

BROMUS, SECTION PNIGMA, IN NEW MEXICO, WITH A KEY TO THE BROMEGRASSES OF THE STATE¹

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ABSTRACT

The distribution, nomenclature, and taxonomy of New Mexico species of *Bromus* section *Pnigma* were reviewed. Discriminant analysis of nine morphologic features suggested the recognition of five species in New Mexico: *B. anomalus*, *B. ciliatus*, *B. frondosus*, *B. lanatipes*, and *B. porteri*. *Bromus richardsonii* and *B. mucroglumis* were subsumed within *B. ciliatus* and *B. lanatipes*, respectively. Pubescence patterns, glume nervature, lemma lengths, and anther lengths were the most valuable distinguishing features. A key to all New Mexico *Bromus*, descriptions, specimen citations, and illustrations are presented.

KEY WORDS: Gramineae, *Bromus*, New Mexico

Approximately sixteen species of brome grass (genus *Bromus*) occur in New Mexico. Half of these are weedy, adventive, annual species found mostly throughout the state along roadsides, in abandoned fields, and on disturbed ground. The remaining eight species are perennials occurring in numerous cool season floras in the state: riparian and canyon communities, piñon/juniper woodlands, pine forests, oak woodlands, high elevation mixed conifer forests, and mountain meadows and parklands. Several of these perennial species provide important grazing forage for wildlife and domestic livestock.

Traditionally (Hitchcock & Chase 1951), the perennial bromes of North America have been aligned with two sections of the genus *Bromus*: *Ceratochloa* and *Bromopsis*. The species of concern here fall within the old section *Bromopsis*. Smith (1970), reviewing the nomenclature of the genus, confirmed the invalid use of the name *Bromopsis* at the sectional rank, and justified its replacement by *Pnigma*. Some workers (Holub 1973; Weber 1987, 1990) have

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Table 1. Taxonomic disposition by various authors of New Mexico species of *Bromus* section *Pnigma*.

	<i>anomalus</i>	<i>ciliatus</i>	<i>frondosus</i>	<i>lanatipes</i>	<i>porteri</i>	<i>richardsonii</i>	<i>macroglumis</i>
Wootton & Standley 1915	n/a	n/a	<i>frondosus</i>	<i>lanatipes</i>	<i>porteri</i>	<i>richardsonii</i>	n/a
Hitchcock & Chase 1951	<i>anomalus</i>	<i>ciliatus</i>	<i>frondosus</i>	var. of <i>anomalus</i>	<i>anomalus</i>	<i>ciliatus</i>	n/a
Wagnon 1952	<i>anomalus</i>	<i>ciliatus</i>	<i>frondosus</i>	<i>lanatipes</i>	<i>porteri</i>	<i>richardsonii</i>	<i>macroglumis</i>
Soderstrom & Beaman 1968	<i>anomalus</i>	<i>ciliatus</i>	<i>porteri</i>	<i>lanatipes</i>	<i>porteri</i>	<i>ciliatus?</i>	<i>anomalus?</i>
Cronquist <i>et al.</i> 1977	<i>anomalus</i>	<i>ciliatus</i>	n/a	n/a	<i>anomalus</i>	<i>ciliatus</i>	n/a
Martin & Hutchins 1980	<i>anomalus</i>	<i>ciliatus</i>	<i>frondosus</i>	<i>lanatipes</i>	<i>anomalus</i>	<i>richardsonii</i>	n/a
Arnow 1987	<i>anomalus</i>	<i>ciliatus</i>	<i>anomalus</i>	n/a	<i>anomalus</i>	<i>ciliatus</i>	n/a
Weber & Wittmann 1992	n/a	<i>canadensis</i>	n/a	<i>lanatipes</i>	<i>porteri</i>	ssp. of <i>canadensis</i>	n/a
Allred, this paper	<i>anomalus</i>	<i>ciliatus</i>	<i>frondosus</i>	<i>lanatipes</i>	<i>porteri</i>	<i>ciliatus</i>	<i>lanatipes</i>

preferred to treat the sections at the generic level; in that case, our species would be assigned to the genus *Bromopsis*.

In reviewing New Mexico specimens of *Bromus* I was bewildered by the amount of variation in the native perennial species of the section *Pnigma*. Identification was close to guesswork, based arbitrarily on which of several features I chose to emphasize. There was a confusing absence of correlation among the numerous features that have been used to identify the species. A resort to the literature only added to the confusion (Table 1). Recent works from adjacent areas (Arnow 1987; Cronquist *et al.* 1977; Gould 1975; Soderstrom & Beaman 1968; Weber 1987, 1990) aided somewhat, but not all the same species were treated as occur in New Mexico. There was also a lack of agreement in the literature on which species occurred in New Mexico. For example, the most recent floristic work for the state (Martin & Hutchins 1980) listed *Bromus purgans* L. as occurring in New Mexico, and many specimens keyed to that entity, but other works (Hitchcock & Chase 1951; Wagnon 1952) excluded that species from the state.

The resolution of all the taxonomic problems in this species complex was beyond the scope of this study. My goals were to conduct an evaluation of the variation present in New Mexico populations of *Bromus* section *Pnigma*, and to provide a reasonable alignment of the variation with the appropriate names. This at least would allow consistent identification of New Mexico

Table 2. Tentative *a priori* grouping of New Mexico *Bromus* specimens.

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- Group 1:* Collars glabrous, pedicels and glumes glabrous, first glume 1 nerved, lemmas pubescent across the back. (16 specimens)
- Group 2:* Collars ciliate at the corners, pedicels and glumes glabrous, first glume 1 nerved, lemmas pubescent on the margin. (46 specimens)
- Group 3:* Collars glabrous, pedicels and glumes glabrous, first glume 3 nerved, lemmas pubescent across the back. (18 specimens)
- Group 4:* Sheaths lanate, collars ciliate at the corners, first glume 1 nerved, lemmas pubescent across the back. (26 specimens)
- Group 5:* Collars glabrous, pedicels and glumes puberulent, first glume 3 nerved, lemmas pubescent across the back. (34 specimens)
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Table 3. Features scored for data analysis of New Mexico *Bromus*.

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- Sheath pubescence (glabrous, lightly pilose/hirtellous/lanate)
- Collar pubescence (glabrous, ciliate at corners)
- Panicle length (cm)
- Pedicel pubescence (glabrous, puberulent)
- Glume pubescence (glabrous, puberulent)
- Number of nerves on glume one
- Lemma pubescence (on margin, across back)
- Lemma length (mm)
- Anther length (mm)
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Table 4. Correlations above 0.4 among features of New Mexico *Bromus*

Pedicel pubescence × glume pubescence	0.9409
Collar pubescence × glume nervation	-0.6980
Sheath pubescence × collar pubescence	0.5774
Sheath pubescence × lemma length	0.5107
Glume pubescence × glume nervation	0.4416
Lemma pubescence × awn length	0.4330
Sheath pubescence × glume nervation	0.4328
Pedicel pubescence × glume nervation	0.4235

material based on some understandable set of criteria.

METHODS

Approximately 470 New Mexico specimens of *Bromus* belonging to section *Pnigma* were examined. Of these, 140 were selected for data analysis. These specimens were chosen to represent all phases of variation that were found, including not only variation considered typical of recognized species, but also variation that was intermediate or not assignable to species. After careful examination of all 470 specimens, each of the 140 specimens was assigned tentatively to one of five *a priori* groups based on patterns perceived intuitively (Table 2). Several specimens did not correspond exactly to only one of the groups, being intermediate between two groups, but were placed arbitrarily in what was judged to be the closest group. The 140 specimens were also scored for nine morphological features (Table 3). Various statistical procedures (Hintze 1987) were then used to assess the variation patterns and morphological relationships. Discriminant analysis tested the statistical validity of the five *a priori* groups, comparing the overall quantitative similarity of the specimens with their assignments to a particular group.

Names were assigned by consulting type specimens, when available, and the original descriptions of each taxon, as well as the nomenclatural discussions in Baum (1967), McNeill (1976), Soderstrom & Beaman (1968), and Wagnon (1952).

RESULTS OF THE DATA ANALYSIS

A correlation matrix revealed limited correlations among the features. The eight highest correlations are listed in Table 4. Of the features examined, pubescence patterns, number of nerves on the first glume, lemma length, and anther length should be the most useful in pattern recognition.

Fig. 1. Variation in lemma length
(Range, mean, \pm std. dev.)

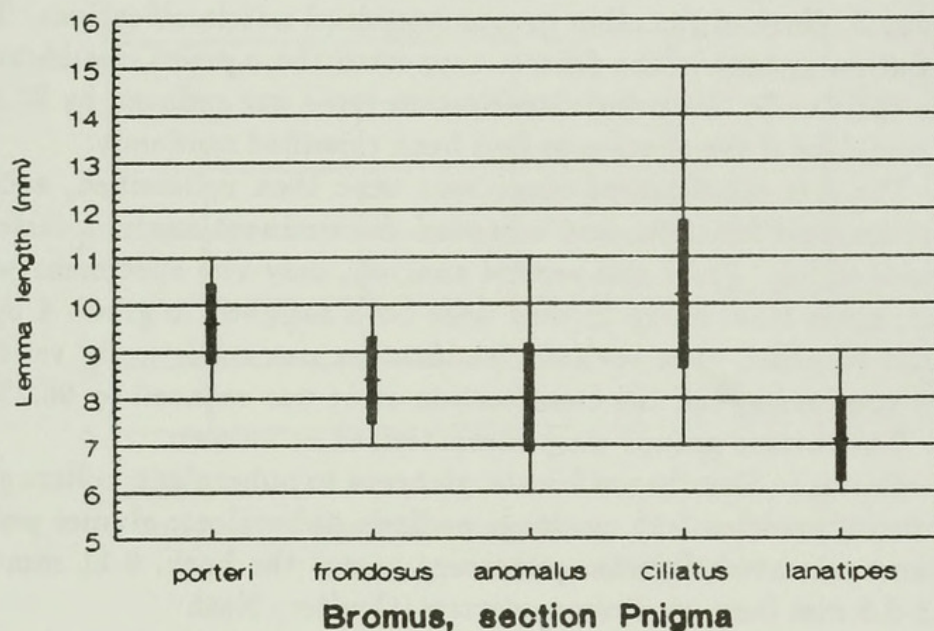
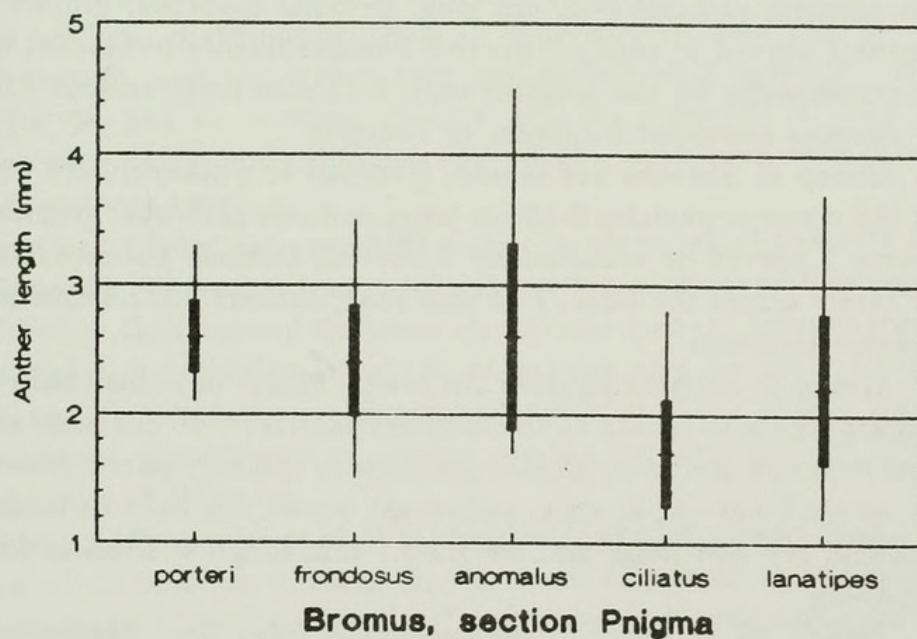


Fig. 2. Variation in anther length
(Range, mean, \pm std. dev.)



Only five of the 140 specimens were judged to be statistically misclassified by the discriminant analysis. All five misclassifications were from group 2: two were assigned by the analysis to group 3, two to group 4, and one to group 5. None of the other groups contained misclassifications. The statistical variation present in the dataset supported the *a priori* classification of 96% of the specimens. Also, the classification error was reduced by 95.5% over what it would be if the specimens had been classified randomly.

The five misclassified specimens were then reclassified, according to the discriminant function, and a second discriminant analysis tested the revised classification. From this second analysis, only two specimens were misclassified, again from group 2; they were both assigned to group 4 by the discriminant function. The revised classification was statistically valid for 98.5% of the specimens, and the classification error was reduced by 98.2%.

The revised groups were characterized as follows:

Group 1: Sheaths not lanate, glabrous to puberulent; collars glabrous at the corners; panicles 7-15 cm long; pedicels puberulent; glumes puberulent; first glume trinerved; lemmas pubescent across the back, 8-11 mm long; anthers 2.1-3.3 mm long. = *Bromus porteri* (Coulter) Nash

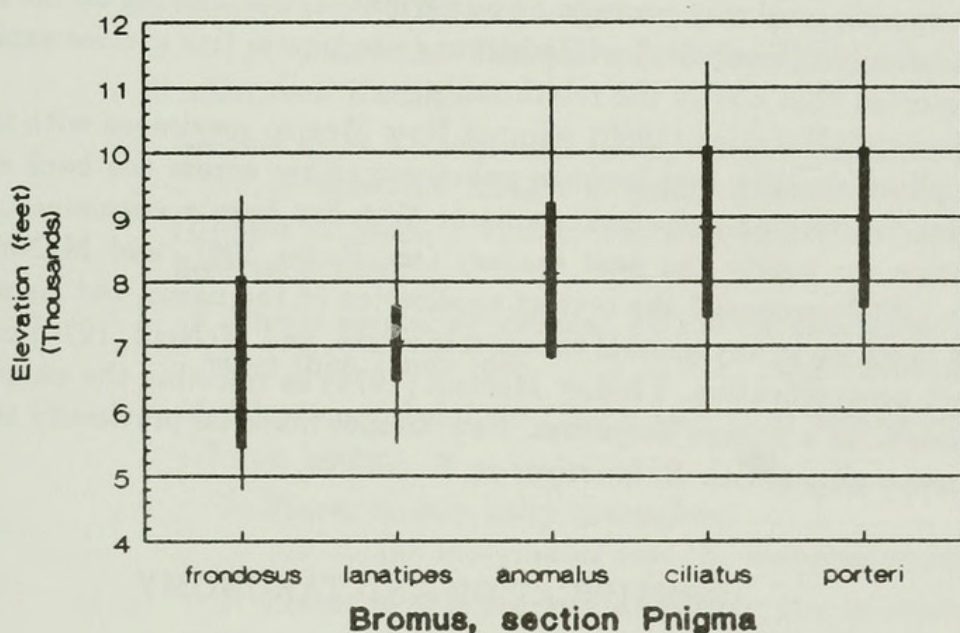
Group 2: Sheaths not lanate, glabrous to puberulent or sparsely pilose; collars glabrous or occasionally with ciliate hairs at the corners; panicles 7-28 cm long; pedicels glabrous; glumes glabrous; first glume trinerved or rarely 1 or 2 nerved; lemmas pubescent on the margins or across the back, 7-10 mm long; anthers 1.5-3.5 mm long. = *Bromus frondosus* (Shear) Wooton & Standley

Group 3: Sheaths not lanate, glabrous to puberulent; collars glabrous at the corners; panicles 8-24 cm long; pedicels glabrous; glumes glabrous; first glume 1 nerved or rarely 2 nerved; lemmas mostly pubescent across the back or occasionally on the margins only, 6-11 mm long; anthers 1.7-4.5 mm long. = *Bromus anomalus* Ruprecht ex Fournier

Group 4: Sheaths not lanate, glabrous to pilose; collars with ciliate hairs at the corners; panicles 6-18 cm long; pedicels glabrous; glumes glabrous, first glume 1 nerved or occasionally 2 nerved; lemmas pubescent on the margins or rarely across the back, 7-15 mm long; anthers 1.2-2.8 mm long. = *Bromus ciliatus* Linnaeus

Group 5: Sheaths (mainly the lower) lanate or occasionally densely pilose; collars ciliate to lanate at the corners; panicles 5-15 cm long; pedicels puberulent or rarely glabrous; glumes glabrous or sparsely pilose; first glume 1 nerved or rarely 3 nerved; lemmas pubescent across the back or occasionally on the margin, 6-9 mm long; anthers 1.2-3.7 mm long. = *Bromus lanatipes* (Shear) Rydberg

Nearly all of the *Bromus* specimens from New Mexico available to me agreed with one of these five groups. As in the statistical analysis, a small fraction of specimens (about 22 of 470) were intermediate between group 2 (*B. frondosus*) and groups 3 or 4.

Fig. 3. Ranges in Elevation(Range, mean, \pm std. dev.)

Variation in lemma length is displayed in Figure 1. *Bromus lanatipes* had the smallest lemmas and *B. ciliatus* the largest. Even though the ranges overlapped, the means of three groups of species were significantly different ($P < 0.05$): *B. lanatipes*, *B. porteri*/*B. ciliatus*, and *B. frondosus*/*B. anomalus*.

Bromus porteri, *B. frondosus*, and *B. anomalus* all had similar anther lengths (Figure 2), and the means were not significantly different. *Bromus ciliatus*, however, had the smallest anthers, and the means of *B. ciliatus* and *B. lanatipes* were significantly different ($P < 0.05$), both from each other and from the other three taxa.

Examination of label data revealed a cline in elevation of habitats for the species (Figure 3). There is rather extensive overlap of the overall ranges in elevation, although the means of the lower elevational species (*Bromus frondosus* and *B. lanatipes*), the midelevational (*B. anomalus*), and the upper elevational (*B. porteri* and *B. ciliatus*) were significantly different ($P < 0.05$). Elevation cannot completely discriminate among the species, but they do tend to occupy habitats at different altitudes.

Recent works (Cronquist *et al.* 1977; Martin & Hutchins 1980; Arnow 1987) have relegated *Bromus porteri* and *B. frondosus* to synonymy without rank under *B. anomalus*. The two species *B. porteri* and *B. anomalus* are rather clearly separated, however, by differences in pedicel and glume pubescence and in glume nervature, as well as by a strong tendency to occupy habitats at

different elevations. Discrimination of *B. frondosus* is much less precise, being based mostly on differences in glume nervature. Recognition of *B. frondosus* at the specific level may prove to be unwarranted, but, relying on the results of the discriminant analysis, I will continue to recognize this species until studies are reported that clarify the relationship.

Martin & Hutchins (1980) referred New Mexico specimens with long panicles, pilose sheaths, and lemmas pubescent either across the back or on the margins to *Bromus purgans* L., a name that has been a consistent source of confusion for nearly the past century (see Baum 1967, and McNeill 1976). Baum (1967) proposed the correct application of the name, but its usage was never taken up in any general taxonomic works, and McNeill (1976) provided a correct neotypification. I follow McNeill (1976) in rejecting the name *Bromus purgans* L. as a *nomen confusum*. New Mexico material previously referred to this name aligns with *B. lanatipes* or *B. ciliatus*.

IDENTIFICATION AND TAXONOMY

Bromus Linnaeus, *Sp. Pl.* 76. 1753.

(*Anisanthus* C. Koch, *Bromopsis* Fourn., *Ceratochloa* Beauv.)

Annuals, biennials, or perennials. Culms hollow. Sheaths closed to near the top; ligules membranous; auricles present or absent. Inflorescence a panicle. Spikelets with several florets, disarticulating above the glumes and between the florets; glumes mostly unequal, shorter than the lowermost lemma, the first 1 to 3 nerved, the second 3 to 5 nerved; lemmas mostly 5 to 9 nerved, usually awned from just below the apex; palea 2 nerved, adhering to the caryopsis at maturity. Stamens usually 3. $x = 7$.

A key is presented to all species of *Bromus* in New Mexico, followed by descriptions of the native species of section *Pnigma*

1. Plants perennial.

2. Rhizomes present (section *Pnigma*, introduced species).
 *B. inermis* Leysser [*Bromopsis inermis* (Leysser) Holub].

3. Spikelets and sheaths glabrous; awns 0-1 mm long.
 var. *inermis*.

3. Spikelets and sheaths pubescent; awns 2-3 mm long.
 var. *purpurascens* (Hooker) Wagnon [*B. pumpellianus* Scribn., *Bromopsis pumpelliana* (Scribn.) Holub].
 This is apparently the native counterpart to the introduced *B. inermis*.

2 Rhizomes absent.

4. Spikelets strongly flattened, the lemmas v-shaped in cross-section; second (upper) glume mostly 5 to 7 nerved.
 5. Lemma awns 0-2.5 mm long.
 . . . *B. catharticus* Vahl [*B. unioloides* (Willd.) H.B.K., *B. willdenovii* Kunth].
 5. Lemma awns 3-8 mm long (rarely as short as 2 mm). ...
 *B. carinatus* Hooker & Arnott [*Ceratochloa carinata* (Hooker & Arnott) Tutin]. The following weak races have been recognized.
 6. Plants annual or biennial, 30-100 cm tall; awns usually more than 7 mm long. the *carinatus* race.
 6. Plants perennial, 80-120 cm tall; awns usually less than 7 mm long.
 7. Plants mostly hairy throughout
 the *marginatus* race [*B. marginatus* Steudel].
 7. Plants mostly hairless, at least in the spikelets. ...
 the *polyanthus* race [*B. polyanthus* Scribner].
4. Spikelets not strongly flattened, but more or less terete, the lemmas rounded on the back in cross section; second (upper) glume 3 nerved (section *Pnigma*, native species).
 8. First glume 3 nerved, the lateral nerves occasionally short.
 9. Glumes and pedicels puberulent; lemmas pubescent across the back; blades erect, the midrib not narrowed below the collar. *B. porteri*.
 9. Glumes and/or pedicels glabrous; lemmas pubescent across the back or on the margins only; blades mostly lax or spreading, the midrib often narrowed below the collar. *B. frondosus*.
 8. First glume 1(-2) nerved.
 10. Sheaths lanate or densely pilose, the hairs spreading from the sheath but becoming matted at the tips; lemmas mostly less than 8 mm long. *B. lanatipes*.
 10. Sheaths glabrous to lightly pilose or hirtellous, if hairy then not becoming matted; lemma length various, but mostly 7-12 mm long.
 11. Sheaths with crinkled hairs at the corners of the collars; lemmas densely hairy on the margins but glabrous or nearly so on the median portion across the back; anthers mostly shorter than 2.2 mm; lemmas mostly longer than 8.6 mm. *B. ciliatus*.

11. Sheaths glabrous at the collars; lemmas hairy across the back, not glabrous on the median portion; anthers mostly longer than 1.8 mm; lemmas mostly shorter than 9.2 mm. *B. anomalus*.

1. Plants annual.

12. Lemma awns 0-2.5 mm long.

13. Lemmas lanceolate, broadest at the base, 9-14 mm long; anthers about 3-4 mm long. *B. catharticus* Vahl (*B. unioides* [Willd.] H.B.K., *B. willdenovii* Kunth).

13. Lemmas inflated, broadest at the middle, 7-9 mm long; anthers 1 mm long or less. .. *B. briziformis* Fisch. & Mey.

12. Lemma awns longer than 3 mm.

14. Lemmas 6-9(-10) mm long at maturity.

15. Awns mostly less than 5 mm long; lemmas rounded, the margins usually rolled around the grain; plants hairless. *B. secalinus* L.

15. Awns mostly more than 5 mm long; lemmas somewhat flattened, the margins not rolled around the grain; plants hairy.

16. Panicles dense, compact, 3-8(10) cm long, the branches stiffly erect. ... *B. hordeaceus* L. The following weak races have been recognized:

17. Awns flattened at the base, divaricate when mature. the *molliformis* race [*B. molliformis* Lloyd].

17. Awns round at the base, straight or curving slightly outward when mature. the *hordeaceus* race [*B. mollis* L.].

16. Panicles open, 6-20 cm long, the branches spreading. ... *B. japonicus* Thunb. ex Murray. The following weak races have been recognized:

18. Panicle branches lax and drooping; awns flattened at the base; anthers 0.8-1.5 mm long; hairs on leaf sheaths spreading or reflexed, soft and becoming matted on handling. the *japonicus* race.

18. Panicle branches stiffly ascending or spreading; awns round at the base; anthers 1.5-2.0 mm long; hairs on leaf sheaths reflexed, straight. the *commutatus* race [*B. commutatus* Schrad.].

14. Lemmas (9-)10-30 mm long at maturity.

19. First glume 3 to 5 nerved; awns 4-8 mm long.
 . . *B. carinatus* Hook. & Arn. See leads 6-7 to distinguish
 the races of this species.
19. First glume mostly 1 nerved (occasionally 3 nerved in *B.*
diandrus); awns (7-)10-60 mm long.
20. Panicle dense, compact, ovoid; panicle branches stout,
 erect, and mostly much shorter than 2 cm.
 *B. rubens* L.
20. Panicle loose, open, elongate; panicle branches often
 spreading or drooping, and mostly much longer than 2
 cm.
21. Awns mostly 3-6 cm long; lemmas 20-35 mm long.
 *B. diandrus* Roth [*B. rigidus* of numerous
 authors, *Anisantha diandra* (Roth) Tutin].
21. Awns mostly 1-3 cm long; lemmas 9-20 mm long.
22. Primary panicle branches mostly with 1(3)
 . spikelets; awns 15-30 mm long; lemmas 14-20
 . mm long. ... *B. sterilis* L. [*Anisantha sterilis*
 . (L.) Nevski].
22. Primary panicle branches mostly with more
 . than 3 spikelets, at least on mature shoots;
 . awns 10-18 mm long; lemmas 9-12 mm long.
 *B. tectorum* L.
 . [*Anisantha tectorum* (L.) Nevski].

Bromus anomalus Ruprecht ex Fournier NODDING BROME, BROMO
 DORMILON. Fig. 4.

Bromus anomalus Rupr. in Galeotti, Bull. Acad. Roy. Brux. 9(2):236. 1842.
Nomen nudum. *Bromus anomalus* Rupr. ex Fourn., Mex. Pl. 2:126.
 1886. *Zerna anomala* (Rupr. ex Fourn.) Henrard, Blumea 4:499. 1941.
Bromopsis anomala (Rupr. ex Fourn.) Holub, Folia Geobot. Phytotax.,
 Praha 8:167. 1973.

Bromus lanatipes (Shear) Rydb. forma *glaber* Wagnon, Leaf. West. Bot.
 6:68. 1950.

Description: Culms 45-110 cm tall, erect, unbranched above the base;
 nodes mostly 4-6, glabrous or rarely sparsely retrorsely pubescent. Sheaths

glabrous to sparingly pilose or hirtellous, shorter than the internodes; ligules 1 mm or less long; auricles absent, the collars glabrous at the corners; blades 12-26 cm long, 3-7 mm wide, flat, glabrous or occasionally lightly hirtellous, the midrib narrowed just below the collar. Panicles 8-24 ($\bar{x} = 16$) cm long, well exerted from the sheath, open; primary branches 5-9 cm long, erect to divaricate, naked at the base. Spikelets 1.8-3.3 cm long, with 4-12 florets; pedicels glabrous; first glume 1-nerved (rarely 2 nerved), glabrous to rarely sparsely hirtellous; lemmas 6-11 ($\bar{x} = 8.0$) mm long, shortly pilose on the margins and across the back between the nerves, occasionally on the margins only; lemma awns 1-4 mm long. Anthers 1.7-4.5 ($\bar{x} = 2.6$) mm long. $2n = 14$.

Habitat: Mountain scrub, oak and piñon/juniper woodlands, ponderosa parklands, aspen groves, mountain meadows and edges of coniferous forest, often in the shaded understory; 6800-11,000 ft (2100-3350 m) elevation, but mostly below 9200 ft (2800 m).

Wagnon (1950) named what he considered glabrous sheathed *Bromus lanatipes* as forma *glaber*. The type (New Mexico: Santa Fe Co.: Santa Fe Cañon, 9 miles east of Santa Fe, 8000 ft, 12 July 1897, A.A. & E. Gertrude Heller 3895, NY!), from mountain pine forests typical of *B. anomalus*, is indistinguishable from the latter species. *Bromus lanatipes* is unknown from Santa Fe County.

***Bromus ciliatus* Linnaeus FRINGED BROME, BROMO HIRSUTO. Figs. 5-7.**

Bromus ciliatus L., *Sp. Pl.* 1:76. 1753. *Bromus inermis* Leysser var. *ciliatus* (L.) Traut., *Acta Hort. Petrop.* 5:135. 1877. *Bromus hookeri* Fourn. var. *ciliatus* (L.) Fourn., *Mex. Pl.* 2:128. 1886. *Forasaccus ciliatus* (L.) Lunell, *Amer. Midl. Nat.* 4:225. 1915. *Zerna ciliata* (L.) Henrard, *Blumea* 4:498. 1941. *Bromopsis ciliata* (L.) Holub, *Folia Geobot. Phytotax.*, Praha, 8:167. 1973.

Bromus ciliatus L. forma *denudatus* Wiegand, *Rhodora* 24:91. 1922.
Bromus ciliatus L. var. *denudatus* (Wiegand) Fernald, *Rhodora* 28:20. 1926.

Bromus canadensis Michx., *Fl. Bor.-Amer.* 1:65. 1803. *Bromus hookeri* Fourn. var. *canadensis* (Michx.) Fourn., *Mex. Pl.* 2:128. 1886. *Bromopsis canadensis* (Michx.) Holub, *Folia Geobot. Phytotax.*, Praha, 8:167. 1973.

Bromus richardsonii Link, *Hort. Berol.* 2:28. 1833. *Bromopsis richardsonii* (Link) Holub, *Folia Geobot. Phytotax.*, Praha, 8:168. 1973.

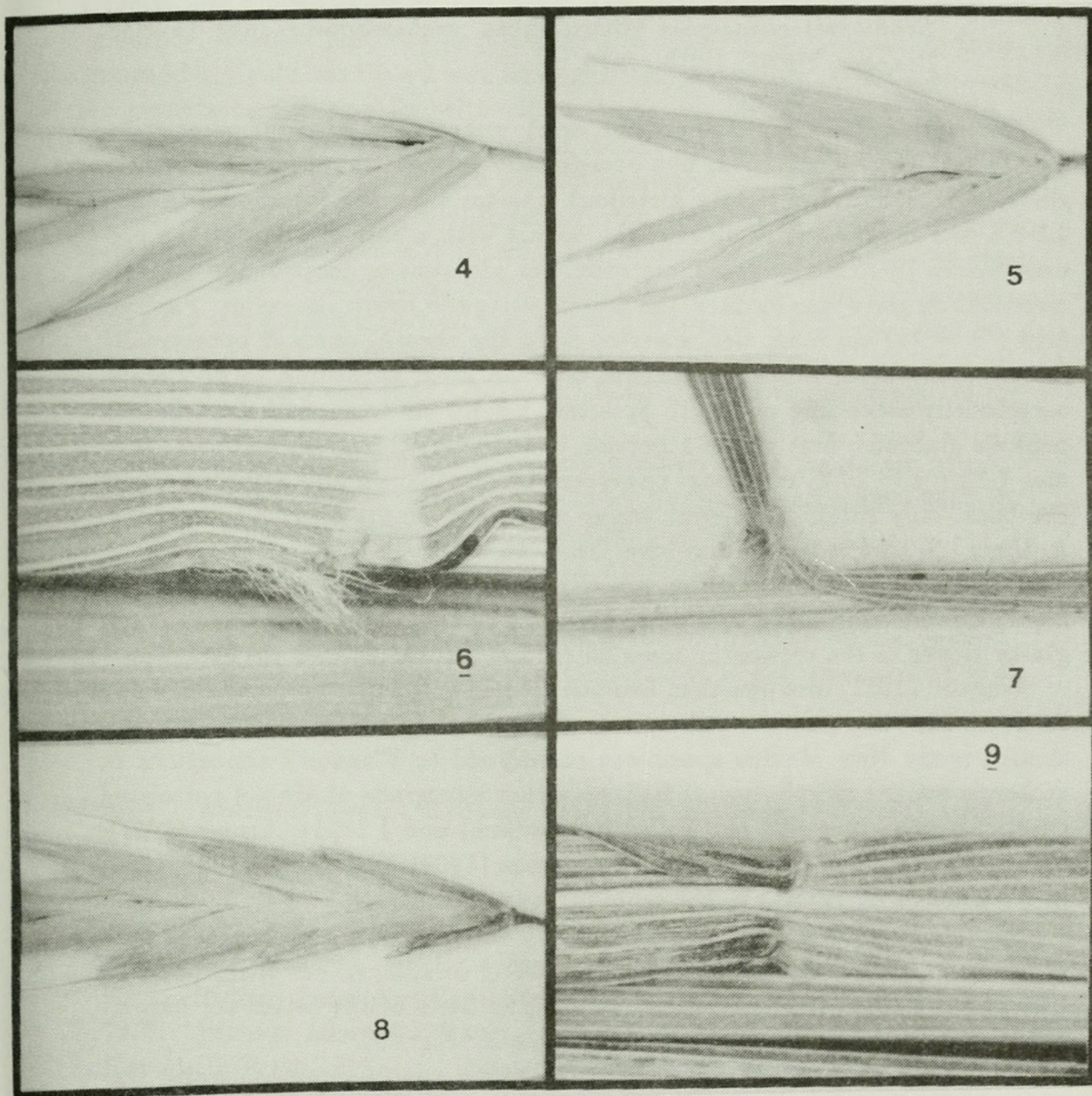


Figure 4. *Bromus anomalus*, spikelet ($\times 4.5$).

Figure 5. *Bromus ciliatus*, spikelet ($\times 4.7$).

Figure 6. *Bromus ciliatus* (glabrous foliage), ciliate collar ($\times 12$).

Figure 7. *Bromus ciliatus* (hairy foliage), ciliate collar ($\times 3$).

Figure 8. *Bromus frondosus*, spikelet ($\times 4.5$).

Figure 9. *Bromus frondosus*, collar, showing narrowed midrib ($\times 9.5$).

Bromopsis canadensis Michx. subsp. *richardsonii* (Link) Tzvelev,
Poaceae, URSS, 1:214. 1976.

Description: Culms 50-140 cm tall, erect, unbranched from the base; nodes mostly 4-7, mostly glabrous, but occasionally retrorsely pubescent. Sheaths glabrous to sometimes lightly hirtellous, shorter than the internodes; ligules 0.5-3.5 mm long; auricles absent, the collars with a tuft of hairs at the corners; blades 12-35 cm long, 3-9 mm wide, flat, glabrous or occasionally sparsely hirtellous on the upper surface, the midrib narrowed below the collar. Panicles 6-18 ($\bar{x} = 11$) cm long, well exerted from the sheath, open or occasionally loosely contracted; primary branches 6-12 cm long, spreading to divaricate, occasionally ascending or erect. Spikelets 1.8-4.0 cm long, with 5-14 florets; pedicels glabrous; first glume 1 nerved, occasionally 2 nerved, glabrous; lemmas 7-15 ($\bar{x} = 10.2$) mm long, pubescent on the margin and glabrous across the back, only rarely pubescent across the back; lemma awns 3-5 mm long. Anthers 1.2-2.8 ($\bar{x} = 1.7$) mm long. $2n = 14, 28$.

Habitat: Sparingly in oak or piñon/juniper woodlands, more common at higher elevations in piñon and ponderosa woodlands, mountain meadows, and grassy slopes in the spruce/fir zone; 6000-11,400 ft (1800-3500 m) elevation.

Wagon (1952) distinguished *Bromus ciliatus* and *B. richardsonii* by ploidy level, anther size, and the pubescence of the blades, collars, and nodes. Although many New Mexico specimens correspond to Wagon's concept of *B. richardsonii*, the morphological features either intergrade or are not correlated (particularly anther size and collar pubescence) and I follow Arnow (1987), Cronquist *et al.* (1977), Soderstrom & Beaman (1968), and Weber (1987, 1990) in recognizing *B. ciliatus* in the more inclusive sense.

Specimens of *Bromus ciliatus* with hairy sheaths have been confused with *B. lanatipes*. The hairs of the former are stiffly hirsute, rather sparse, and do not form a mat of tangled ends (Fig. 7). The hairs of the latter are densely pilose to lanate, forming a mat of tangled ends (Fig. 11).

I accept the neotypification of the well known epithet *Bromus ciliatus* Linnaeus by McNeill (1976), which obviates the use of *B. canadensis* Michaux for fringed brome (Baum 1967).

***Bromus frondosus* (Shear) Wooton & Standley** WEEPING BROME, BROMO FRONDOSO. Figs. 8-9.

Bromus porteri Nash var. *frondosus* Shear, USDA Div. Agrost. Bull. 23:37. 1900. *Bromus frondosus* (Shear) Woot. & Standl., New Mexico Exp. Sta. Bull. 81:144. 1912. *Bromopsis frondosa* (Shear) Holub, Folia Geobot. Phytotax., Praha 8:167. 1973.

Description: Culms 26-98 cm tall, erect, unbranched above the base; nodes 3-6, glabrous. Sheaths glabrous to puberulent or sparsely pilose, shorter than the internodes; ligule less than 1 mm long; auricles absent, the collars glabrous at the corners or occasionally with ciliate hairs; blades 9-22 cm long, 2.5-5.0 mm wide, flat or loosely folded, lax or loosely spreading, glabrous or the basal blades puberulent, the midrib usually narrowed below the collar. Panicles 7-28 ($\bar{x} = 15$) cm long, well exerted from the sheath, open to loosely contracted; primary branches 4-12 cm long, ascending to spreading or less commonly divaricate-reflexed. Spikelets mostly 2-3 cm long, with 5-12 florets; pedicels glabrous; glumes glabrous; first glume 3 nerved or rarely 1 or 2 nerved; lemmas 7-10 ($\bar{x} = 8.4$) mm long, pubescent across the back or on the margins only; lemma awns 2-5 mm long. Anthers 1.5-3.5 ($\bar{x} = 2.4$) mm long. $2n = 14$.

Habitat: Semidesert mountain scrub and riparian areas, mountain brush, oak/juniper and pine/oak woodlands, ponderosa/juniper forests; 4800-9400 ft (1500-2900 m) elevation, but mostly below 8100 ft (2500 m).

Bromus frondosus may grade into both *B. anomalus* and *B. ciliatus*. This is the least distinct of the five species treated here, and perhaps should be merged with one of the above. *Bromus porteri* is distinguished by its puberulent pedicels and glumes, erect blades, and a midrib that is not narrowed at the collar (compare Figs. 9 and 13).

***Bromus lanatipes* (Shear) Rydberg SHAGGY BROME, BROMO VEL-LUDO. Figs. 10-11.**

Bromus porteri Nash var. *lanatipes* Shear, USDA Div. Agrost. Bull. 23:37. 1900. *Bromus lanatipes* (Shear) Rydb., Colo. Exp. Sta. Bull. 100:52. 1906. *Bromus anomalus* Rupr. ex Fourn. var. *lanatipes* (Shear) A.S. Hitchc., J. Wash. Acad. Sci. 23:449. 1933. *Bromopsis lanatipes* (Shear) Holub, Folia Geobot. Phytotax., Praha 8:168. 1973.

Bromus mucroglumis Wagnon, Leaf. West. Bot. 6:67-68. 1950. *Bromopsis mucroglumis* (Wagnon) Holub, Folia Geobot. Phytotax., Praha, 8:168. 1973.

Description: Culms 35-85 cm tall, erect, unbranched above the base; nodes retrorsely puberulent or occasionally glabrous. Sheaths (especially the lower) lanate or sometimes only densely pilose, the hairs spreading but matted at the tips, often longer than the internodes except on very elongate culms; ligules 1-2 mm long; auricles absent, the collars ciliate to lanate at the corners; blades 10-30 cm long, (2-)3-7 mm wide, flat, glabrous, the midrib narrowed below the

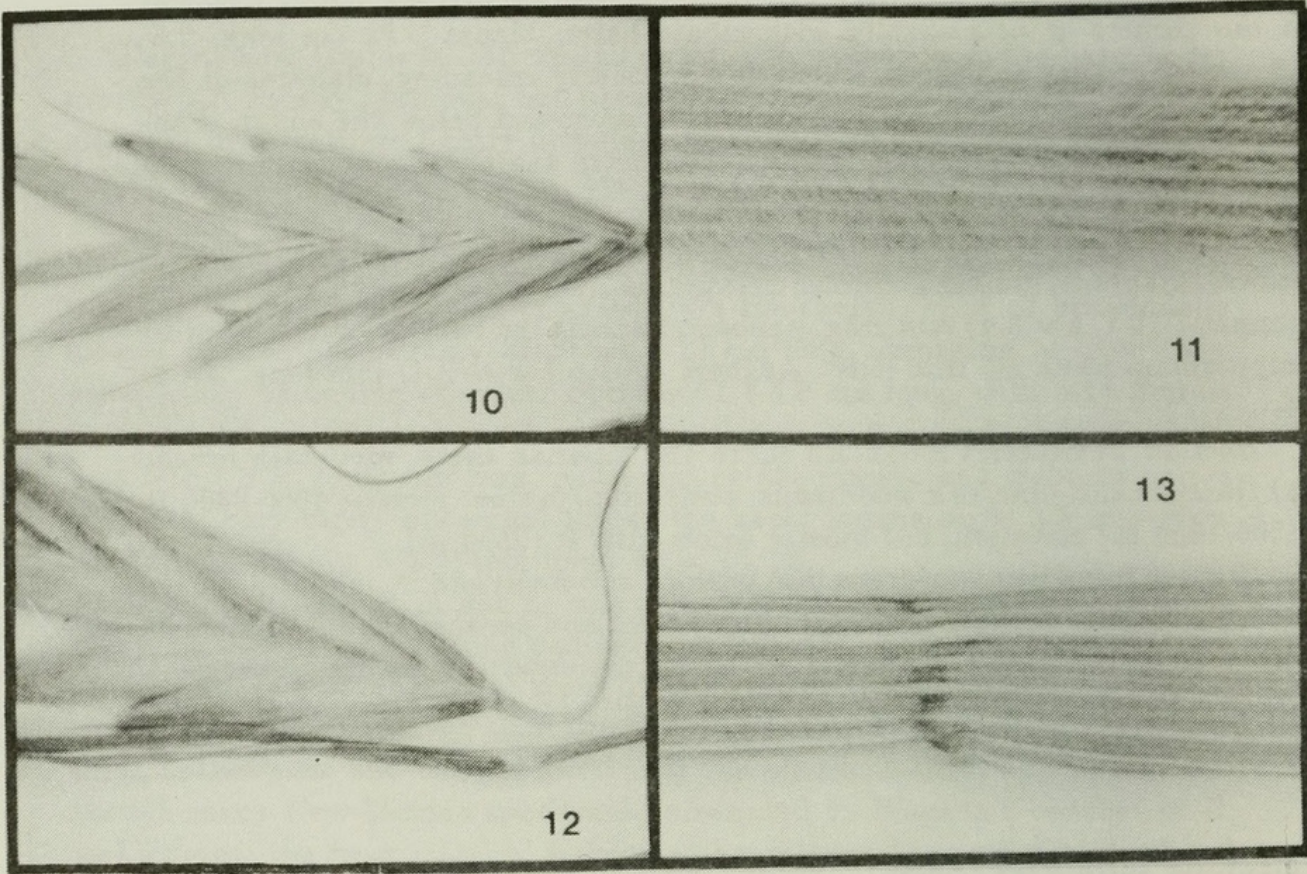


Figure 10. *Bromus lanatipes*, spikelet ($\times 4.6$).

Figure 11. *Bromus lanatipes*, sheath ($\times 10$).

Figure 12. *Bromus porteri*, spikelet & pedicels ($\times 4.2$).

Figure 13. *Bromus porteri*, collar, showing midrib not narrowed ($\times 10$).

collar. Panicles 5-15 ($\bar{x} = 11$) cm long, loosely contracted to somewhat open; primary branches 5-9 cm long, erect to ascending. Spikelets 1.5-3.0 cm long, with 5-14 florets; pedicels puberulent or rarely glabrous; glumes glabrous to sparsely pilose; first glume 1 nerved or rarely 3 nerved; lemmas 6-9 ($\bar{x} = 7.1$) mm long, pubescent across the back or occasionally on the margins only; lemma awns 2-4 mm long. Anthers 1.2-3.7 ($\bar{x} = 2.2$) mm long. $2n = 28$.

Habitat: Semidesert riparian areas and mountain brush, juniper plains and woodlands, piñon/juniper and juniper/oak woodlands; 5400-8800 ft (1600-2700 m) elevation.

Wagon (1950, 1952) based *Bromus mucroglumis* Wagon on pubescent sheaths and glumes, 1 nerved first glumes, mucronate second glumes, and lemmas pubescent across the back. For the most part, these features agree with *B. lanatipes*, or with disparate specimens of *B. anomalus* having hairy glumes. The type specimen of *B. mucroglumis* lacks any basal material, but the pubescence of the upper sheaths, glumes, and florets are consistent with *B. lanatipes*.

Bromus lanatipes forma *glaber* is subsumed under *B. anomalus*, q.v.

Other species, particularly *Bromus ciliatus*, may have hairy sheaths. The sheath pubescence of *B. lanatipes* is distinct, however, by being densely pilose or lanate with matted ends, rather than stiffly hirtellous (compare Figs. 7 & 11).

This is the least diverse of the species in terms of habitat and ecological amplitude. Most plants occupy relatively dry habitats in the piñon/juniper/oak zones between 6500 and 7600 ft (1900-2300 m).

***Bromus porteri* (Coulter) Nash** PORTER'S BROME, BROMO DE PORTER.
Figs. 12-13.

Bromus kalmii A. Gray var. *porteri* Coult., *Man. Bot. Rocky Mts. Reg.* 425. 1885. *Bromus ciliatus* L. var. *porteri* (Coult.) Rydb., *Contr. U.S. Nat. Herb.* 3:192. 1895. *Bromus porteri* (Coult.) Nash, *Bull. Torrey Bot. Club* 22:512. 1895. *Bromopsis porteri* (Coult.) Holub, *Folia Geobot. Phytotax.*, Praha 8:168. 1973.

Description: Culms 36-120 cm tall, erect, unbranched above the base; nodes 3-5, glabrous or retrorsely puberulent. Sheaths glabrous to puberulent, shorter or longer than the internodes; ligules 1-3 mm long; auricles absent, the collars glabrous at the corners; blades 10-36 cm long, 3-12 mm wide, mostly stiffly erect, the midrib not narrowed below the collar, glabrous. Panicles 7-15 ($\bar{x} = 11$) cm long, open or occasionally loosely congested; primary branches 4-10 cm long, ascending to loosely spreading, rarely divaricate. Spikelets 1.8-3.0 cm long, with 5-12 florets; pedicels puberulent; glumes puberulent; first

glume 3 nerved; lemmas 8-11 ($\bar{x} = 9.6$) mm long, pubescent across the back; lemma awns 1.5-4.0 mm long. Anthers 2.1-3.3 ($\bar{x} = 2.6$) mm long. $2n = 14$.

Habitat: Ponderosa parklands, aspen groves, mixed conifer forests, high mountain meadows, openings in spruce/fir forests; 6800-11,400 ft (2100-3500 m) elevation.

This is perhaps the most distinct species in this complex, with puberulent and 3 nerved glumes, puberulent pedicels, and stiffly erect blades. The glume and pedicel pubescence were highly correlated in the statistical analysis.

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The curators of NMC, UNM, and US generously made available their facilities and allowed me to borrow specimens. John Mosley helped with the data accumulation and analysis. Rex Pieper and Richard Spellenberg offered constructive comments on the manuscript. This paper is a contribution from the New Mexico Agricultural Experiment Station.

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SELECTED SPECIMENS EXAMINED

Bromus anomalus: BERNALILLO Co.: Mesa, north of Albuquerque, 24 Sep 1959, Caudill, M. 23 (UNM). CATRON Co.: Redstone Park, Trail 206, 4 Sep 1976, Spellenberg, R., J. Reitzel, D. Hill 4493 (NMC); Eagle Peak, 9750 ft (2972 m), 23 Jul 1986, Spellenberg, R., C. Barrera 8571 (NMC); Madre Mt, Blue Springs area, 10 Oct 1955, Potter, L.D. 105 (UNM); Mogollon Mts, Apache Spring, spruce forest, 10,000 ft (3048 m), 23 Aug 1968, Hess, W. 2275 (NMC); Mogollon Mts, Iron Creek Canyon, 7760 ft (2365 m), 21 Jul 1978, Moir, W.H. & E.L. Fitzhugh 310 (NMC). CIBOLA Co.: Rock ledge, Zuni Mts, 8640 ft (2633 m), 7 Sep 1968, Riffle, N.L. (UNM); La Mosca Lookout, Mt. Taylor, 11000 ft (3353 m), 27 Jul 1952, [no collector] 2707 (UNM). DONA ANA Co.: Filmore Canyon, Organ Mts, 23

Sep 1906, *Wooton, E.O. s.n.* (NMC); Filmore Canyon, Organ Mts, 20 Sep 1908, *Wooton, E.O., P. Standley s.n.* (NMC); Old Tiptop, Organ Mts, 18 Oct 1903, *Metcalf, O.B. s.n.* (NMC). GRANT Co.: Gallinas Campground along road from San Lorenzo to Hillsboro, 5 Aug 1988, *Allred, K.W. 4832* (NMCR); Mimbres Mts, McKnight Mt, 26 Sep 1987, *Allred, K.W. 4651* (NMCR). HARDING Co.: Spring, east side of Canadian River, 5500 ft (1676 m), 30 Jun 1981, *Fletcher, R. 5271* (UNM). HIDALGO Co.: Peloncillo Mts, along Geronimo Trail, 5 Sep 1987, *Allred, K.W. 4584* (NMCR). LINCOLN Co.: Sierra Blanca, 4.2 mi. W of Alto, 28 Aug 1976, *Wagner, W.L. & D. Sabo 2526* (UNM); White Mts, 7400 ft (2256 m), 25 Aug 1907, *Wooton E.O., Standley, P. 3568* (NMC). LOS ALAMOS Co.: Water Canyon, ponderosa-pinyon area, 6500 ft (1981 m), 31 Aug 1977, *Tierney G. & T. Fozz 36* (UNM); Frijoles Canyon, Bandelier Nat. Mon., 1 Aug 1941, *Clark, O.M. 9962* (UNM); Pajarito Canyon, 6750 ft (2057 m), 24 Jul 1979, *Fozz & Tierney 385* (UNM). RIO ARriba Co.: Gallinas Canyon, 9 Aug 1936, *Nisbet, G. 8268* (UNM). SAN JUAN Co.: Chaco Canyon National Monument, 29 May 1987, *Allred, K.W. 4392* (NMCR). SAN MIGUEL Co.: Panchuela Creek, 8500 ft (2591 m), 16 Jul 1908, *Standley, P.C. 4361* (NMC); Barillas Peak, mixed conifer, *Perry, J.L. 16* (UNM); Cowles, 4 mi. south, 16 Jul 1949, *Castetter & Dittmer 2706* (UNM). SANDOVAL Co.: Upper Las Huertas canyon, Sandia Mts, 24 Sep 1960, *Dixon, H.N. 159* (UNM); Las Huertas Creek road, Sandia Mts, 7000 ft (2134 m), 18 Sep 1982, *Dunbar, T. 338* (UNM). SIERRA Co.: Beaverhead, Taylor Creek, 7400 ft (2256 m), 14 Aug 1982, *Spellenberg R., R. Soreng, & R. Wahl 6599* (NMC); Timber Mt, Caballo Range, 20 Aug 1986, *Allred, K.W. 4216* (NMCR). SOCORRO Co.: Water Canyon, 16 Jul 1897, *Herrick, C.L. 744* (NMC); Mogollon Mts, Mogollon Creek, 8000 ft (2438 m), 26 Jul 1903, *Metcalf, O.B. 327* (NMC); Magdalena Mts, South Canyon, 8000 ft (2438 m), 28 Jul 1973, *Hutchins, B. 4582* (UNM); Magdalena Mts., Forest road 235, 9320 ft (2841 m), 21 Aug 1978, *Moir, W.H. & E.L. Fitzhugh 671* (NMC); Monica Ranger Station, pinyon-juniper, 7400 ft (2256 m), 11 Oct 1955, *Potter, L.D. 158* (UNM); Water Canyon, 16 Jul 1897, *Herrick, C.L. 742* (NMC); Water Canyon, 3 Sep 1964, *Powers, W.H. 14* (UNM). TAOS Co.: Red River Village, rocky hillside, 8600 ft (2621 m), 13 Aug 1955, *Castetter, E.L. 9826* (UNM); Red River, 11 Jun 1937, *Hare, Q.A. 1886* (NMCR); Costilla Canyon, spruce hillside, 18 Jul 1953, *Castetter, E.F. 8757* (NMC); Costilla Creek, Sangre De Cristo Mts, 8500 ft (2591 m), 15 Aug 1973, *Holmgren N.H. & P.K. Holmgren 7178* (UNM); Costilla Canyon, spruce hillside, 18 Jul 1953, [no collector] 2700 (UNM). TORRANCE Co.: Manzano Mts. between Bosque Peak and Tajique-Torreon loop road, 8800 ft (2682 m), 26 Aug 1963, *Bedker, E.J. 1410* (UNM).

Bromus ciliatus: BERNALILLO Co.: Kiwanis meadow, Sandia Mts, 10400 ft (3170 m), 23 Sep 1982, *Dunbar, T. 276* (UNM); Open meadow among spruce, Sandia crest, 10000 ft (3048 m), 3 Aug 1952, [no collector] 2705 (UNM); 7.2 mi. NW of Sandia park, dense douglas fir and aspen on limestone, 9450 ft (2880 m), 5 Aug 1949, *Gordon, S. & K. Norris 134* (UNM); Cienega Canyon, Sandia Mts, 30 Sep 1961, *Simms, H.R. 112* (UNM); Open forest meadows, west of road near tree springs, Sandia Mts, 8400 ft (2560 m), 30 Aug 1967, *Jones, C.B. 54-22* (UNM); Woods, Sandia Rim, 10500 ft (3200 m), 18 Sep 1932, *Castetter, E.F. 2709* (UNM); Cienega

Canyon, many trees, herbs, 7800 ft (2377 m), 30 Sep 1961, *Boyd, D.M. 12* (UNM); Hillside heavily forested with *Quercus*, *Juniperus*, *Pinus*, and *Pseudotsuga*, 3.3 mi. SW of Sandia Park, 8000 ft (2438 m), 8 May 1949, *Gordon, S. & K. Norris 109* (UNM); Kiwanis Meadow, Sandia Mts, 10400 ft (3170 m), 2 Aug 1982, *Dunbar, T. 157* (UNM). CATRON Co.: Mogollon Mts. Gilita Campground, 8100 ft (2469 m), 7 Sep 1978, *Moir, W.H. & E.L. Fitzhugh 713* (NMC); 40 mi NW of Pietown, 27 Aug 1936, *Parker, K.W. 1219* (NMCR); 20 mi NE of Reserve, 1939, *Bridges, J.O. 1486* (NMCR); Gila Natl. Forest, Mogollon Mts, Water Canyon, mixed conifer dry riparian, 17 Oct 1984, *Fletcher, R. 7925* (UNM); Gila Natl. For., Luna District, Rd 209, 1 mi NE of jct Rd 4 (Nolan Canyon Rd), 11 Sep 1982, *Allred, K.W. 2361* (NMCR); Trail Canyon, Apache Natl. Forest, 7400 ft (2256 m), 8 Aug 1960, *Reimers, M.A. 19* (UNM); Reserve on Eagle Peak, fir/aspen woods, 9750 ft (2972 m), 23 Jul 1986, *Spellenberg, R. & C. Barrera 8570* (NMC); 5 mi E of Mogollon, 7 Sep 1936, *Parker, K.W. 888* (NMCR); 20 mi S of Beaverhead, 21 Sep 1932, *Parker, K.W. 115* (NMCR); Datil Mts, volcanic soil, 9000 ft (2743 m), 19 Jul 1976, *Fletcher 634* (UNM). CIBOLA Co.: In aspen grove, Mt. Taylor, 10700 ft (3261 m), 22 Jul 1960, *Osborn, N. 422* (UNM); Horace Mesa, 20 mi NE Grants, 12 Sep 1933, *Parker, K.W. 429* (NMCR); W exposure above creek in Lobo Canyon, Mt. Taylor, 8100 ft (2469 m), 15 Jul 1960, *Osborn, N. 218* (UNM); Mt. Taylor, 10800 ft (3292 m), 22 Jul 1960, *Osborn, N. 398* (UNM); Upper Lobo Canyon, Mt. Taylor, 8500 ft (2591 m), 10 Aug 1960, *Osborn, N. 516* (UNM); Upper Lobo Canyon, road to Gooseberry Spring, Mt. Taylor, 8600 ft (2621 m), 25 Aug 1960, *Osborn, N. 606* (UNM); La Mosca Canyon, Mt. Taylor, 20 Jul 1961, *Osborn, N. 753* (UNM); In aspen grove, Mt. Taylor, 10700 ft (3261 m), 22 Jul 1960, *Osborn, N. 422* (UNM); Summit of Mt. Taylor, open area, 11389 ft (3471 m), 23 Jul 1960, *Osborn, N. 439* (UNM). COLFAX Co.: Johnson Mesa, Las Vegas District, Santa Fe Forest, Sandy loam, 22 Sep 1960, *Prichard, L.A. 12* (UNM); Potato Canyon; doug fir/ponderosa pine habitat, 10 Aug 1982, *Jepson, R. 1111* (UNM). DONA ANA Co.: Filmore Canyon, Organ Mts, 6700 ft (2042 m), 29 Oct 1904, *Wooton E.O.* (NMC). GRANT Co.: Hillsboro Peak, 10000 ft (3048 m), 25 Aug 1904, *Metcalfe, O.B. 1251* (NMC); Black Range, McKnight Road, 8700 ft (2652 m), 11 Aug 1978, *Moir, W.H. & E.L. Fitzhugh 638* (NMC); Black Range, near Mimbres Lake, 9600 ft (2926 m), 13 Aug 1978, *Moir, W.H. & E.L. Fitzhugh 646* (NMC); Gila Natl For, Hwy 90, Emory Pass vista, 2 Oct 1982, *Villalobos, M. 31* (NMCR); Hillsboro Peak, among spruce, shady slopes, 10000 ft (3048 m), 25 Aug 1904, *Metcalfe, O.B.* (UNM); Mimbres Mts, McKnight Mt, 26 Sep 1987, *Allred, K.W. 4657* (NMCR); Hillsboro Peak, among spruce, shady slopes, 10000 ft (3048 m), 25 Aug 1904, *Metcalfe, O.B. 1251* (UNM); Gallinas Campground along road from San Lorenzo to Hillsboro, 5 Aug 1988, *Allred, K.W. 4831* (NMCR); Mimbres Mts, McKnight Mt, 26 Sep 1987, *Allred, K.W. 4650* (NMCR). LINCOLN Co.: Lincoln Natl. For., For. Rd 108, 2 Sep 1983, *Allred, K.W. 2550* (NMCR); White Mt. Peak, 10000 ft (3048 m), 1 Aug 1901, *Wooton, E.O. s.n.* (NMC); About 10 mi N of Ruidoso on Sierra Blanca, *Sanchez, J.R. s.n.* (NMCR); Gravel loam of Monjeau Peak, White Mts, south slope, 9641 ft (2939 m), 26 Oct 1968, *Hutchins, B. 1755* (UNM); White Mountains, mountain north of Sierra Blanca Ski Lodge, 9 Oct 1987, *Allred, K.W. 4662* (NMCR); Ruidoso Creek, 3 mi up from Ruidoso, 21 Jul 1935, *Parker, K.W.*

612 (NMCR); Gilmore's Ranch, Eagle Creek, White Mts, 7000 ft (2134 m), 14 Jul 1895, *Wooton, E.O.* (UNM); Sierra Blanca ski area, 11300 ft (3444 m), 7 Aug 1977, *Haggren, W.* 440 (UNM); Gravel loam of east slope in the White Mts, 7950 ft (2423 m), 30 Jun 1969, *Hutchins, B.* 2117 (UNM); Gravel loam of east slope, White Mts, 7950 ft (2423 m), 30 Jun 1969, *Hutchins, B.* 2117 (UNM); Sierra Blanca Ski Area, 9000 ft (2743 m), 9 Jul 1977, *Haggren, W.* 311 (UNM); 4 mi off of Timberon Rd on Old Sun Spot Rd, 8 Sep 1979, *Whitmore, K.* 13 (NMCR); Gilmore Ranch, White Mts, 17 Aug 1908, *Wooton, E.O. s.n.* (NMC); White Mts, 7400 ft (2256 m), 25 Aug 1907, *Wooton E.O. & P. Standley* 3570 (NMC); Sierra Blanca Ski Area, 11,300 ft (3444 m), 8 Jul 1977, *Manthey, T. & W. Haggren* 1993 (UNM); Sierra Blanca ski area, 10000 ft (3048 m), 7 Aug 1977, *Haggren, W.* 403 (UNM). LOS ALAMOS Co.: Pajarito Mts. Mixed conifer, 8250 ft (2515 m), [no collector] 636 (UNM); Bottom Frijoles Canyon, Bandelier Natl. Monument, 1 Aug 1941, *Clark, M.O.* 9963 (UNM); Shady bottoms at Frijoles Canyon, 6000 ft (1829 m), 1 Aug 1941, *Clark, O.M.* 9963 (UNM); In spruce-fir S. of Upper Frijoles Meadow, 9600 ft (2926 m), 18 Aug 1982, *Dunbar, T.* 244 (UNM); Frijoles Canyon Campground, 6000 ft (1829 m), 23 Sep 1939, *Thomas, C.G.* 10 (UNM); Upper Frijoles meadow, 9600 ft (2926 m), 18 Aug 1982, *Dunbar, T.* 222 (UNM). MCKINLEY Co.: Westfork Peach Spring Canyon, Sandstone, 6700 ft (2042 m), 10 Sep 1976, *Wagner, W.L.* 2627 (UNM); Dalton Pass Canyon, upper mesa, 7400 ft (2256 m), 29 Jul 1976, *Marley, G.* 89 (UNM); Along bottom of Dalton Pass Canyon, pinyon and Douglas-fir, 2400 ft (732 m), 31 Jul 1976, *Powell, R.* 139 (UNM); 7 mi. S of Washington Pass, 8800 ft (2682 m), 3 Aug 1958, *McKnight, A.* (UNM-58080309). OTERO Co.: in the Lincoln Natl. For., 7 mi SW of High Rolls, 29 Aug 1939, , *Bridges, J.O.* 1513 (NMCR); Hwy 24, 1/2 mi S of jct hwy 130, 8 Sep 1979, *Allred, K.W.* 1705 (NMCR); 4 mi E of Cloudcroft, 9000 ft, 25 Sep 1938, *Bridges, J.O. s.n.* (NMCR); Cloudcroft, Sacramento Mts, 8750 ft (2667 m), 24 Aug 1901, *Wooton, E.O. s.n.* (NMC); Karr Canyon, Sacramento Mts, 3 Aug 1952, *Swallen, J.R.* 2704 (UNM). RIO ARRIBA Co.: San Pedro Mts, Santa Fe Natl. Forest, San Gregorio Lake, 9400 ft (2865 m), 19 Sep 1964, *Jennings, D.T. s.n.* (UNM); 2 mi. S of Lake San Gregorio, 25 Jul 1965, *Fleck, A. s.n.* (UNM); S. branch Paleo Creek, San Pedro Park's wild area, 9800 ft (2987 m), 12 Jul 1964, *Fleck, A.* 54 (UNM); Vega Redondo Road, E. of forest sign, 12 Aug 1965, *Fleck, A. s.n.* (UNM); San Gregorio, 19 Sep 1964, *Fleck, A. s.n.* (UNM); Cochiti, NE slope, 19 Apr 1964, *Robertson, C.* 7 (UNM); Bare dry hillside, La Cueva, Jemez Mountains, 11 Aug 1931, [no collector] 2715 (UNM); Carson National Forest, just off of hwy 64, about 12 air miles west of Tres Piedras, 7 Sep 1988, *Allred, K.W.* 4855 (NMCR); San Pedro Mts. near San Gregorio Lake, 9400 ft (2865 m), 19 Sep 1964, *Fleck A.* (UNM). SAN MIGUEL Co.: Harvey's upper ranch, 9600 ft (2926 m), 1 Aug 1908, *Standley, P.C.* 4737 (NMC); West Panchuela R.S., Santa Fe Natl. For., 29 Aug 1937, *Hare, Q.A. s.n.* (NMCR); Meadows along Winsor Creek, Cowles, 8500 ft (2591 m), 8 Sep 1954, *Castetter, E.F.* 9422 (UNM); Pecos Wilderness, Forest Rds 645 & 156, between Terrero Mine and summit of Elk Mt, Santa Fe Mts, 19 Aug 1984, *Hill, S.R.* 15248 (NMCR); Jack's Creek, 5 mi above Cowles, Jul 1938, *Bridges, J.O.* 1425 (NMCR); Roadside at Cowles, 25 Aug 1946, *Springfield, W.* 2705 (UNM); Sandstone escarpment, Trujillo Hill, 30 mi. E. of Las Vegas, 1 Sep 1955, *Swallen,*

J.R. 10193 (UNM). SANDOVAL Co.: Sandy outwash near Paliza Creek, 3 mi. N. Ponderosa, 7000 ft (2134 m), 22 Jun 1960, *Martin, W.C. 4205* (UNM); Jemez Biological Camp, Jemez Mts., 7100 ft (2164 m), 25 Aug 1931, *Castetter, E.F. 2720, 2722* (UNM); Alamo Canyon, Bandelier Natl. Monument, 6100 ft (1859 m), 31 Aug 1975, *Halley, R. 75* (UNM); Bandelier Natl. Monument, Capulin Canyon Trail, 1/4 mi N of Base Camp, 3 Jul 1983, *Salazar, R.A. 21* (NMCR); Among large spruce and corkbark fir, on medium to deep soil on limestone, 10500 ft (3200 m), 7 Aug 1963, *Naylor, J. 148* (UNM); Bandelier Natl. Monument, 1977 Acquisition, 10 mi NW of Bandelier Natl. Monument entrance station, along Rd 4 at S side of hwy, 10 Aug 1983, *Salazar, R.A. 49* (NMCR). SANTA FE Co.: Chupadero Canyon, Oak zone, 9600 ft (2926 m), 25 Jul 1961, *Dixon, C.K. 183* (UNM); Arroyo Hondo, Santa Fe Forest, gravel woodland, 7100 ft (2164 m), 10 Sep 1960, *Stephenson, J.E. 30* (UNM); North Fork Tesuque Creek, 10920 ft (3328 m), 18 Aug 1973, *Moir, W.H. 228* (NMC). SIERRA Co.: San Mateo Mts., Barney Park, 8020 ft (2444 m), 23 Aug 1978, *Moir, W.H. & E.L. Fitzhugh 681* (NMC); Gallinas Planting Station, July 1908, *Standley, P.C.* (NMC). SOCORRO Co.: Milo Canyon, San Mateo Mts, 8900 ft (2713 m), 27 Aug 1979, *Moir, W.H. & E.L. Fitzhugh s.n.* (NMC); Milo Canyon, San Mateo Mts, 8630 ft (2630 m), 27 Aug 1978, *Moir, W.H. & E.L. Fitzhugh 749* (NMC); Abandoned mine near the end of the road in a canyon 5-6 mi. S of Magdalena, 8000 ft (2438 m), 3 Oct 1948, *Dunn, D. 5116* (UNM); Magdalena Mts. East slope of Water Canyon, 8000 ft (2438 m), 10 Sep 1959, *Martin, W.C. 3660* (UNM); Roadside among aspens, north slope of Mt. Withington, 9600 ft (2926 m), 11 Jul 1952, *Castetter, E.F. 2710* (UNM); Willow Creek, 7 Sep 1936, *Parker, K.W. 882* (NMCR); Magdalena Mts, Water Canyon, open grassland, 8000 ft (2438 m), 3 Oct 1964, *Vickery, L. 13* (UNM); Roadside among aspens, north slope of Mt. Withington, 9600 ft (2926 m), 11 Jul 1952, *Castetter, E.F. 2708* (UNM); Water Canyon, Magdalena, Summer 1897, *Wootton, E.O. 332* (UNM); 2 mi. W of Rosedale in a clearing on the forest floor, 7750 ft (2362 m), 28 Aug 1948, *Dunn & Lint 4676* (UNM). TAOS Co.: Cabresto Creek Canyon, 9350 ft (2850 m), 21 Jul 1973, *Moir, W.H. 98* (NMC); Carson Forest, Aug 1960, *Engstrom, G.E. 3* (UNM); Costilla Creek, Sangre de Cristo Mts, 8500 ft (2591 m), 15 Aug 1973, *Holmgren, N.H. & P.K. Holmgren 7178* (NMC); Sangre de Cristo Mts, Carson Natl. Forest, Frazier Mt, July 1989, *Warren, A. s.n.* (NMCR); Carson Forest, 29 Aug 1960, *Blanchard, R.L. 29* (UNM); Sangre de Cristo Range, rocky slopes, 6 Jul 1966, *Weeks, M.C. 15* (UNM); Creek bottoms, east of Questa, 8 Aug 1951, *Clark, M. s.n.* (UNM). TORRANCE Co.: Manzano Mts, Kaiser Mill Canyon, mixed hardwood conifer assoc, 8400 ft (2560 m), 18 Aug 1962, *Bedker, E.J. 589* (UNM); Manzano Mts. Red Canyon W. of Red Canyon Camp, 8000 ft (2438 m), *Bedker, E.J. 1286* (UNM); Manzano Mts, lower 1 mi. part of De La Vereda Canyon, 7600 ft (2316 m), 28 Jul 1962, *Bedker, E.J. 248* (UNM); Manzano Mts, along crest 1/2 mi. N of Manzano Creek, conifer assoc., 9900 ft (3018 m), 18 Aug 1962, *Bedker, E.J. 706* (UNM).

Bromus frondosus: BERNALILLO Co.: Albuquerque ECW District, 8000 ft (2438 m), 11 Nov 1936, *Greenwall 157* (UNM). CATRON Co.: Middle Fork Gila River, Mogollon Mts, 7120 ft (2170 m), 10 Sep 1978, *Moir, W.H. & E.L. Fitzhugh 590* (NMC); Gila Natl. For., Luna District, For Rd 19, about 2 mi N of Luna,

11 Sep 1982, *Allred, K.W. 2332, 2372* (NMCR); 40 mi NW of Pietown, 27 Aug 1936, *Parker, K.W. 852, 853* (NMCR); Snow Lake Road, junction with Reserve-Beaverhead road, Mogollon Mts, 8400 ft (2560 m), 8 Sep 1978, *Moir, W.H. & E.L. Fitzhugh 715* (NMC); Datil Mts, sandy arroyos, 7600 ft (2316 m), 10 Jul 1976, *Fletcher 463* (UNM). CIBOLA Co.: Zuni Mts, 7800 ft (2377 m), 17 Aug 1968, *Riffle, N.L. s.n.* (UNM); Mt. Taylor, La Mosca Lookout, 19 Jul 1961, *Osborn, N. 695* (UNM). DONA ANA Co.: Craters, 6000 ft (1829 m), 28 Jul 1906, *Wooton, E.O. s.n.* (NMC); Filmore Canyon, Organ Mts, 23 Sep 1906, *Wooton, E.O. s.n.* (NMC); E side of Organ Mts on the College area, 29 Jul 1940, *Bridges, J.O. 1558* (NMCR); Indian Hollow, N end of Organ Mts, 28 Sep 1935, *Anderson, S.E. 94* (NMCR); Dripping Springs, Boyd ranch, Organ Mts, 6000 ft (1829 m), 21 Oct 1950, *Dunn, D.B. 7231* (UNM); Box Canyon off Soledad, 11 Sep 1904, *Wooton, E.O. s.n.* (NMC); Organ Mts, 6000 ft (1829 m), 23 Sep 1906, *Wooton E.O. & P. Standley s.n.* (NMC). EDDY Co.: Guadalupe Ridge near large cave, 7200 ft (2195 m), 14 Sep 1916, *Chapline, W.R. 692* (NMC). GRANT Co.: along road from San Lorenzo to Hillsboro, about 5 miles east of San Lorenzo, 5 Aug 1988, *Allred, K.W. 4806* (NMCR); Kneeling Nun, 1/4 mi. E of Mimbres Mts, 7 Sep 1985, *Spellenberg R., N. Zucker, & R. Soreng 8288* (NMC); Gila National Forest, Hwy 90 roadside, 6000 ft (1829 m), 8 Aug 1976, *Wagner, W.L. 2342* (UNM). HIDALGO Co.: Post Office Canyon SE of Rodeo, 5600 ft (1707 m), 12 Sep 1977, *Moir, W.H. 707* (NMC); Animas Mts, Lower Indian Creek Canyon, 5750 ft (1752.6 m), 22 Jul 1975, *Wagner, W. 1163* (UNM); West Fork Indian Creek Canyon, Animas Mts, 7000 ft (2134 m), 6 Aug 1976, *Wagner, W.L. 2263* (NMC); Animas Mts, Lower Indian Creek Canyon, 5800 ft (1767 m), 6 Aug 1976, *Wagner, W.L. 2245* (UNM); Cloverdale, at intersection of roads, 6 Aug 1987, *Sherman, J. s.n.* (NMCR); Peloncillo Mts, along Geronimo Trail, 5 Sep 1987, *Allred, K.W. 4580* (NMCR); Peloncillo Mts, Coronado National Forest, Skeleton Canyon, about 1/4 mile east of Arizona state line, 15 Sep 1989, *Allred, K.W. 5029* (NMCR); Gray Ranch, east slopes of Animas Mt, unknown canyon bottom, 26 Oct 1990, *Allred, K.W. 5182* (NMCR); Clanton Draw, Coronado Natl. For. near the entrance to forest lands, 5 Sep 1987, *Allred, K.W. 4575* (NMCR); Guadalupe Canyon, Guadalupe Mts, 22 Aug 1956, *Castetter, E.F. 11215* (UNM); Peloncillo Mts, Coronado Natl. Forest, Clanton Draw, 19 Aug 1986, *Allred, K.W. 4168, 4169, 4175* (NMCR); Peloncillo Mts, along Geronimo Trail, 5 Sep 1987, *Allred, K.W. 4581* (NMCR). LINCOLN Co.: Lincoln Natl. For., Forest Rd 108, 2 Sep 1983, *Allred, K.W. 2557* (NMCR). LOS ALAMOS Co.: Water Canyon, Pistol Range, 6500 ft (1981 m), 11 Jun 1978, *Fox & Tierney 21* (UNM). MORA Co.: Sapello, 2 mi. north, 22 Sep 1954, *Williams, E. 9424* (UNM). OTERO Co.: Karr Canyon, Sacramento Mts, 3 Aug 1952, *Castetter, E.F. 8364* (NMC); Between Weed and Sacramento, 12 Aug 1970, *Correll D.S. & H.B. Correll 39232* (NMC); White Mts, South Fork Eagle Creek, 31 Jul 1897, *Wooton, E.O. s.n.* (UNM); Mayhill, Lincoln Forest Experimental Area, 6800 ft (2072 m), Oct 1960, *Hoyer, R.C. 27* (UNM). RIO ARRIBA Co.: Carson National Forest, *Brown, D. s.n.* (UNM); Santa Fe National Forest, Jarosa, 9000 ft (2743 m), 25 Aug 1960, *Romero, E. 22* (UNM). SAN MIGUEL Co.: near Cowles, 3 Aug 1938, *Mocho, P. 1746* (NMCR). SANDOVAL Co.: Jemez Mts, Monument Canyon, ponderosa

pine, 8200 ft (2499 m), 22 Sep 1983, *Fletcher, R. 7455* (UNM). SOCORRO Co.: Rosedale, 2 mi. west, 7750 ft (2362 m), 29 Aug 1948, *Dunn, D. & Lint 4743* (UNM); Rosedale Rd. & hwy. 107, 5 mi. north in rocky gorge, 29 Aug 1948, *Dunn D. s.n.* (UNM); South of Magdalena along stream bed, 7500 ft (2286 m), 10 Mar 1948, *Dunn, D. 5147* (UNM); Mogollon Creek, Mogollon Mts, 8000 ft (2438 m), 27 Jul 1903, *Metcalf, O.B. 325* (NMC); Rosedale, abandoned gold mine, open forest and meadow, 7200 ft (2195 m), 29 Aug 1948, *Dunn, D. 4748* (UNM); Magdalena Mts, dry stream in South Canyon, 6800 ft (2073 m), 25 Aug 1973, *Hutchins, B. 4650* (UNM); Forest Road 330, San Mateo Mts, 9330 ft (2844 m), 27 Aug 1978, *Moir W.H. & E.L. Fitzhugh 700* (NMC); 5 mi W of Willow Creek, 8 Sep 1936, *Parker, K.W. 884* (NMCR); Magdalena Mts, ridge between Timber Peak and South Baldy, 9000 ft (2743 m), 11 Sep 1959, *Martin, W.C. 3717* (UNM); Milo Canyon, San Mateo Mts, 8780 ft (2676 m), 27 Aug 1978, *Moir W.H. & E.L. Fitzhugh 748* (NMC).

Bromus lanatipes: BERNALILLO Co.: Sandia Park, Sandia Peak, 7575 ft (2309 m), 5 Aug 1949, *Gordon, S. & K. Norris 21, 65* (UNM); Sandia Mts, 24 Sep 1897, *Herrick, C.L. s.n.* (NMC); South of Sedillo Hill, 7300 ft (2225 m), 10 Oct 1980, *Fletcher, R. 5147* (UNM). CATRON Co.: Rocks along arroyo 4 mi. SW of Datil on Route 12, 6 Aug 1952, *Roller, J.W. & E.F. Castetter 2699* (UNM); Datil Mountains, volcanic soil, 8500 ft (2591 m), 18 Sep 1976, *Fletcher, R. 1618* (UNM). CIBOLA Co.: Base of cliff, Canyon de Calafia, 7700 ft (2347 m), 24 Sep 1977, *Marley, G.A. 862* (UNM); Inscription Rock Natl. Mon. at base of cliff, 26 Aug 1936, *Parker, K.W. 839* (NMCR); 3 mi N of Datil, Sep 1939, *Bridges, J.O. 1732* (NMCR); El Morro Natl. Monument, Sandfilled cracks on Inscription Rock, 7200 ft (2195 m), 27 Sep 1980, *McCallum, D.A. 938* (UNM); El Morro National Monument, under ponderosa, 7200 ft (2195 m), 30 Oct 1980, *McCallum, D.A. 967* (UNM); Zuni Canyon, Zuni Mts, 7400 ft (2256 m), 10 Aug 1968, *Riffle, N.L. s.n.* (UNM); Craters, 28 Jul 1906, *Wooton, E.O. s.n.* (NMC); Inscription Rock, 7000 ft (2134 m), 27 Aug 1936, *Gardner, J.L.* (NMC); Grants Lava Flow, growing in damp depression with shrubs, 7000 ft (2134 m), 27 Jul 1986, *DeBruin, E. 449* (UNM). COLFAX Co.: 15 mi SE of Cimarron on Vallejo Ranch, 6 Oct 1977, *Gould, F.W. 15325* (NMCR). DONA ANA Co.: V. Pasture, 23 Jul 1905, *Wooton, E.O. s.n.* (NMC); Dripping Springs, Organ Mts, 29 Sep 1935, *Parker, K.W. 725* (NMCR). HIDALGO Co.: SE of Rodeo, Owl Canyon, 5500 ft (1676 m), 9 Aug 1977, *Moir, W.H. 774* (NMC); Animas Mtns, Upper Indian Creek Canyon, 7000 ft (2134 m), 4 Oct 1975, *Wagner, W. 1721* (UNM); Mexican Springs upper area, 7500 ft (2286 m), 28 Aug 1936, *Gardner, J.L. s.n.* (NMC); Animas Mtns, Upper Indian Creek Canyon, 6300 ft (1920 m), 13 Sep 1975, *Wagner, W. 1541* (UNM); Peloncillo Mts, Cloverdale Creek, public land southeast of Pendleton Ranch, Forest Service cabin, 6 Aug 1987, *Sherman, J. s.n.* (NMCR). LINCOLN Co.: Fort Stanton, E pasture (ungrazed section), 12 Sep 1980, *Lebgue 396* (NMCR); White Mts. NW slope, gravel loam, 7200 ft (2195 m), 24 Oct 1969, *Hutchins, B. 2703* (UNM); Gray, 6250 ft (1905 m), July 1900, *Earle, F.S. & E.S. Earle 162* (NMC); White Mts. North Fork of Eagle Creek, partial shade, 8800 ft (2682 m), 22 Jul 1981, *Ward, D. 81-22* (NMC); Capitan Mts, douglas fir-ponderosa pine-white fir, 2300 m, 1 Aug 1976, *Wagner, W.L. & D. Sabo 2169* (UNM). LUNA Co.: along bank of drainage on slope of Cooke's Peak, 29 Aug 1987, *Columbus, J.T.*

1712 (NMCR); along small stream in bottom of Rattlesnake Canyon; near small metal watertank, 21 Aug 1987, *Columbus, J.T. 1583* (NMCR); Just below ridgetop at base of large wall-like rock outcrop some 15 ft tall, 30 Jul 1986, *Columbus, J.T. 344* (NMCR). MCKINLEY Co.: Mountain Valley Navajo Experiment Station, 7500 ft (2286 m), 28 Aug 1936, *Gardner s.n.* (NMC); Upper Dalton Pass Mesa, sandy soil among rocks at canyon edge, 7400 ft (2256 m), August 1976, *Marley, G. 129* (UNM); Head of Running Edge Canyon, 7200 ft (2195 m), 24 Jul 1976, *Powell, R. 127, 129* (UNM); Dalton Canyon, surrounding disturbed drill site, sand and sandstone, pinyon-juniper and *Cowania*, 7200 ft (2195 m), 31 Jul 1976, *Powell, R. 140* (UNM); Burning Bridge Wash, 4 mi. SW of Pueblo Pintado Trading Post, 6700 ft (2042 m), 10 Aug 1976, *Spellenberg, R., J. Reitzel, & H. McKinney 4321* (NMC). OTERO Co.: Mayhill, 27 Oct 1936, *Goodding, L.N. & E.W. Hardies 867* (NMC). QUAY Co.: Mosquero, 20 mi. west, 28 Jul 1942, *Bradford, H.W. s.n.* (NMC). SAN MIGUEL Co.: Mesita de Los Ladrones, sandstone rim, lower end of pinyon-juniper, 16 Sep 1982, *Fletcher, R. 6773* (UNM). SANDOVAL Co.: Lower Jemez Canyon roadside, Jemez Mts, 7500 ft (2286 m), 12 Aug 1931, *Castetter, E.F. 2716* (UNM). SIERRA Co.: North Percha Creek, 6000 ft (1829 m), 12 Aug 1904, *Metcalf, O.B. 1131* (NMC, UNM). SOCORRO Co.: 6 Mile Canyon, 14 Aug 1949, *Fleetwood, R.J. 9710* (UNM); Ladron Mts. along Canyon del Alamito, arroyo, 6800 ft (2073 m), 15 Aug 1965, *Baca, O. 275* (UNM); Water Canyon, E of South Baldy Peak, 8300 ft (2530 m), 12 Oct 1955, *Potter, L.D. 239* (UNM); Magdalena Mts, Water Canyon, 3 mi from mouth, 10 Jul 1940, *Bridges, J.O. 1656* (NMCR); Vicinity of Water Canyon, Magdalena Mtns, 7475 ft (2278 m), 27 Jul 1973, *Hutchins, B. 4310, 4436, 4512, 4528* (UNM); Gravel loam of stream area in South Canyon, Magdalena Mts, 8000 ft (2438 m), 28 Jul 1973, *Hutchins, B. 4602* (UNM); Ladron, in ponderosa stand at head of Canyon del Norte, 6850 ft (2088 m), 2 Oct 1975, *Manthey, T. 670* (UNM); Grand Cañon, East Fork of Gila, 6000 ft (1829 m), 19 Aug 1900, *Wooton, E.O. s.n.* (NMC); Gravel loam of dry stream area, South Canyon, Magdalena Mts, 6800 ft (2073 m), 25 Aug 1973, *Hutchins, B. 4648* (UNM). TAOS Co.: 2 mi. E of Valdez, riparian habitat, 22 Aug 1966, *Robinson & McLean 40* (UNM); Huerfano, south facing fields, 8500 ft (2591 m), 8 Jul 1967, *Mackay, H. 5-23* (UNM); Rich soil, disturbed, grazed, Kit Carson State Park, 6952 ft (2119 m), Nov 1966, *Jones, C.B. 54-11* (UNM). TORRANCE Co.: Manzano Mtns, Priest Canyon, pinyon-juniper association, 7000 ft (2134 m), 1 Sep 1963, *Bedker, E.J. 1439* (UNM).

Bromus porteri: BERNALILLO Co.: Sandia Crest, 20 Jul 1936, *Carter, C.B. s.n.* (NMC). CATRON Co.: Apache National Forest, 14 Oct 1960, *Bilbrey, D. 27* (UNM); 5 mi S of Mogollon, 7 Sep 1936, *Parker, K.W. 973* (NMCR); Datil Mts, sandstone soil, 7300 ft (2225 m), 10 Aug 1976, *Fletcher 936* (UNM); Datil Mts, volcanic soil, bog area, 8000 ft (2438 m), 10 Jul 1976, *Fletcher 540* (UNM); Apache National Forest, 19 Aug 1960, *Laney, V.F. 19* (UNM); Datil Mts, volcanic soil, bog area, 8000 ft (2438 m), 10 Jul 1976, *Fletcher 540* (UNM); Gila Natl. For., Flannagan Cienega, For Rd 220, 11 Sep 1982, *Allred, K.W. 2347* (NMCR). CIBOLA Co.: Just below Mt. Taylor Peak, 11000 ft (3353 m), 18 Aug 1961, *Osborn, N. 893* (UNM); Mt. Taylor, 22 Aug 1965, *Barnett, L. 13* (UNM); Pescado Spa, 2 Aug 1892, *Wooton, E.O. s.n.* (NMC); Just below Mt. Taylor Peak, 11000 ft (3353 m), 10 Aug 1960,

Osborn, N. 512 (UNM); North of Ramah, 25 Jul 1906, *Wootton*, E.O. s.n. (NMC). GRANT Co.: Gila Natl. For., hwy 90, Emory Pass vista, 2 Oct 1982, *Gallegos*, M. 32 (NMCR); Graveyard at Kingston, *Bridges*, J.O. 1919 (NMCR). LINCOLN Co.: Lincoln Natl. For., For Rd 108, 2 Sep 1983, *Allred*, K.W. 2553 (NMCR); White Mountains, mountain north of Sierra Blanca Ski Lodge, 9 Oct 1987, *Allred*, K.W. 4663 (NMCR); Skyline Picnic Area, White Mts, 9000 ft (2743 m), 26 Oct 1968, *Hutchins*, B. 1759 (UNM). LOS ALAMOS Co.: Upper Frijoles Meadow, 9600 ft (2926 m), 19 Jul 1982, *Dunbar*, T. 102 (UNM); White Rock in Pajarito Canyon, juniper-grassland, 29 Aug 1979, *Fox & Tierney* 635 (UNM). MORA Co.: [no locality], 11360 ft (3463 m), August 1982, *Andrews*, T. 133 (UNM). OTERO Co.: Gilmore Ranch, Eagle Creek, White Mts, 12 Aug 1897, *Wootton*, E.O. 3321 (UNM); Monjeau Lookout, Sierra Blanca, 10000 ft (3048 m), 17 Aug 1952, [no collector] 2698 (UNM). RIO ARriba Co.: 3 mi NW of Chama (private land), 22 Aug 1940, *Bridges*, J.O. 2149 (NMCR); El Vado Dam, 14 Jun 1936, *Carter*, C.B. s.n. (NMC); Carson National Forest, 24 Jul 1960, *Hutt*, J.F. 27 (UNM); Carson National Forest, 12 Jul 1960, *Eby*, J.W. 17 (UNM). SAN JUAN Co.: Whiskey Lake, Chuska Mts, 8600 ft (2621.28 m), August 1934, *Shirley*, W.D. 21 (NMC); Crystal, western flanks of Chuska Mts, ponderosa pines, 8000 ft (2438 m), 30 Jul 1958, *McKnight*, A. s.n. (UNM); Whiskey Lake Region, Chuska Mts, 8500 ft (2590.8 m), 22 Jul 1935, *Carter*, C.B. 8244 (NMC). SAN MIGUEL Co.: Harvey's Upper Ranch, 9600 ft (2926 m), 1 Aug 1908, [no collector] 4738 (NMC); Panchuela Creek, 8800 ft (2682 m), 4 Jul 1908. [*Standley*, P.C.?] 4186 (NMC); Jack's Creek, 5 mi above Cowles, Jul 1939, *Bridges*, J.O. 1380 (NMCR); Pecos Wilderness, For. Rds. 645 & 156, between Terrero Mine and Summit of Elk Mt, Santa Fe Mts, 19 Aug 1984, *Hill*, S.R. 15314 (NMCR); Ridge 5 mi above Cowles, Jul 1939, *Bridges*, J.O. 1362 (NMCR). SANDOVAL Co.: Jemez Mts, hwy 4, about 3 mi W of Berlandier Natl. Monument boundary, 11 Aug 1983, *Allred*, K.W. 2543 (NMCR). SANTA FE Co.: Santa Fe, 5 Oct 1960, *Weissenborn*, K.R. 32 (UNM); Lower Canoncito, about 8 air mi SE of Santa Fe, 8 Aug 1985, *Allred*, K.W. 3016 (NMCR); Near Otowi ruins, 6700 ft (2042 m), 18 Jul 1938, *Spuhler* 9 (UNM). SIERRA Co.: 17 mi NW Winston, 6 Sep 1936, *Parker*, K.W. 912 (NMCR). SOCORRO Co.: Meadow top of Mt. Withington, 11 Jul 1952, [no collector] 2697 (UNM). TAOS Co.: Along banks of East Fork of Red River, 9600 ft (2926 m), 5 Aug 1980, *Fletcher*, R. 4733 (UNM); Sagebrush-pinyon-juniper community among large basaltic outcrops, about 3 mi E of Hwy 285 along Hwy 96 to Carson, 7 Aug 1986, *Allred*, K.W. 4097 (NMCR); Mouth of Saw Mill Fork, Carson Forest, Questa, 10000 ft (3048 m), 24 Jan 1933, *Nelson*, A. 2721 (UNM).



Allred, Kelly W. 1993. "Bromus, section Pnigma, in New Mexico, with a key to the brome-grasses of the state." *Phytologia* 74, 319–345.

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