, 8/20/55, Castetter (UNM 20372). Lincoln Co.: Gallinas Mountains, 8/26/04, Wooton (NMSU 2256). Luna Co.: Near Monument 33, 7/29/40, Hershey (NMSU 40227). Socorro Co.: San Antonio, 8/4/52, Swallen (UNM 17126). Valencia Co.: East of Belen, 7/4/52, Roller (UNM 7962).

Aristida glauca (Nees) Walp. Bernalillo Co.: Albuquerque, 6/3/36, Carter (NMSU 38722). Chaves Co.: 10 miles north of Roswell, 8/18/52, Swallen (UNM 8339). Dona Ana Co.: West of the Organ Mountains, 10/6/04, Wooton (NMSU 2278). Lincoln Co.: 5 miles northwest of Carrizozo, 10/23/69, Hutchins (UNM 43550). Sandoval Co.: Juan Tabo Recreation Area, 9/25/70, Krehoff. Santa Fe Co.: Santa Fe Airport, 8/10/53, McKinley (UNM 16935). Socorro Co.: West of San Antonio, 4/14/08, Wooton (NMSU 2275). Torrance Co.: 1 mile south of Manzano. 9/13/59, Martin

(UNM 33222).

Aristida purpurea Nutt. Bernalillo Co.: Southeast of Albuquerque, 6/3/36 (NMSU 38452). Chaves Co.: Near Dunlap, 5/25/42, Hershey (NMSU 38956). De Baca Co.: Buchanan, 8/12/09, Wooton (NMSU 2353). Dona Ana Co.: Mesilla, 6/19/97, Wooton (RMH 18073). Eddy Co.: East of Carlsbad, 7/29/09, Wooton (NMSU 2330). Harding Co.: South of Gallegos, 6/21/57, Springfield (UNM 6996). Hidalgo Co.: 5/27/37, (UNM 3796). Lea Co.: Monument, 5/30/55, Castetter (UNM 19179). Lincoln Co.: 35 miles south of Torrance, 8/10/09, Wooton (NMSU 2267). McKinley Co.: Zuni Reservation, 7/28/92, Wooton (NMSU 2302). Otero Co.: Mescalero Sands, 8/15/52, Roller (UNM 8381). San Miguel Co.: Las Vegas, 8/--/35, Nisbet (UNM 19432). Santa Fe Co.: Santa Fe, 5/15/97, Heller & Heller (RMH 11254). Sierra Co.: Kingston, 10/4/63, Potter (UNM 35078). Socorro Co.: 1 mile east of Bingham, 8/--/48, Blume (UNM 13735). Torrance Co.: Torrance, 8/11/09, Wooton (NMSU 2288).

Aristida roemeriana Scheele. Dona Ana Co.: West of Organ Mountains, 8/19/06, Wooton & Standley (NMSU 2342). Otero Co.: Guadalupe Mountains, 8/4/09, Wooton (NMSU 2332).

Aristida wrightii Nash. Bernalillo Co.: Near Albuquerque, 10/8/51, Rominger (UNM 18615). De Baca Co.: Buchanan, 8/12/09, Wooton (NMSU 2376). Dona Ana Co.: Dona Ana Mountains, 10/28/06, Wooton & Standley (NMSU 2377). Hidalgo Co.: Little Hatchet Mountains, 8/20/54, Castetter (UNM 20348). Luna Co.: West of Nutt, 8/18/55, Castetter (UNM 20445). Sierra Co.: Near Hot Springs, 6/20/52, Swallen (UNM 7803). Socorro Co.:

Chupadera Mountains, 8/15/48, Dunn & Lint UNM 13736). Taos Co.: West of La Cueva, 9/11/55, Castetter (UNM 20491). Torrance Co.: Manzano Mountains, 7/4/52, Roller (UNM 8320). Valencia Co.: Los Pilares, Atarique de Garcia, 7/20/06, Wooton (NMSU 2374).

Aristida pansa Woot. Dona Ana Co.: West of Organ Mountains, 10/6/04, Wooton (NMSU 2326). Eddy Co.: Carlsbad Caverns, 7/28/50, Springfield (UNM 6339). Hidalgo Co.: 8 miles south of Hachita, 8/24/54, Gordon & Buchanan (UNM 24934). Luna Co.: South of Hurley, 8/30/40, Clark (UNM 23629). Otero Co.: Sacramento Mountains, 7/25/53, Roller (UNM 8759). Socorro Co.: Sierra Oscura Mountains, 8/4/48, Dunn & Lint (UNM 16615).

Aristida longiseta Steud. var. longiseta Bernalillo Co.: Albuquerque, 6/17/31, Castetter (RMH 128099). Colfax Co.: Near Springer, 6/23/07, Wooton (NMSU 2388). Curry Co.: West of Clovis, 5/21/50, Clark (UNM 11219). De Baca Co.: Buchanan, 8/12/09, Wooton (NMSU 2301). Dona Ana Co.: South of White Sands, 8/28/97, Wooton (RMH 18044). Hidalgo Co.: San Luis Mountains, 4/20/07, Woods (UNM 4288). Rio Arriba Co.: Valley below El Rito, 8/18/04, Wooton (NMSU 2304). San Juan Co.: Chuska Mountains, 7/--/34 (NMSU 29095). San Miguel Co.: Pecos River National Forest, 1908, Standley (NMSU 2287). Santa Fe Co.: South of Santa Fe, 8/23/04, Wooton (NMSU 2306). Sierra Co.: 3 miles northeast of Shelly Ranch, 6/11/35, Moeller (RMH 152370). Taos Co.: 1 mile south of Questa, 7/22/38, Hitchcock, Rethke, & van Raadshooven (RMH 175375). Valencia

Co.: Mt. Taylor, 7/15/60, Osborn (UNM 26803).

Aristida longiseta var. rariflora Hitch. Dona Ana Co.: 25 miles north of Las Cruces, 4/25/70, Spellenberg & Spellenberg (NMSU 40229). Guadalupe Co.: 46 miles east of Palma, Van Rossen & Dawson (UNM 13733). Harding Co.: Mills Canyon (UNM 30958). Lea Co.: Knowles, 7/29/09, Wooton (NMSU 2300). McKinley Co.: Chuska Mountains, 6/5/34, Starr & Zumwalt (NMSU 38458). Quay Co.: 25 miles south of Tucumcari, 6/26/36, Lake (UNM 39317). Rio Arriba Co.: Rosa, 6/--/99 (RMH 22663). Sandoval Co.: T14N, R3E, 10/16/36, Salmon (UNM 5189). San Juan Co.: Southeast of Mexican Springs Headquarters, 5/3/34, Bsklinger (NMSU 38459). San Miguel Co.: Near Pecos, 8/15/08, Standley (NMSU 2293). Socorro Co.: Socorro, 9/5/95, Herrick (NMSU 2298). Taos Co.: Carson Forest Experimental Station, 7/--/60, Engstrom (UNM 27773). Union Co.: Capulin Mountain National Monument, 9/6/67, Jones (UNM 43860).

Aristida longiseta var. robusta Merr. Bernalillo Co.: Near Albuquerque, 7/30/51, Rominger (UNM 18616). De Baca Co.: Ft. Sumner, 6/6/36, Nisbet (UNM 19426). San Miguel Co.: Santa Fe Forest, Weissenborn (UNM 30665). Socorro Co.: 1 mile east of Bursum triangulation point, 7/25/48, Dunn & Lint (UNM 16618). Torrance Co.: Manzano Mountains, 7/25/52, Roller (UNM 8304). Union Co.: East of Folsom, 8/24/52, Roller (UNM 8134). Valencia Co.: East of Bernardo, 6/10/59, Martin (UNM 24008).

Aristida fendleriana Steud. Bernalillo Co.: Near Albuquerque, 7/30/51, Rominger (UNM 18618). Catron Co.: Rito Quemado, 7/18/06, Wooton (NMSU 2268). Dona Ana Co.: West of

Organ Mountains, Wooton (NMSU 2381). Eddy Co.: Carlsbad, 10/25/58 (UNM 33214). McKinley Co.: 25 miles south of Gallup, 7/31/04, Wooton (NMSU 2272). Otero Co.: Mescalero Reservation, 7/27/38, Humphreys (UNM 12963). Quay Co.: Tucumcari, 8/30/54, Castetter (UNM 16324). Rio Arriba Co.: Carson Forest Experimental Area, 11/24/60, Baum (UNM 28204). Sandoval Co.: Upper Rio Puerco, 9/4/52, Roller (UNM 7998). San Juan Co.: South of Aztec, 6/5/35, Flory & Carter (NMSU 38415). San Miguel Co.: Pecos River National Forest, 1908, Standley (NMSU 2273). Sierra Co.: Near Engle, 8/27/37, Thompson (UNM 4285). Socorro Co.: Southeast of Socorro, 8/13/47, Dunn & Levine (UNM 13731). Taos Co.: San Cristobal, 7/10/66, Robinson & Mclean (UNM 39484). Torrance Co.: 16 miles east of Palma, 7/--/40, Van Rossen & Dawson (UNM 13732). Valencia Co.: Near Suwanee, 8/1/06, Wooton (NMSU 2271).

Aristida parishii Hitchc. Socorro Co.: Puertecito, 1910, Watson (RMH 83274). Valencia Co.: El Morro, 1910, Watson (RMH 83275).

Aristida arizonica Vasey. Catron Co.: Jewett Gap, 7/12/06, Wooton (NMSU 2225). Lea Co.: Knowles, 7/29/09, Wooton (NMSU 2229). Lincoln Co.: White Mountains, 8/11/97, Wooton (RMH 18078). San Miguel Co.: 5 miles northwest of Las Vegas, 8/30/34, Goodmans (RMH 153157). Sierra Co.: 7/27/61, Wyche (UNM 35655). Socorro Co.: Magdalena 8/10/97, Herrick (UNM 17737). Valencia Co.: Mt. Taylor, 9/14/62, Jones (UNM 35047).

LITERATURE CITED

Fernald, L. M. 1950. Gray's manual of botany. 8th ed. American Book Co., New York. 1,632 p.

Gould, Frank W. 1951. Grasses of the southwestern United States. Univ. Arizona Press, Tucson. 352 p.

Harrington, H. D. 1964. Manual of the plants of Colorado. Sage Books, Denver. 666 p.

Henrard, J. T. 1926. A critical revision of the genus Aristida. Meded. Rijks Herb. Leiden 54:1-701.

Hitchcock, A. S. 1920. The North American species of Aristida. Contrib. U.S. Nat. Herb. 22:517-586.

Hitchcock, A. S. 1935. North American flora. 17(5):355-418.

Hitchcock, A. S. 1951. Manual of the grasses of the United States. 2nd ed. revised by Agnes Chase. U.S. Dep. Agr. Misc. Pub. 200. 1,051 p.

Kearney, T. H., and R. H. Peebles. 1964. Arizona flora. 8th ed. Univ. California Press, Berkeley. 1,081 p.

Martin, W. C., and E. F. Castetter. 1970. A checklist of gymnosperms and angiosperms of New Mexico. Published privately. 245 p.

Merrill, E. D. 1901. U.S. Dep. Agr., Div. Agrost. Cir. 34:8.

Wooton, E. O., and P. C. Standley. 1915. Flora of New Mexico. Contrib. U.S. Nat. Herb. 10:1-794.