

## THE GENUS *ARISTIDA* (GRAMINEAE) IN CALIFORNIA

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**ABSTRACT.**—The taxonomy of *Aristida* (Gramineae) in California is revised. The genus is represented in the state by six species and 11 taxa. Identification keys, descriptions, selected synonymy, distribution records, and illustrations are provided.

*Key words:* *Aristida*, floristics, California.

As part of the current revision of Willis Lynn Jepson's *A Manual of the Flowering Plants of California* (1923), sponsored by the Jepson Herbarium of the University of California at Berkeley, an examination of the taxonomy, nomenclature, and distribution of the California species of *Aristida* was undertaken. Jepson (1923) originally listed 10 species of *Aristida* for California, and subsequent floristic endeavors increased this number to 12, reported by Munz and Keck (1968). This work treats six species apportioned to 11 total taxa.

*Aristida* are peculiar in the development of the fusiform, indurate floret. The lemma (in North American species) is convolute and completely encloses the palea and flower, forming a rather firm anthoecium, or flower casing. This configuration customarily prevents the exertion of anthers and stigmas, resulting in cleistogamous (and self-pollinated) reproduction. However, in some spikelets of *A. purpurea* Nuttall, *A. divaricata* Humb. & Bonpl. ex Willenow, and other species, swelling of the lodicules will often spread the lemma and palea, and the anthers and stigmas are commonly exerted from the anthoecium during and after anthesis, evidence of possible cross-pollination. In *A. dichotoma* Michaux of central and eastern United States, two kinds of flowers are developed: one with three anthers each 2–3 mm long, presumably adapted for chasmogamous reproduction, and the other with a single anther less than 0.3 mm long (personal observation). The smaller anther is always found retained within the floret and apparently functions in cleistogamous reproduction. This condition is also reported for *A. oligantha* Michaux (Henrard 1929).

The tip of the lemma often bears a column or beaklike structure in species of *Aristida*, and two terms describe this condition. An awn column is formed by the connivent or coalescent, often twisted bases of the awns above the lemma. This is a relatively uncommon arrangement but is seen in *Aristida californica* Thurber. A *beak* of the lemma, however, is sometimes formed by the lemma apex. It is often narrow and twisted, as in *A. divaricata* and *A. purpurea*. The term *awn*, as used herein, refers to the free portion only and is measured from the summit of the beak or awn column to the tip of the awn.

North American *Aristida* have been classified in three different sections of the genus: *Arthratherum*, *Streptachne*, and *Aristida* (*Chaetaria*) (Henrard 1929, Clayton and Renvoize 1986). In section *Arthratherum*, the lemma body is terminated by an awn column that disarticulates from the rest of the floret. This section is represented in California by *A. californica*. The section *Streptachne* is characterized by the extreme reduction of the lateral awns, illustrated consistently in *A. ternipes* Cav-anilles, but also found in other species that are not usually placed in this section, such as *A. adscensionis* Linnaeus. In a study of *Aristida* species affiliated with *A. divaricata*, Trent (1985) found that some degree of reduction of the lateral awns was a common occurrence in numerous species, and concluded that this feature was often not a good indicator of biologic relationship. The validity of the section *Streptachne* based on this criterion is doubtful. Section *Aristida* comprises the remaining California species without articulation in the lemma or consistent reduction of lateral awns.

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Because the sectional classification of the genus remains largely unexamined and unsatisfactory, for this report the California species are sorted into informal "groups." These groups do not necessarily correspond to any formal rank but parallel those used by Hitchcock and Chase (1951) and Allred (1986).

GROUP ADSCENSIONES.—*Aristida adscensionis*; characterized by the annual habit, branching at the upper nodes, and erect awns.

GROUP DICHOTOMAE.—*Aristida oligantha*; characterized by the annual habit, branching at the upper nodes, and a tendency for the central awn to coil.

GROUP DIVARICATAE.—*Aristida divaricata* and *A. ternipes*; characterized by the stiffly spreading primary (and often secondary) branches with axillary pulvini. These two species are usually placed in different sections of the genus (*Aristida* and *Streptachne*, respectively).

GROUP PURPUREAE.—*Aristida purpurea*, including seven varieties; characterized by generally unequal glumes, a narrowed beak of the lemma, and generally erect branches; merges with the Divaricatae through *A. purpurea* var. *parishii* (Hitchcock) Allred, as well as *A. pansa* Wootton & Standley of the Chihuahuan Desert.

GROUP TUBERCULOSAE.—*Aristida californica*; characterized by the disarticulation of the awns and awn column from the body of the lemma.

Following are identification keys to all taxa, descriptions based on California specimens, counties of occurrence in California, lists of selected specimens examined, and an illustration of each taxon. Herbaria are abbreviated according to Holmgren et al. (1981). Updated information on the distribution of *Aristida* in California will be welcomed by the author.

*Aristida* Linnaeus, Sp. Pl. 82. 1753.

Tufted annuals or perennials; *culms* generally erect, the internodes mostly semisolid. *Sheaths* open. *Ligules* a ring of hairs. *Blades* flat to involute, lacking auricles. *Inflorescence* generally a panicle, occasionally racemose or spicate. *Spikelets* 1-flowered, disarticulating above the glumes. *Glumes* equal to very unequal, thin, membranous, 1- to 7-nerved, often as long as the floret or longer. *Lemma* 3-nerved, terete, indurate at maturity and enveloping the palea and flower; *callus* oblique, usually sharp-pointed and bearded; *awns* 3 in number, terminal on the lemma, the lateral awns sometimes

reduced or obsolete. *Palea* 2-nerved, thin, shorter than the lemma. *Lodicules* 2. *Stamens* 1 or 3. *Caryopsis* enclosed in the anthoecium, fusiform, the hilum scar linear, the embryo small.  $X = 11$ .

#### Key to the Genus *Aristida*

1. Culm internodes and nodes conspicuously hairy . . . . . *A. californica* var. *californica*
- Culm internodes and nodes glabrous . . . . . 2
- 2(1). Plants annual, generally much branched above the base . . . . . 3
- Plants perennial, simple or only weakly branched above the base . . . . . 4
- 3(2). Central awns mostly 3–7 cm long . . . . . *A. oligantha*
- Central awns mostly 0.7–2 cm long . . . . . *A. adscensionis*
- 4(2). Primary panicle branches erect to spreading or drooping, but at least the bases of the branches appressed to the main axis, without pulvini in the branch axils . . . . . *A. purpurea*
- Primary panicle branches abruptly spreading from the main axis with pulvini in the branch axils . . . . . 5
- 5(4). Lower panicle branches ascending, the upper branches appressed . . . . . *A. purpurea* var. *parishii*
- Lower and upper panicle branches spreading . . . . . 6
- 6(5). Anthers 0.8–1 mm long; summit of lemma twisted at maturity; base of blade glabrous above the ligule . . . . . *A. divaricata*
- Anthers 1.2–3 mm long; summit of lemma not or only slightly twisted at maturity; base of blade with scattered pilose hairs above the ligule . . . . . *A. ternipes*

***Aristida adscensionis*** Linnaeus, Sp. Pl. 82. 1753. SIX WEEKS THREEAWN (Fig. 1) [*A. adscensionis* var. *abortiva* Beetle, *A. adscensionis* var. *decolorata* (Fournier) Beetle, *A. adscensionis* var. *modesta* Hackel]. Tufted and generally annual, but extremely variable in size, growth habit, and longevity; *culms* erect to geniculate, simple to much-branched, (3)10–50(80) cm tall; *internodes* glabrous. *Sheaths* generally shorter than the internodes. *Ligules* 0.4–1 mm long. *Blades* flat to involute, 2–14 cm long, 1–2.5 mm wide. *Panicle* narrow and contracted, 5–15(20) cm long, often interrupted below, the spikelets aggregated on short branches. *Glumes* unequal, 1-nerved, the first 4–8 mm long, the second 6–11 mm long. *Lemmas* 6–9 mm long, slightly flattened, scabrous on the midnerve; *awns* flattened at the base, spreading, the central awn 7–18(23) mm long, the lateral awns somewhat shorter, rarely 0–2 mm long. *Palea* 0.5–1 mm long, hyaline, blunt, fan-shaped. *Anthers* 0.3–0.7 mm long. *Caryopsis* somewhat shorter than the lemma.  $2n = 22$ . Dry, open places and rocky hills below



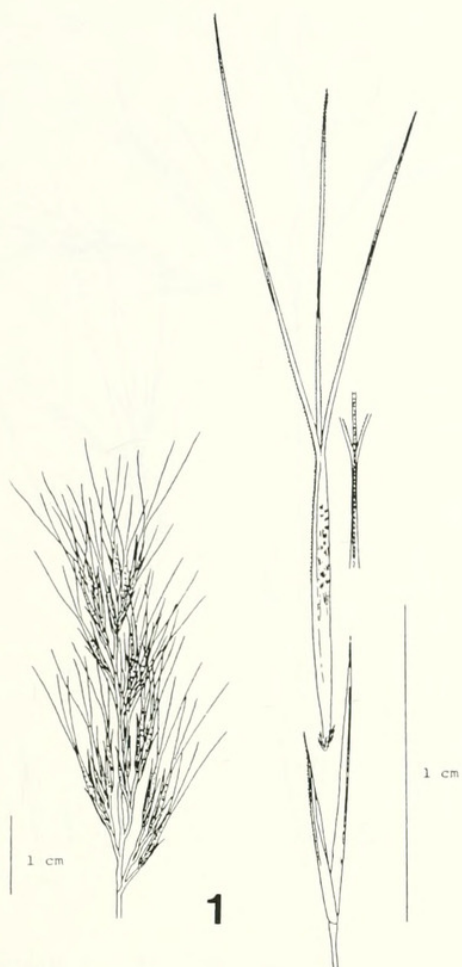


Fig. 1. *Aristida adscensionis*, inflorescence and spikelet.

1000 m. COUNTIES: Imperial, Inyo, Los Angeles, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara.

*Aristida adscensionis* ranges in habit from small, unbranched plants scarcely 3 cm tall with only one or two spikelets to large, much-branched clumps 80 cm tall with numerous branches and spikelets. Several varieties have been named based on differences in plant and panicle size, degree of branching, and the development of the awns. Variation in size and robustness seems related to precipitation, and populations at the same site may vary drastically from year to year. The validity of reduced lateral awns as a taxonomic character is also questionable. Most species of *Aristida* have forms with the lateral awns reduced, and this seems to occur almost indiscriminately and without any correlation with other features.

**SELECTED SPECIMENS.**—**Imperial Co:** rd from Ogilby to Blythe, 17 Feb 1958, Bacigalupi, R. 6136 [JEPS]; Carriso Mts, Painted Gorge, 17 May 1938, Ferris, R. S. 9622 [UC]; near Dixieland, 13 Oct 1912, Parish, S. B. 8239 [JEPS].

**Inyo Co:** Panamint Mts, Death Valley, 18 Apr 1978, Dedecker 4541 [UC]; 11 mi W of Death Valley, 28 Mar 1947, Keck, D. 5847 [UC]. **Los Angeles Co:** Pasadena, 27 Feb 1882, Jones, M. E. s.n. [CM]; San Clemente Island, 8 May 1962, Raven, P. H. 17609 [UC]. **Riverside Co:** 9.4 mi N of Blythe, 19 Feb 1958, Bacigalupi, R. 6188 [JEPS]; Marshall Canyon, 10 mi W of Coachella, 16 Apr 1905, Hall, H. M. 5797 [UC]; near Mecca, 28 Jun 1902, Parish, S. B. 8122 [UC]; S end of Coxcomb Mts, 27 Mar 1941, Wiggins, I. L. 966 [UC]. **San Bernardino Co:** NW side of Copper Basin, 6 May 1939, Alexander 710 [UC]; Sheep Hole Mts, 25 Apr 1932, Ferris, R. S. 8020 [UC]; Needles, 12 Mar 1919, Tidestrom, I. 8556 [UC]. **San Diego Co:** San Diego, 29 Apr 1902, Brandegee 832 [UC]; 6 mi NW of Agua Caliente, 5 Apr 1960, Everett 24075 [UC]; 1.5 mi E of Vallecitos, 28 Jan 1940, Munz, P. A. 15856 [UC]; Borrego Springs, 18 Mar 1976, Schroeder 51 [UC]. **San Luis Obispo Co:** San Luis Obispo, 9 May 1882, Jones, M. E. 3245 [UC]. **Santa Barbara Co:** Santa Ynez Mts, 9 May 1954, Pollard [UC].

***Aristida californica*** Thurber in S. Watson, Bot. Calif. 2:289. 1880. Tufted, slightly bushy perennial; culms erect, much-branched, generally 10–40 cm tall; internodes glabrous or pubescent. Sheaths much shorter than the internodes, pubescent at the throat and on the collar. Ligules about 0.5 mm long. Blades mostly folded to involute, occasionally flat, stiffly spreading, 2–5 cm long, mostly less than 1 mm wide, scabrous to hispid-puberulent. Inflorescence few-flowered, 2–6 cm long, the terminal ones paniculate, the axillary ones racemose. Glumes unequal, 1-nerved. Lemma with a narrow column at the tip formed by the twisting and fusing of the awn bases; awns nearly equal, breaking from the lemma, the zone of articulation at the base of the awn column.  $2n = 22$ .

**var. californica.** CALIFORNIA THREEAWN (Fig. 2). Internodes pubescent, the hairs pilose to sublanose. Glumes very unequal, the first 4–8 mm long and the second 9–12 mm long. Lemma body 5–7 mm long when mature, the awn column 8–26 mm long; awns 2–4.5 cm long. Dry, sandy, desert areas. COUNTIES: Imperial, Riverside, San Bernardino, San Diego.

The other variety of this species is var. *glabrata* Vasey, known principally at the species level as *Aristida glabrata* (Vasey) Hitchcock. This variety differs from var. *californica* primarily in having glabrous, rather than pubescent,



internodes and occurs in the slightly higher elevations of the deserts to the east of the range of var. *californica*. Both taxa are diploids ( $2n = 22$ ), and they overlap considerably in spikelet dimensions (Reeder and Felger 1989). Variety *glabrata* is not known from California.

**SELECTED SPECIMENS.—Imperial Co:** Signal Mt, 2 Apr 1903, Abrams, G. D. s.n. [DS-186664] [DS]; 8 mi E of El Centro, among larrea bushes, 22 Apr 1942, Beetle, A. A. 3172 [AHUC]; Bard, near Arizona line, 22 Sep 1912, Thornber, J. J. s.n. [ARIZ], a few mi E of Holtville, Jun 1951, Tofsrud, R. s.n. [AHUC]. **Riverside Co:** near Thousand Palms, rocky desert slopes, 27 Apr 1943, Beetle, A. A. 1938 [AHUC]; Pinto Basin, 16 mi from Cottonwood Springs, 15 May 1938, Ferris, R. S. 9522 [DS]; canyons along Colorado River, 1 May 1905, Hall, H. M. 5963 [ARIZ, POM, UC]; Coachella Valley, 6 mi SE of Garnet Station, sand dunes, ca 500 ft, 11 Mar 1928, Howell, J. T. 3443 [DS, CAS, AHUC]. **San Bernardino Co:** Joshua Tree National Monument, 1700 ft, north ledge, T1S R10E, 18 May 1941, Cole, J. E. 734 [UC]; Baxter, S of Mojave River, 23 May 1915, Parish, S. B. 9886 [UC, DS]; Dale Lake Valley (W of lake), 13 mi E of 29 Palms, sun-dry sand flats, abundant, 29 May 1941, Wolf, C. B. 10876 [RSA, DS, CAS]. **San Diego Co:** San Felipe Narrows, ca 350 ft, 20 Apr 1935, Jepson, W. L. 17101 [JEPS]; canyon W of Borrego Spring, 1500 ft, 19 Apr 1906, Jones, M. E. s.n. [POM-117001] [POM]; Colorado Desert, clay hills, 25 Jun 1888, Orcutt, C. R. 1486 [DS].

***Aristida divaricata*** Humb. & Bonpl. ex Willdenow, Enum. Pl. 1:99. 1809. POVERTY THREEAWN (Fig. 3). Tufted perennials; culms erect, mostly unbranched, 25–70 cm tall; internodes glabrous. Sheaths longer than the internodes. Ligules 0.5–1 mm long. Blades loosely involute, glabrous, 5–20 cm long, 1–2 mm wide. Panicle open, 10–30 cm long, 6–25 cm wide; primary branches stiffly spreading from the main axis, axillary pulvini present, 2–12 cm long, generally naked on the lower portion. Branchlets and spikelets generally appressed along the branches, but sometimes spreading. Glumes nearly equal, 1-nerved, 8–12 mm long, acuminate-aristate. Lemma 8–13 mm long to base of awns, the terminal 2–3 mm narrowed and generally twisted four or more turns; awns subequal to unequal, (7)10–22 mm long, the lateral awns at least slightly shorter than the central. Anthers 0.8–1 mm long,  $2n = 22$ . To be looked for on dry



Fig. 2. *Aristida californica*, inflorescence, spikelet, and detail of branching.

slopes below 150 m elevation. COUNTIES: San Diego.

It is doubtful that *Aristida divaricata* currently occurs in California. Most reports are based on collections of C. R. Orcutt in 1884, and no known specimens have been collected from the state since that time. In addition, it is possible that Orcutt's labels are in error, because on at least one specimen of *A. divaricata* he located Hansen's Ranch, which is in Baja California, in San Diego County.

A similar species, *Aristida orcuttiana* Vasey, also supposedly was collected from southern California in 1884 by C. R. Orcutt, and two specimens are housed at US. The labels describe San Diego as the collection locality, and these specimens are apparently the basis for reports of either *A. orcuttiana* or *A. schiedeana* Trinius & Ruprecht from California (Abrams 1923, Jepson 1923, Hitchcock 1924, Munz & Keck 1968). Coincidentally, the type locality of *A. orcuttiana* is again Hansen's Ranch in Baja California, mentioned above. It is possible that neither *A. divaricata* nor *A. orcuttiana* was ever collected from California by Orcutt, but from



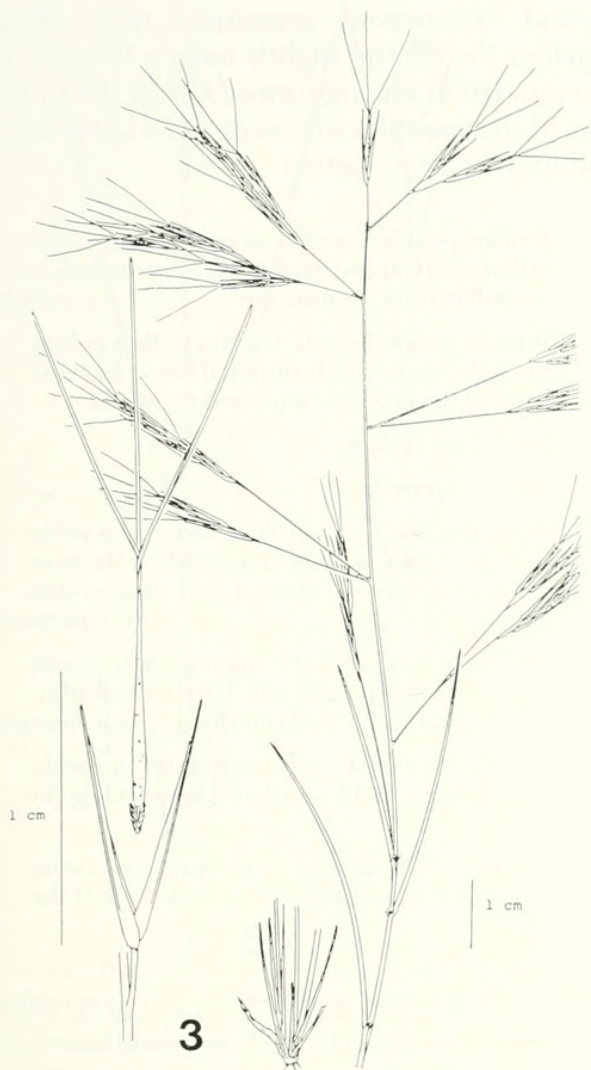


Fig. 3. *Aristida divaricata*, inflorescence, spikelet, and base of plant.

Baja California. *Aristida orcuttiana* resembles *A. divaricata* in the stiffly spreading panicle branches, but the lateral awns are very short or absent, and the blades are generally flat and somewhat curling in *orcuttiana*.

**SPECIMENS EXAMINED.**—Without definite locality but recorded as California: Santa Catalina Mts [Santa Catalina Island?], in 1884, Orcutt, C. R. 2 [US]; Santa Clara Mountains [possibly Arizona?], in 1884, Orcutt, C. R. 2 [US]. **San Diego Co:** San Diego, Orcutt, C. R. s.n. [NY, US].

***Aristida oligantha*** Michaux, Fl. Bor. Amer. 1:41. 1803. **OLDFIELD THREEAWN** (Fig. 4) [*A. oligantha* var. *nervata* Beal]. Tufted annuals; culms wiry, 30–70 cm tall, much-branched, the innovations extravaginal; internodes glabrous, pithy. Sheaths mostly shorter than the internodes. Ligules 0.1–0.5 mm long. Blades flat to involute, 3–22 cm long, 1–2 mm wide, reduced



Fig. 4. *Aristida oligantha*, inflorescence, spikelet, and detail of branching.

upwards. **Inflorescence** few-flowered, racemose, the spikelets nearly sessile. **Glumes** subequal or the second longer, awn-tipped, mostly (12)18–34 mm long, the first 3- to 5(7)-nerved and short-awned, the second 1- to 3-nerved with an awn 8–13 mm long. **Lemma** (10)13–20 mm long to base of awns; **central awn** (2)3.5–7 cm long, the **lateral awns** generally somewhat shorter.  $2n = 22$ . Dry hills and fields, bare ground, scrub land, 90–1000 m elevation. **COUNTIES:** Amador, Butte, El Dorado, Humboldt, Imperial, Lake, Madera, Mendocino, Merced, Modoc, Nevada, Placer, Redding, Sacramento, San Joaquin, Shasta, Siskiyou, Solano, Sonoma, Stanislaus, Tehama, Tuolumne, Yuba.



Some specimens of *Aristida oligantha* from northern California (Lake and Modoc counties) and adjacent areas of southern Oregon exhibit smaller glumes, lemmas, and awns than are typical and have been segregated as either *A. ramosissima* Engelman var. *chaseana* Henrard or *A. oligantha* var. *nervata* Beal. In addition, the central awn in these plants is sometimes acutely reflexed and the florets darkened. This configuration is intermediate between *A. oligantha* and *A. ramosissima*.

**SELECTED SPECIMENS:** **Butte Co:** Chico, 27 Jul 1903, Copeland 3488 [US, WIS]; volcanic uplands between Pentz and Dry Creek, 15 Jul 1914, Heller, A. 11576 [UC]; 2.5 mi S of Wyandotte, 28 Nov 1933, Jensen 367 [UC]. **Humboldt Co:** Cottrell Ranch, 17 Sep 1955, Mallory 122 [UC]; Trinity River near mouth of Willow Creek, 15 Sep 1919, Tracy 5222 [UC]; vicinity of Garberville, 27 Aug 1933, Tracy 13000 [UC]; Dobbryn Creek, 9 Jul 1934, Tracy 13341 [UC]. **Lake Co:** dry hills between Upper Lake and Scott Valley, 17 Aug 1905, Tracy, J. P. 2365 [UC] (var. *nervata*). **Madera Co:** Minturn, 1 Oct 1936, Hoover, R. F. 1618 [JEPS, UC]. **Merced Co:** Tuttle, 17 Jul 1936, Hoover, R. F. 1580 [JEPS, UC]. **Modoc Co:** 19 Aug 1935, Whitney, L. 3627 [UC]; Fletcher Creek, 6 Sep 1935, Wheeler, L. C. 3959 [US] (var. *nervata*). **Nevada Co:** Tahoe Natl Forest, S of Grass Valley, Aug 1931, Smith 2638 [JEPS, UC]. **Sacramento Co:** 5 mi SE of Folsom, Yates, H. S. 5953 [UC]. **Shasta Co:** Redding, 21 Jun 1909, Blankinship [JEPS]; 1 mi N of Anderson, 21 Jul 1932, Long 190a [UC]. **Stanislaus Co:** vicinity of La Grange, 30 Sep 1961, Allen [JEPS]; between Knight's Ferry and Warnerville, 1 Sep 1941, Hoover, R. F. 5582 [UC]; 1 mi NW of Waterford, Yates, H. S. 6858 [UC]. **Tehama Co:** 9.7 mi N of Red Bluff, 14 Aug 1954, Bacigalupi, R. 4808 [JEPS]; Volcanic Plateau NE of Red Bluff, 22 Sep 1940, Hoover, R. F. 4617 [UC]. **Tuolumne Co:** near Keystone, Yates, H. S. 6148 [UC].

*Aristida purpurea* Nuttall, Trans. Amer. Philos. Soc. 5:145. 1837. Tufted perennials; culms erect and generally unbranched, 10–80 cm tall; internodes glabrous. Sheaths longer than the internodes. Ligules 0.1–0.5 mm long. Blades mostly involute. Panicle variable, contracted and spikelike to open and flexuous, the branches without pulvini in the axils (except var. *parishii*). Glumes mostly unequal (except var. *parishii*), the first about half the length of the

second, 1(3)-nerved, acuminate. Awns about equal or the central slightly longer. Because of intergradation among forms (Allred 1984), the taxa of this complex are recognized as varieties within *Aristida purpurea*.

1. Primary panicle branches, at least the lower, with axillary pulvini and usually stiffly spreading to ascending from the main axis . . . . . var. *parishii*
- Primary panicle branches lacking axillary pulvini, the spikelets variously disposed but at least the bases of the branches appressed to the axis . . . . . 2
- 2(1). Awns 4–10 cm long . . . . . 3
- Awns 1–3.5 cm long . . . . . 4
- 3(2) Summit of lemma 0.1–0.3 mm wide; awns rather delicate, mostly 0.2 mm or less wide at the base, 4–6 cm long; second glume mostly shorter than 16 mm . . . . . var. *purpurea*
- Summit of lemma 0.3–0.8 mm wide; awns usually stout, more than 0.2 mm wide at the base, 4–10 cm long; second glume 16–25 mm long . . . . . var. *longiseta*
- 4(2). Summit of lemma mostly less than 0.2 mm wide; awns delicate, mostly less than 0.2 mm wide at the base . . . . . 5
- Summit of lemma mostly more than 0.2 mm wide; awns stout, mostly 0.2 mm or more wide at the base . . . . . 6
- 5(4). Panicle branches and pedicels erect, stiff, occasionally spreading or flexuous . . . . . var. *nealleyi*
- Panicle branches and pedicels drooping to flexuous . . . . . var. *purpurea*
- 6(4). Panicles mostly 3–14 cm long; blades mostly basal and less than 10 cm long . . . . . var. *fendleriana*
- Panicles mostly 15–30 cm long; blades mostly cauline and more than 10 cm long . . . . . var. *wrightii*

**var. *fendleriana*** (Steudel) Vasey, Contr. U.S. Natl. Herb. 3:46. 1892. FENDLER THREEAWN (Fig. 5) [*A. fendleriana* Steudel, Syn. Pl. Glum. 1:420. 1855]. Culms 10–40 cm tall. Blades involute, mostly less than 10 cm long, usually basal but occasionally cauline. Panicle 3–14 cm long, narrow. Glumes unequal, the first 5–8 mm long, the second 10–15 mm long. Lemma 8–14 mm long; awns generally 1.8–4 cm long, 0.2–0.3 mm wide at the base.  $2n = 22, 44$ . Dry, often rocky slopes and hills, 1000–2000 m elevation. COUNTIES: Inyo, Riverside, San Bernardino, San Diego.

**SELECTED SPECIMENS.**—**Inyo Co:** Devil's Kitchen Cyn, SE ¼, Sec 7, T22S R39E, 21 May 1978, Zembal, R. L. 531 [RSA/POM]. **Riverside Co:** 20 Jul 1905, Griffiths, D. 8008 [MO]; San Jacinto Mts, Pinyon Flats, 18 May 1958, Raven, P. H. 13003 [RSA/POM]. **San Bernardino Co:** near Jupiter Mine, Kingston Range,





Fig. 5. *Aristida purpurea* var. *fendleriana*, inflorescence, spikelet, and base of plant.

30 May 1980, de Nevers, G. 348 [RSA/POM]; SW New York Mts, 5.5 mi E of Cima in Cottonwood Canyon near Cottonwood Spring, 2 Jun 1973, Henrickson, J. 10339 [RSA/POM]; Ivanpah Mts, Kessler Peak, 2 Jun 1931, Jepson, W. L. 15825 [JEPS]; San Bernardino Mts, 15 Jun 1895, Parish, S. B. [UC]; Budweiser Wash, near 35d 46m N, 115d 44m W, Granite Mts, 28 Oct 1977, Prigge, B. A. et al. 2320 [RSA/POM]; Caruthers Cyn, New York Mts, 30 May 1973, Thorne, R. F. 43639 [RSA/POM]. **San Diego Co:** 3 mi WNW of Jacumba, Yates, H. S. 6805 [UC]; 5 mi ENE of Jacumba, Yates, H. S. 6808 [UC].

**var. *longiseta*** (Steudel) Vasey in Rothrock, U.S. Survey W. 100th Merid. Rpt. 6:286.1855. RED THREEAWN (Fig. 6) [*A. longiseta* Steudel, Syn. Pl. Glum. 1:420. 1855, *A. longiseta* var. *robusta* Merrill]. Culms 10–40 cm tall, delicate or stout. Blades 4–16 cm long, mostly involute, basal or cauline. Panicle 5–15 cm long, the branches stout and erect to delicate and drooping, but usually not very flexuous or tangled.



Fig. 6. *Aristida purpurea* var. *longiseta*, inflorescence and spikelet.

Glumes unequal, the first 8–12 mm long, the second 16–25 mm long, sometimes shorter. Lemma 12–16 mm long, 0.4–0.8 mm wide just below the awns; awns stout, 4–10 cm long, 0.2–0.5 mm wide at the base.  $2n = 22, 44, 66, 88$ . Dry, desert hills and plains, 300–1500 m elevation. COUNTIES: Mono, Riverside, San Bernardino, San Diego.

The varieties *longiseta* and *fendleriana* are often confused, but are most easily distinguished by the width of the awns and lemma apices, and not by whether the leaves are basal or cauline.

SELECTED SPECIMENS: **Riverside Co:** Joshua Tree National Monument, 1 May 1942, Roos 1153 [US]; Deep Canyon, T7S R5E, 27 Jun 1937, Yates, H. S. 6722 [RSA/POM]. **San Bernardino Co:** E New York Mts, W of Castle Buttes between Corral and Dove Spring, 12 May 1974, Henrickson, J. 13933 [RSA/POM]; Rock Springs, Palmer, E. 537 [UC]; plains near Leastalk, 3 Jun 1915, Parish, S. B. 10329 [UC]; 2.2 mi ESE of Brant on N side range of New York Mts, 8 May 1978, Prigge, B. A. et al. 2905 [RSA/POM]; San Bernardino Natl Forest,



above Cactus Flat W of Hwy 18 N of Baldwin Lake, 2–3 Jun 1980, Thorne, R. F. 54375 [RSA/POM]. **San Diego Co:** head of Box Canyon near Mason Valley, 12 May 1932, Duran, V. 3208 [WIS].

**var. *nealleyi*** (Vasey in Coulter) Allred, Brittonia 36:391. 1984. NEALLEY THREEAWN (Fig. 7) [*A. glauca* (Nees) Walpers, *A. stricta* Michaux var. *nealleyi* Vasey in Coulter, Contr. U.S. Natl. Herb. 1:55. 1890]. Culms 20–45 cm tall, tightly clustered. Blades generally basal, involute, curving in age, 5–15 cm long. Panicle narrow, spikelike, light brown, 8–18 cm long, the branches mostly erect-appressed. Glumes mostly unequal, the first 4–7 mm long, the second 8–14 mm long. Lemma 7–13 mm long, 0.1–0.2 mm wide just below the awns; awns delicate, 1.5–2.5 cm long, mostly 0.1 mm wide at the base.  $2n = 22, 44$ . Dry, desert plains and slopes, 200–1200 m elevation. COUNTIES: Imperial, Inyo, Riverside, San Bernardino, San Diego.

Variety *nealleyi* grades into var. *purpurea* with flexuous branches, and into var. *wrightii* with more robust panicles and broader lemma apices and awns.

**SELECTED SPECIMENS.—Imperial Co:** Painted Gorge, Carisso Mts, 17 May 1938, Ferris, R. S. 9623 [UC]. **Inyo Co:** Johnson Creek, Death Valley, 28 Apr 1940, Gilman, M. F. 4190 [RSA/POM]; Cave Springs Wash, 25 Apr 1930, Hoffman, R. [US]; Funeral Mts, 2 May 1917, Jepson, W. L. 6907 [JEPS]; Titanothera Cyn, Grapevine Mts, E side of Death Valley, 26 Mar 1947, Wiggins, I. L. 11566 [RSA/POM, UC]. **Riverside Co:** Cottonwood Spring, 30 Mar 1940, Hitchcock, C. L. 5871 [MO, RSA/POM, UC]; Eagle Mts, Cottonwood Springs, 25 Apr 1928, Jepson, W. L. 12585 [JEPS]; mouth of Andreas Canyon, 4–6 April 1917, Johnston, I. M. 1010 [RSA/POM]; E of Hemet, along San Jacinto River, 7 Aug 1938, Roos, J. C. 582 [RSA/POM]. **San Bernardino Co:** Providence Mts, Fountain Canyon, 15 May 1937, Beal 301 [JEPS]; route 95, 18 mi N of Travis, 23 Apr 1942, Beetle, A. A. 3193 [WIS]; 39 mi from Needles on Parker Road, 24 Apr 1928, Ferris, R. S. 7226 [RSA/POM]. **San Diego Co:** San Felipe, 16 Apr 1895, Brandegee [UC]; San Felipe Gap, 6 Apr 1901, Brandegee [UC]; head of Fox Canyon near Mason Valley, 12 May 1932, Duran, V. 3208 [MICH, MO, RSA/POM, UC]; Yaqui Well, 22 Apr 1928, Jepson, W. L. 12516 [JEPS].

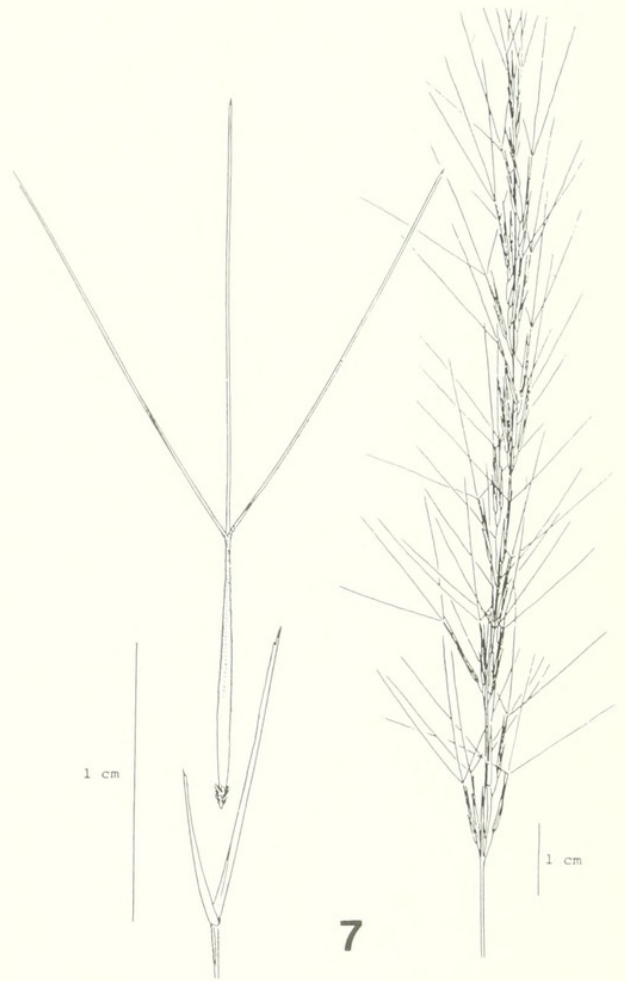


Fig. 7. *Aristida purpurea* var. *nealleyi*, inflorescence and spikelet.

**var. *parishii*** (A. S. Hitchcock in Jepson) Allred, Brittonia 36:392. 1984. PARISH'S THREEAWN (Fig. 8) [*A. parishii* A. S. Hitchcock in Jepson, Fl. Calif. 1:101. 1912, *A. wrightii* Nash var. *parishii* (Hitchcock in Jepson) Gould]. Culms thick, stout, erect. Blades mostly flat, longer than 10 cm. Panicle narrow, spikelike or the lower branches with axillary pulvini and spreading at about a 45-degree angle, 15–24 cm long, reddish when young. Glumes unequal to equal, the first 7–11 mm long, the second 10–15 mm long. Lemma 10–13 mm long, 0.2–0.3 mm wide just below the awns; awns 2–3 cm long, 0.2–0.3 mm wide at the base. Chromosome number not reported. Dry hills and plains, 300–1000 m elevation. COUNTIES: Imperial, Inyo, Los Angeles, Riverside, San Bernardino, San Diego.

Variety *parishii* is very similar to var. *wrightii* but differs most strikingly in the sometimes spreading primary branches, the reddish color of the panicle when young, and the more clustered arrangement of the spikelets. It also





Fig. 8. *Aristida purpurea* var. *parishii*, inflorescence and spikelet.

flowers earlier, mostly March through May, while var. *wrightii* flowers mostly May through October. Parish's threeawn also resembles some members of the *Divaricatae* group because of its spreading primary branches and generally subequal glumes.

**SELECTED SPECIMENS.**—**Imperial Co:** 9.2 miles NE of Glamis, 18 Mar 1962, Hitchcock, C. L. 2225 [F]; Palo Verde Mts, 8 Apr 1949, Roos, J. C. 4198 [US]. **Inyo Co:** specimen without locality at RSA/POM. **Riverside Co:** Chuckawalla Springs, 15 mi SE of Guiladay, 9 Jul 1957, Crampton, B. s.n. [AHUC]; Palm Canyon, 4 Apr 1917, Johnston, I. M. 1008 [US, MICH]; Riverside and vicinity of upper fork of Salt Creek Wash, 19 Mar 1927, Reed, F. M. 5440 [AHUC, RSA/POM]; between March AFB and Lakeview, 29 Apr 1966, Roos, J. C. s.n. [RSA/POM]. **San Bernardino Co:** 2 mi NE of Fifteenmile Point, 3000 ft, 28 Apr 1935, Axelrod, D. 321 [AHUC, UC]; between Bullion and Sheep Hole Mts, 7 Apr 1940, Munz, P. A. 16568 [RSA/POM]; Budweiser Wash, near 35d

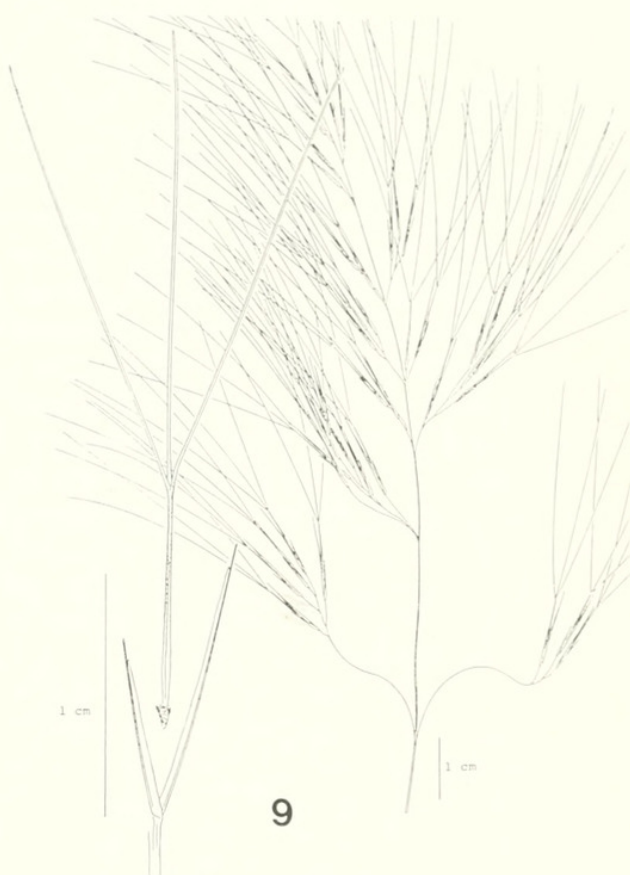


Fig. 9. *Aristida purpurea* var. *purpurea*, inflorescence and spikelet.

46m N, 115d 44m W, Granite Mts, 28 Oct 1977, Prigge, B. A. et al. 2320 [RSA/POM]. **San Diego Co:** 0.5 mi N of Miramar Reservoir, clay soil, 4 Mar 1981, Reveal, J. s.n. [AHUC]; Anza Canyon E of Julian, 3 Apr 1940, Wilson, E. s.n. [AHUC].

**var. *purpurea*.** PURPLE THREEAWN (Fig. 9) [*A. purpurea* var. *californica* Vasey]. Culms 25–60 cm tall. Blades flat to involute, mostly cauline, 3–17 cm long, 1–2 mm wide. Panicle purplish, often nodding, 10–25 cm long, the branches usually delicate, drooping or flexuous. Glumes unequal, the first 4–9 mm long, the second 7–16 mm long. Lemma 6–12 mm, 0.1–0.3 mm wide just below the awns; awns 2–3(4) cm long, 0.2–0.3 mm wide at the base.  $2n = 22, 44, 66, 88$ . Dry, grassy hills, scrub lands, 250–800 m elevation. COUNTIES: Mono, Riverside, San Bernardino, San Diego.

This is a beautiful grass, with its drooping, reddish, plumelike panicles. It commonly intergrades with the varieties *nealleyi*, *longiseta*, and *wrightii*.

**SELECTED SPECIMENS:** **Mono Co:** McAfee Creek, White Mts, Fishlake Valley drainage, 6 Aug 1984, Morefield, J. D. JDM-2480(e) [RSA/POM]. **Riverside Co:** 1 mile E of Banning,



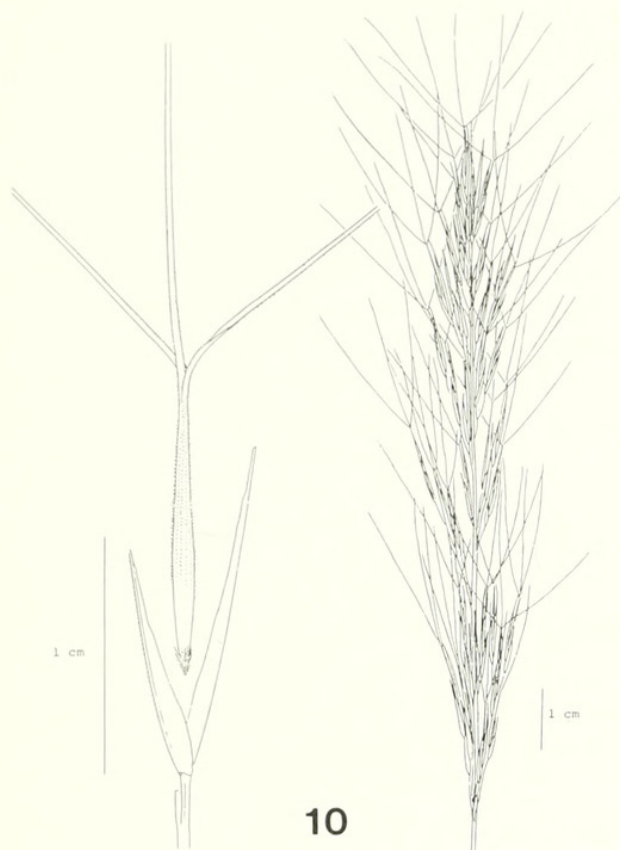


Fig. 10. *Aristida purpurea* var. *wrightii*, inflorescence and spikelet.

20 Jul 1905, Griffiths, D. 8007 [MO]; Palm Canyon, 4 Apr 1917, Johnston, I. M. 1008 [US, MICH]; base of San Jacinto Mountain, June 1882, Parish, S. B. et al. 1549 [F, MICH]; Lower San Jacinto River Canyon, Yates, H. S. 6711 [UC]. **San Bernardino Co:** road from Highland to Running Springs, 1 mi from valley floor, 26 Jun 1942, Beetle, B. A. 3644 [F, WIS]; near Upland, 7 Nov 1916, Johnston, I. M. 1120 [MICH]; San Bernardino Valley, 2 Jun 1906, Parish, S. B. 5783 [NMCR]; Clark Mts, 5 Aug 1950, Roos, J. C. et al. 4906 [RSA/POM, UC]. **San Diego Co:** 6 mi N of Ocean Side Ranch, coast hills in chaparral, 21 Apr 1942, Beetle, A. A. 3145 [TAES]; near Vallecitos Station, 2 Apr 1939, Gander, F. 7142 [MICH]; Harbison Canyon, 19 Jun 1938, Gander, F. F. 5999 [RSA/POM].

**var. *wrightii*** (Nash in Small) Allred, Brittonia 36:393. 1984. WRIGHT'S THREEAWN (Fig. 10) [*A. wrightii* Nash in Small, Fl. Southeast. U.S. 116. 1903]. Culms erect, to 80 cm tall. Blades involute to flat, cauline, 10–25 cm long, 1–3 mm wide. Panicle narrow, spikelike, 14–30 cm long, the branches erect-appressed. Glumes unequal, the first 5–10 mm long, the second

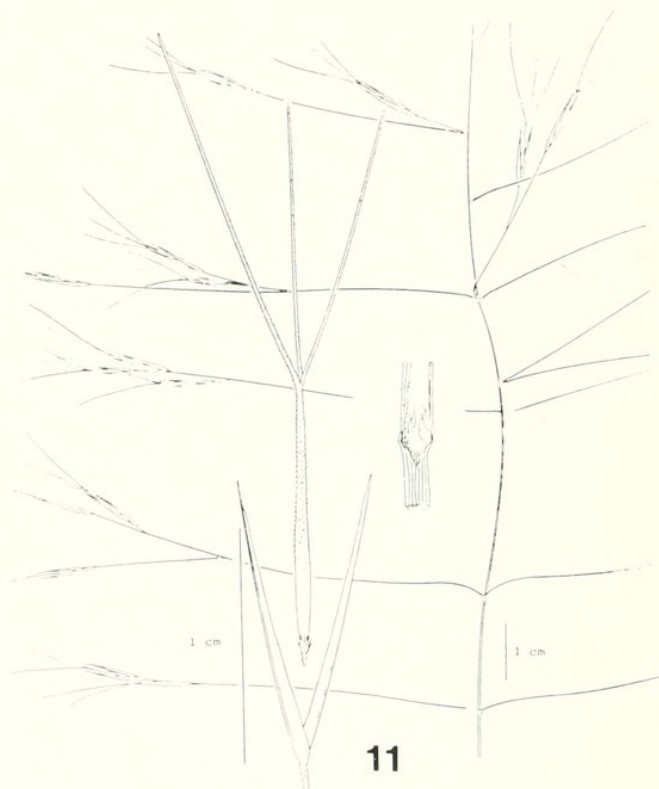


Fig. 11. *Aristida ternipes* var. *hamulosa*, inflorescence, spikelet, and detail of ligular region.

10–16 mm long. Lemma 8–14 mm long, 0.2–0.3 mm wide just below the awns; awns mostly 2–3.5 cm long, 0.2–0.3 mm wide at the base.  $2n = 22, 44, 66$ . Sandy or rocky hills and plains, 500–1500 m elevation. COUNTIES: Riverside, San Bernardino, San Diego.

Wright's threeawn intergrades with the varieties *purpurea*, *fendleriana*, and *parishii*.

**SELECTED SPECIMENS.**—**San Bernardino Co:** Slover Mts, 14 Aug 1907, Reed F. M. 1307 [WIS]; 2.5 mi SE of Kingston Peak, T19N R10E, Sec 34-27, 23 Oct 1977, Henrickson, J. 16321 [RSA/POM]; rocky canyon between Bullion and Sheep Holt Mts, 7 Apr 1940, Munz, P. A. 16568 [UC]. **San Diego Co:** 3 mi WNW of Jacumba, T18S R8E, 3 Sep 1937, Yates, H. S. 6805 [RSA/POM].

***Aristida ternipes*** Cavanilles, Icon. Pl. 5:46. 1799. Tufted perennials; culms few, erect to sprawling, simple or only weakly branched, 25–80 cm tall; internodes glabrous. Sheaths mostly longer than the internodes. Ligules 0.2–0.5 mm long. Blades flat to involute, 5–40 cm long, 1–2 mm wide, with scattered long hairs above the ligule. Panicle 15–40 cm long, open, the branches widely spreading from the main axis and naked at the base, axillary pulvini present.



*Spikelets* appressed or spreading from the branches. *Glumes* about equal, 1-nerved, 9–15 mm long. *Lemma* 10–15 mm long, usually not twisted at the apex; *awns* equal to very unequal. *Anthers* 1.2–3 mm long.

**var. *hamulosa*** (Henrard) Trent, *Sida* 14(2):260. 1990. HOOK THREEAWN (Fig. 11) [*A. hamulosa* Henrard, Med. Rijks Herb. Leiden 54:219. 1926]. *Central awn* 10–25 mm long. *Lateral awns* mostly 6–23 mm long, sometimes shorter.  $2n = 44$ . Dry hills and slopes, 100–800 m elevation. COUNTIES: Butte, Colusa, Fresno, Glenn, Kern, Los Angeles, Madera, Riverside, San Bernardino, San Diego, Santa Barbara, Sonoma, Stanislaus, Sutter, Tehama, Tulare, Ventura, Yolo.

Trent and Allred (1990) documented the morphologic variation and similarity of *Aristida ternipes* and *A. hamulosa*, concluding that the *hamulosa* taxon should be treated as a variety of *ternipes*. Variety *ternipes* does not occur in California and differs only in the length of the lateral awns. Variety *hamulosa* also resembles *A. divaricata*, which differs most consistently in having shorter anthers and lacking pilose hairs above the ligule. Based on numbers of specimens in California herbaria, var. *hamulosa* is unusually common.

SELECTED SPECIMENS.—**Butte Co:** South Butte, 10 Sep 1981, Ahart 1535 [UC]; along Hwy 32, 1 mi E of Chico, 16 Aug 1983, Ahart, L. 4277 [TAES]. **Colusa Co:** 10 mi W of Williams, 5 Jul 1955, Burcham, L. T. 317 [AHUC, TAES, UC]; 10.7 mi SE of Leesville, 19 May 1958, Crampton, B. 4789 [AHUC]. **Fresno Co:** Citrus Grove, 11 May 1940, Hoover, R. F. 4385 [UC]; 8 mi N of Orange Cove, 8 Jun 1960, Howell, J. T. 35481 [ISC]. **Glenn Co:** 5.5 mi S of Orland, 29 May 1942, Beetle, A. A. et al. 3353 [AHUC]; 5 mi W of Orland on the Newville road, 27 May 1914, Heller, A. A. 11432 [US]. **Kern Co:** lowest slopes of the Tehachapi Mts, 15 mi S of Bakersfield, 14 Apr 1942, Beetle, A. A. 3017 [AHUC]; 15 mi S of Bakersfield, 7 Jun 1946, Beetle, A. A. 4679 [UC]. **Los Angeles Co:** Alta Dena, 2 Apr 1905, Grant 66-6459 [ARIZ, RSA/POM, UC]; Pomona, 1 Jul 1937, Horton 448 [UC]; Liveoak Canyon, San Gabriel Mts, 15 Apr 1934, Wheeler, L. C. 2525 [AHUC]. **Madera Co:** near Raymond, on sheep ranch, 11 May 1934, Wilson, E. s.n. [AHUC]. **Riverside Co:** 10 mi N of Pala, 17 Mar 1964, Hitchcock, C. L. et al. 23113 [NY]; lower San Jacinto River Canyon, Yates, H. S. 6710 [UC]. **San**

**Bernardino Co:** near Upland, 7 Nov 1916, Johnston, I. 1121 [ARIZ]; mesa near Rialto, 20 May 1888, Parish, S. B. [UC]; Granite Mountains, Budweiser Wash, 28 Oct 1977, Prigge, B. A. et al. 2321 [RSA/POM]. **San Diego Co:** Rolando, 14 Jan 1938, Gander, F. F. 4936 [SD]; San Jamento, 4 Jul 1890, Hasse, H. E. s.n. [NY]; Escondido, 10 Aug 1928, Meyer 652 [JEPS]. **Santa Barbara Co:** Santa Cruz island, N of biological station in central valley, 23 Apr 1979, Thorne, R. F. et al. 52466 [RSA/POM]. **Sonoma Co:** Little Geysers, 1 mi E of Big Sulphur Creek, 10 Aug 1984, Leitner [UC]. **Stanislaus Co:** vicinity of La Grange, 30 Sep 1961, Allen, P. s.n. [AHUC, JEPS]. **Sutter Co:** Sutter Buttes, 10 Sep 1981, Ahart L. 3129 [NY]. **Tehama Co:** about 5 km N of Black Butte Reservoir and about 17 km NW of Orland, 26 Mar 1990, Buck, R. 1469 [JEPS]; Jelly's Ferry Rd, 0.5 mi from I-5 exit, 16 Aug 1991, Allred, K. W. 5467 [NMCR]. **Tulare Co:** Three Rivers, 24 Aug 1905, Brandegee s.n. [UC]; 10 mi SE of Porterville on Tule Indian Reservation Rd, 28 Dec 1964, Guthrie, L. 66 [AHUC]; Fountain Springs Rd, 6.3 mi W of California Hot Springs, 25 Jun 1966, Twisselmann, E. C. 12537 [AHUC]. **Ventura Co:** Upper Santa Ana Creek, Santa Ynez foothills, 13 Jun 1957, Pollard, H. M. s.n. [TAES]. **Yolo Co:** foothills, open slope, 2 mi W of Winters, 24 Aug 1953, Crampton, B. 1600 [AHUC].

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