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# A taxonomic revision of *Bromus* (Poaceae: Pooideae: Bromeae) in México and Central America

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## Abstract


A taxonomic treatment of *Bromus* in México and Central America is presented. Twenty-two species and one variety are recognized in the region. Twelve of these species are native, and ten are adventive and introduced. *Bromus* section *Mexibromus* is newly described, representing a distinct lineage in molecular studies of the genus. It includes two species endemic to México (*B. attenuatus*, *B. densus*) and one endemic to México and Guatemala (*B. dolichocarpus*), distinguished from species in other *Bromus* sections by their 3(–5)-nerved lemmas. *Bromus pinetorum* is a poorly understood species of *Bromus* sect. *Bromopsis* endemic to Coahuila. Taxa that have been variously treated in the past are discussed in detail. *Bromus mucroglumis* and *B. thysanoglottis* are treated as synonyms of *B. richardsonii*, and *B. meyeri* is treated as a synonym of *B. anomalus*. Two varieties are recognized in *B. carinatus*, *B. carinatus* var. *carinatus* and *B. carinatus* var. *marginatus*. Lectotypes are designated for the names *B. carinatus* var. *californicus*, *B. hookeri* var. *schlechtendalii*, *B. trinii*, *B. trinii* var. *pallidiflorus* and *B. trinii* var. *stricta*. A second-step neotype is designated for *B. rigidus*. Keys for determining the species in English and Spanish, descriptions, synonymies, illustrations, distribution maps, comments and lists of all specimens examined are provided for each species.

**Resumen**

Se presenta un tratamiento taxonómico para el género *Bromus* en México y America Central. Para la región se reconocen veintidós especies y una variedad. Dos de estas especies son nativas, y diez son adventicias e introducidas. *Bromus* sección *Mexibromus* es descrita como nueva y representa un linaje distinto para estudios moleculares de este género. Esta incluye dos species endémicas de México (*B. attenuatus*, *B. densus*) y uno endémica de México y Guatemala (*B. dolichocarpus*), y se distingue de las especies de otras secciones de *Bromus* por tener lemas 3(–5)-nervadas. *Bromus pinetorum* es una especie endémica para Coahuila y conocida solo por escasas colectas. Los taxa que han sido tratados taxonomicamente de forma variada en el pasado son discutidos con detalle. *Bromus mucroglumis* y *B. thysanoglottis* son tratados como sinónimos de *B. richardsonii*, y *B. meyeri* es tratado como un sinónimo de *B. anomalus*. Se reconocen dos variedades, de *B. carinatus*: *B. carinatus* var. *carinatus* y *B. carinatus* var. *marginatus*. Se designan lectotipos para *B. carinatus* var. *californicus*, *B. hookeri* var. *schlechtendalii*, *B. trinii*, *B. trinii* var. *pallidiflorus* y *B. trinii* var. *stricta.* Además, un neotipo es designado para *B. rigidus*. Se presentan claves para determinar las especies en inglés y español, así como descripciones, sinonimia, ilustraciones, mapas de distribución, comentarios y listado de los especímenes examinados para cada especie.

## Introduction

*Bromus* Linnaeus (1753: 76) is a large and taxonomically complex grass genus that includes more than 160 species distributed in temperate regions worldwide. The genus is distinguished from other grass genera by the combination of leaf sheaths that are closed for most of their length, awns that are inserted subapically and hairy appendages on the apices of the ovary. Approximately 80 *Bromus* species are currently recognized in North, Central and South America (Pavlick *et al.* 2003). Some ten species are agriculturally important as forage species, a few have been used for revegetation purposes, and there is considerable potential for developing new *Bromus* varieties for agriculture in temperate regions, given the broad diversity in wild species (Williams *et al.* 2011). Many *Bromus* species are problematic invasive weeds (Cussans *et al.* 1994, Otfinowski *et al.* 2007, Huttanus *et al.* 2011).

Putative lineages within *Bromus* have been variously recognized as sections, sub-genera or genera (Smith 1970, Saarela *et al.* 2007). Most workers recognize five sections in *Bromus*: *Bromus*, *Bromopsis* Dumortier (1824: 116), *Ceratochloa* (Palisot de Beauvois 1812: 75) Griseb. in Ledebour (1852: 360), *Genea* Dumortier (1824: 116) and *Neobromus* (Shear 1900: 23) Hitchcock (1935: 55). Some recent authors recognize these groups as genera (Cope & Gray 2009, Shaw & Montgomery 2011, Weber & Wittmann 2011) or subgenera (Stebbins 1981, Acedo & Llamas 1999, Klos *et al.* 2009). Recognizing the major lineages as genera is not consistent with knowledge of phylogenetic relationships in the genus. In molecular phylogenetic studies of nuclear ribosomal and plastid DNA sequence data, sects. *Bromus*, *Ceratochloa* and *Genea* have been resolved as natural groups (Pillay & Hilu 1990, 1995, Ainouche & Bayer 1997, Saarela *et al.* 2007, Fortune *et al.* 2008). Analyses of sequence data of the nuclear *Waxy* gene indicate that sect. *Genea* may be paraphyletic, as some copies of the gene in polyploid members of the section are more closely related to sequences from species of sects. *Bromus* and *Bromopsis* (Fortune *et al.* 2008). The globally widespread sect. *Bromopsis* is not monophyletic; it appears to comprise distinct Mexican, North American, South American and Eurasian lineages (Pillay & Hilu 1990, 1995, Saarela *et al.* 2007).

## Taxonomic History of *Bromus* in México and Central America

The first species of *Bromus* reported from México was *B. exaltatus* Bernhardi (1841: 90). Three species from México were reported by J.F. Ruprecht in his list of grasses collected in México by H. Galeotti (Galeotti 1842): *B. anomalus* Ruprecht in Galeotti (1842: 236) *nom. nud.*, *B. subalpinus* Ruprecht in Galeotti (1842: 237) *nom. nud.* and *B. lividus* Kunth in Humboldt *et al.* (1816: 150) (=*Festuca livida* (Kunth) Willdenow ex Sprengel 1825: 353). Fournier (1886) reported three species of *Bromus* from México: *B. exaltatus*, *B. anomalus* Ruprecht ex Fournier (1886: 126) (validating the name) and *B. hookeri* Fournier (1886: 127) *nom. nud.* (with six varieties), and one species of *Ceratochloa* P. Beauv. (=*Bromus* sect. *Ceratochloa*), *C. unioloides* (Willdenow 1803b: 3) Palisot de Beauvois (1812: 75). A treatment by Hemsley (1885), based on a draft of Fournier's work, also recognized four species, except he treated *C. unioloides* in *Bromus* (i.e., *B. unioloides* Kunth in Humboldt *et al.* 1816: 151) and *B. hookeri* as *B. ciliatus* Linnaeus (1753: 76).

Shear's (1900) treatment of the North American species of *Bromus* excluded Mexican species, but he considered Fournier's Mexican taxa in a subsequent publication (Shear 1901). In an early nineteenth century revision of Mexican grasses, Hitchcock (1913) recognized seven *Bromus* species in México, and he later recognized two of these in Central America (Hitchcock 1930). Five new species were described from México in the 1940s and 1950s: *B. pinetorum* Swallen (1943: 77), *B. meyeri* Swallen (1950: 395), *B. densus* Swallen (1950: 396), *B. attenuatus* Swallen (1950: 397) and *B. dolichocarpus* Wagnon (1950: 65). Another new species, *B. mucroglumis* Wagnon (1950: 67), described from Arizona, was reported from Baja California and Chihuahua in México.

Numerous treatments and checklists of *Bromus* in México and Central America were published in the latter half of the twentieth century. Wagnon (1952) revised *Bromus* sect. *Bromopsis* in North America and recognized seven species of the section in México. This treatment is still widely consulted. Soderstrom & Beaman (1968) produced the first revision of *Bromus* in México and Central America. They recognized 16 species in the genus, including ten in sect. *Bromopsis*, but they used just four of the seven names used by Wagnon (1952). The different names and, in some instances, taxon concepts in these two major revisions have resulted in considerable confusion for later users regarding some of the native Mexican *Bromus* species. Beetle (1977) listed 19 *Bromus* species in México, and later he treated 24 species for the country (Beetle 1987). In more recent checklists for México, Espejo-Serna *et al.* (2000) included 26 species and Dávila Aranda *et al.* (2006) included 25 species. Treatments of *Bromus* in studies of the grasses or plants of more restricted geographical regions in México (usually states) have generally followed the taxonomy in Soderstrom & Beaman (1968) and/or Beetle (1987) (e.g., Gould and Moran 1981, McVaugh 1983, Pohl & Davidse 1994, Herrera Arrieta 2001, Herrera Arrieta *et al.* 2010). Three *Bromus* species were recently reported for Costa Rica (Morales 2003).

Several *Bromus* species have been reported as present in the Mexican flora, but not all of these have been confirmed by voucher specimens. Wiggins (1980) reported *B. arenarius* Labillardière (1805: 23), *B. grandis* (Shear 1900: 43) Hitchcock in Jepson (1912: 175) and *B. orcuttianus* Vasey (1885b: 223) from northern Baja California. Gould & Moran (1981) noted they did not see specimens of these species and did not treat them in their *Grasses of Baja California*. We also have not seen specimens of these species, and do not treat them here. Wiggins (1980) also included several species from adjacent California as "possibly" or "probably" extending into Baja California: the native species *B. laevipes* Shear (1900: 45) and *B. pseudolaevipes* Wagnon (1950: 64), and the introduced species *B. racemosus* Linnaeus (1762: 114), *B. briziformis* Fischer & Meyer in Fischer *et al.* (1837: 30) and *B. arvensis* Linnaeus (1753: 77). Of these, only *B. pseudolaevipes* is confirmed to be present in Baja California.

Beetle (1987) noted that *B. commutatus* Schrader (1806: 353) has been collected in Chihuahua, but is not established there; it was reported recently from the same location by Royo Márquez & Melgoza Castillo (2012). We have not seen specimens of this taxon from México. Villaseñor & J. Espinosa-García (2004) included 16 non-native *Bromus* species in their list of invasive plants of México, compiled from literature records. This list included *B. arvensis*, *B. briziformis* and *B. racemosus*, which were probably included based on their inclusion in Wiggins (1980). The remaining taxa are confirmed in México (*B. rigidus* is treated as a synonym of *B. diandrus*, and *B. mollis* as a synonym of *B. hordeaceus*).

Inclusion of endemic Mexican species of sect. *Bromopsis* in a recent molecular phylogenetic study yielded unexpected insight into their evolutionary history. Saarela *et al.* (2007) found the Mexican species *B. attenuatus* and *B. dolichocarpus* to be the sister group of the rest of the genus, based on ITS nuclear ribosomal DNA sequence data, and distinct from other *Bromopsis* species based on plastid data. These taxa are not closely related to other species of sect. *Bromopsis* in North America. These species, along with *B. densus* (not sampled by Saarela *et al.* 2007) are unique morphologically in sect. *Bromopsis* by having distinctly 3(–5)-nerved lemmas (vs. 7-nerved), as noted previously by Wagnon (1952) and Soderstrom & Beaman (1968). *Bromus attenuatus* and *B. densus* are endemic to the Sierra Madre Oriental in northeastern México, whereas *B. dolichocarpus* is more broadly distributed in central México south to Guatemala. Phylogenetic analyses of new sequence data from the ITS and ETS nuclear ribosomal regions from multiple individuals of *B. attenuatus*, *B. dolichocarpus*, as well as *B. densus*, are consistent with our earlier results and identify these taxa as a strongly-supported clade that is the sister group of the rest of the genus (A. Menna & J.M. Saarela, unpublished data). Given that these species represent a unique lineage in the genus, we propose a new section for them.

Here we present a revised taxonomic treatment for *Bromus* in México and Central America. We accept 22 species in the flora (Table 1), of which twelve are native and ten introduced. We include a key to the species in English and Spanish, descriptions, synonymies, illustrations, distribution maps, images of representative herbarium specimens and lists of all specimens examined.

**TABLE 1.** Infrageneric classification of *Bromus* in México and Central America, native or introduced status of species and their country-level distributions.

| Section | Species | Introduced or Native | Distribution |
|---|---|---|---|
| Sect. *Bromus* | *B. hordeaceus* L. | Introduced | México |
| | *B. japonicus* Houtt. | Introduced | México |
| | *B. secalinus* L. | Introduced | México |
| Sect. *Bromopsis* | *B. anomalus* Rupr. ex E. Fourn. | Native | Guatemala, México |
| | *B. exaltatus* Bernh. | Native | Costa Rica, Guatemala, México, Panama |
| | *B. frondosus* (Shear) Woot. & Standl. | Native | México |
| | *B. inermis* Leyss. | Introduced | Guatemala, México |
| | *B. lanatipes* (Shear) Rydb. | Native | México |
| | *B. pinetorum* Swallen | Native | México |
| | *B. pseudolaevipes* Wagnon | Native | México |
| | *B. richardsonii* Link | Native | México |
| Sect. *Ceratochloa* | *B. arizonicus* (Shear) Stebbins | Native | México |
| | *B. carinatus* Hook. & Arn. | Native | Costa Rica, El Salvador, Honduras, Guatemala, México |
| | *B. catharticus* Vahl | Introduced | Costa Rica, Guatemala, México, Panama |
| Sect. *Genea* | *B. diandrus* Roth | Introduced | Guatemala, México |
| | *B. madritensis* L. | Introduced | México |
| | *B. rubens* L. | Introduced | México |
| | *B. tectorum* L. | Introduced | México |
| Sect. *Mexibromus* | *B. attenuatus* Swallen | Native | México |
| | *B. densus* Swallen | Native | México |
| | *B. dolichocarpus* Wagnon | Native | México |
| Sect. *Neobromus* | *B. berteroanus* Colla | Introduced | México |

## Materials and Methods

This study is based on over 2000 herbarium specimens from ANSM, ARIZ, ASU, CAN, CAS/DS, CR, F, GH, MEXU, P, RSA-POM, US, MICH, MSC, NY, SD. Herbarium abbreviations follow Index Herbariorium (Thiers continuously updated). We have examined the type specimens of most species studied; many of these were seen digitally via JSTOR Global Plants (2013). Specimens from several herbaria were accessed online: ASU, via the Southwest Environmental Information Network (http://swbiodiversity.org/seinet/index.php); ARIZ, via the University of Arizona Herbarium website (http://ag.arizona.edu/herbarium/home); P, via the Herbier National de Paris website (http://coldb.mnhn.fr/colweb/form.do?model=SONNERAT.wwwsonnerat.wwwsonnerat.wwwsonnerat), and MO, via Tropicos (2013). For these records, only specimens that could be reliably determined from images are included here. Specimens at MO are duplicates of collections we have seen; we include these in the specimen citations, but have not seen the MO sheets. Specimens at CAS/DS are cited in Pohl & Davidse (1994); these are also duplicates of collections we have seen, but we have not seen the CAS/DS sheets.

Descriptions for species treated in Saarela (2008) and Saarela & Peterson (2012) were modified to reflect the range of variation observed in Mexican specimens; all other descriptions are new and are based on material from throughout México and Central America. Nomenclatural information was compiled through study of the primary literature and numerous secondary sources, including Pavlick (1995), Pavlick *et al.* (2003), Tropicos (2013) and the International Plant Names Index (2013). We have not attempted to account for all of the names that have been applied to the introduced taxa in their native European ranges (i.e., species of sects. *Bromus* and *Genea*), as these names are rarely used in the North American literature. Information on common names in English and Spanish was

obtained through internet searches and the taxonomic literature cited throughout this paper. Data on geographical distribution, elevation and habitat are based on herbarium specimen label data and our field observations. When not available on specimen labels, geographic coordinates were georeferenced manually using internet resources, including Wikipedia and Google Earth. Secondary coordinates are included in square brackets in the specimen citations. Distribution maps were produced with SimpleMappr (Shorthouse 2013). Most of the illustrations were prepared by Cynthia T. Roché, published originally in *Flora of North America* volume 24 (Barkworth *et al.* 2007) and reproduced here with permission from M. Barkworth (Utah State University). *Bromus attenuatus*, *B. densus*, *B. dolichocarpus* and *B. exaltatus* were newly illustrated by Paulette Dennis of Ontario, Canada.

## Taxonomic Treatment

*Bromus* Linnaeus (1753: 76), *nom. et. typ. cons.*

Conserved Type:—*Bromus secalinus* Linnaeus (1753: 76). Lectotype designated by Shear (1900: 8) and Smith (1970: 366), not Wagnon (1952: 421) and Pinto-Escobar (1981: 447), nor Hitchcock & Green (1929), nor Soderstrom & Beaman (1968); for conserved type see Jarvis (1992: 559), Brummitt (1995: 611) and Barrie (2006: 95).

*Ceratochloa* Palisot de Beauvois (1812: 75, 158). Lectotype:—*Ceratochloa cathartica* (Vahl 1791: 22) Herter (1940: 144), designated by Henrard (1940: 498) as *Ceratochloa cathartica* (Vahl) Henrard (1940), *nom. illeg. superfl.*

*Bromopsis* (Dumort.) Fourreau (1869: 187). Basionym: *Bromus* sect. *Bromopsis* Dumortier (1824: 116). Lectotype:—*Bromopsis aspera* Fourreau (1869: 187) (=*Bromus ramosus* Hudson 1762: 40), designated by Fourreau (1869: 89) by exclusion of *Bromus giganteus* Linnaeus (1753: 77) (=*Festuca gigantea* (L.) Villars 1787: 110); see Wagnon (1952:425) and Holub (1973: 159).

*Serrafalcus* Parlatore (1840: 14). Lectotype:—*Serrafalcus racemosus* (Linnaeus 1762: 114) Parlatore (1840: 14), designated by Hitchcock (1920: 24).

*Anisantha* Koch (1848: 394). Type:—*Anisantha pontica* Koch (1848: 394).

*Triniusa* Steudel (1854: 328). Type:—*Triniusa danthoniae* (Trinius ex Meyer 1831: 24) Steudel (1854: 328).

*Festuca* subg. *Stenofestuca* Honda (1930: 44). Type:—*Festuca pauciflora* Thunb. in Murray (1784: 119).

*Trisetobromus* Nevski (1934: 15). Type:—*Trisetobromus hirtus* (Trinius 1836b: 300) Nevski (1934: 15).

*Nevskiella* Krecz. & Vved. in Nevski (1934: 15). Type:—*Nevskiella gracillima* (Bunge 1851: 527) Krecz. & Vved. in Nevski (1934: 15).

Plants annual or perennial, usually caespitose, occasionally rhizomatous. Culms 7–192 cm tall, one to several per plant. Leaf sheaths closed for most of their length, glabrous or variously pubescent; auricles present or absent; ligules to 7 mm long; blades flat, abaxial and adaxial surfaces glabrous or variously pubescent. Inflorescences panicles, sometimes racemose, occasionally reduced to a single spikelet, open to dense, erect to nodding. Spikelets 1.3–4 cm long, terete or compressed dorsiventrally to laterally, disarticulation above the glumes and below the lemmas. Glumes unequal, shorter than the adjacent lemma, glabrous or variously pubescent; lower glumes 1–7(–9)-nerved; upper glumes 3–9(11)-nerved. Lemmas rounded to keeled, glabrous or variously pubescent, 3–11-nerved, with a single ± terminal or subterminal awn, occasionally unawned; paleas shorter than lemmas, usually variously ciliate on the keels. Styles 2, inserted laterally on a bilabiate appendage of the ovary. Anthers 2–3. Caryopses somewhat ellipsoid, dorsally flattened (sections *Bromus*, *Bromopsis*, *Genea*, *Mexibromus* and *Neobromus*) to terete and laterally compressed (section *Ceratochloa*), ventral face flattened or slightly concave to folded (section *Ceratochloa*) with a hilum running nearly the entire length, apex or rostellum short-pilose. Base chromosome number $x = 7$.

## A new *Bromus* section endemic to México

***Bromus*** sect. ***Mexibromus*** Saarela, P.M. Peterson & Valdés–Reyna, *sect. nov.*

Type:—*Bromus densus* Swallen
Differs from other infrageneric taxa of *Bromus* by its 3(–5)-nerved lemmas.

Plants perennial, loosely to densely tufted, not rhizomatous. Culms up to 192 cm tall, erect, glabrous to pubescent below inflorescence; nodes 2–6, glabrous to pubescent. Leaf sheaths glabrous or pubescent; auricles absent or

present; ligules 0.4–1.5(–3) mm long; blades up to 74 cm × 2–16 mm, flat, linear or attenuate proximally, glabrous to pilose. Panicles up to 33 cm long, open, nodding, 1–4 spikelets per branch. Spikelets (1.5–)2–3.6(–4) cm long, 5–8-flowered, elliptic, lanceolate to linear-lanceolate, terete to moderately laterally compressed; glumes usually glabrous, sometimes weakly pubescent; lower glumes 6.5–13(–14) mm long, narrowly lanceolate to lanceolate, apices acute, rarely acuminate, 1(–3)-nerved; upper glumes 8–19 mm long, lanceolate to obovate-lanceolate, apices obtuse, acute, acuminate or mucronate, 3-nerved. Lemmas 10–20 mm long, elliptic, lanceolate or linear-lanceolate, rounded over the backs, 3(–5)-nerved, glabrous to pubescent; awns (1–)2–13 mm long; anthers 1.1–6.5 mm long; caryopses 6–15 mm long.

**Included species:—***Bromus attenuatus*, *B. densus*, *B. dolichocarpus*.

## Key to *Bromus* of México and Central America

1 Spikelets strongly flattened laterally; lemmas strongly keeled (sect. *Ceratochloa*) ..... 2
– Spikelets not strongly flattened laterally; lemmas rounded over the mid-rib, not strongly keeled ..... 4
2 Awns 0–3.5(–4) mm long; upper glumes 9(–11)-nerved, lemma nerves usually raised ..... 6. *B. catharticus*
– Awns 4–15 mm long; upper glumes 5–7-nerved, lemma nerves not raised ..... 3
3 Upper glumes ca. equal in length to the lowermost lemma; lemmas generally hairy along the margins, backs hairy or glabrous, marginal hairs generally longer than those on lemma backs; panicles with 1–2 spikelets per branch; spikelets 1.5–2.5(–2.7) cm long; plants annual ..... 2. *B. arizonicus*
– Upper glumes shorter than the lowermost lemmas; lemmas scabrous or variously hairy, marginal hairs if present similar in length to those on lemma backs; panicles with 1–3(–9) spikelets per branch; spikelets 2–4 cm long; plants perennial ..... 5. *B. carinatus*
4 Lemma apices conspicuously bidentate, teeth hyaline, awn-like to acuminate; largest lemmas generally < 2 mm wide ... 5
– Lemma apices entire or inconspicuously bidentate, teeth usually not hyaline; largest lemmas generally > 2 mm wide .. 10
5 Awns geniculate and/or twisted; spikelets elliptic to lanceolate (sect. *Neobromus*) ..... 4. *B. berteroanus*
– Awns straight, not twisted; spikelets linear-elliptic to cuneate (sect. *Genea*) ..... 6
6 Lemmas mostly > 20 mm long; awns 30–65 mm long; upper glumes 18–35 mm long ..... 8. *B. diandrus*
– Lemmas mostly < 20 mm long; awns 8–30 mm long; upper glumes 7–21 mm long ..... 7
7 Inflorescences open, branches spreading to nodding, usually one-sided, often sinuous, usually longer than the spikelets; spikelets 1.5–2(–2.5) cm long (2.5–3.5 cm including awns) ..... 22. *B. tectorum*
– Inflorescences dense, branches ascending to spreading, not one-sided or sinuous, usually shorter than the spikelets; spikelets 2–4.5 cm long (3–6.5 cm including awns) ..... 8
8 Inflorescence internodes gradually reduced distally, some branches usually longer than spikelets, shortest branch on lowest inflorescence node 6–24 mm long, longest branch on lowest node 0–1 times branched; culms glabrous below the inflorescences; florets not overlapping at maturity ..... 16. *B. madritensis*
– Inflorescence internodes abruptly reduced distally, branches shorter than spikelets, shortest branch on lowest inflorescence node ≤ 6 mm long, longest branch on lowest node 2–5 times branched; culms pubescent below the inflorescences; florets overlapping at maturity ..... 20. *B. rubens*
10 Plants annual; lower glumes 3(5)-nerved; upper glumes 5–9-nerved (sect. *Bromus*) ..... 11
– Plants perennial; lower glumes 1(3)-nerved; upper glumes 3(5)-nerved ..... 13
11 Awns inserted 1.5–5 mm below lemma apex, straight to strongly divergent ..... 14. *B. japonicus*
– Awns inserted <1.5 mm below lemma apex, straight ..... 12
12 Lemmas densely pubescent, nerves raised; glumes sparsely to densely pubescent; lower glumes 5.2–7 mm long; upper glumes 6–8.5 mm long; lemmas 7.5–9 mm long; spikelets not widening substantially by divergence of the florets as the fruit forms, lemmas continuing to obscure most rachillas; caryopses flat or crescent shaped in cross section; panicles usually dense ..... 12. *B. hordeaceus*
– Lemmas glabrous, occassionally scabrous distally, nerves smooth, not distinctly raised; glumes glabrous or scabrous; lower glumes 3.6–4.9 mm long; upper glumes 4.2–6.1 mm long; lemmas 6–7.7 mm long; spikelets widening substantially by divergence of the florets as the fruit forms, many rachillas becoming visible as the lemma wraps around the caryopses; caryopses U- and V-shaped in cross section; panicles ± open ..... 21. *B. secalinus*
13 Lemmas 3(–5)-nerved (sect. *Mexibromus*) ..... 14
– Lemmas 5–7-nerved (sect. *Bromopsis*) ..... 16
14 Awns 7–13 mm long; lemmas 14–20 mm long; anthers 1.1–2(–3) mm long ..... 9. *B. dolichocarpus*
– Awns < 5 mm long; lemmas < 14 mm long; anthers > 3 mm long ..... 15
15 Anthers 6–6.5 mm long; widest leaf blades 2–3 mm wide, blades not narrowing towards their base; awns (1–)2–3.5 mm long; auricles usually absent (sometimes present in plants from Cerro Potosí, NL); plants densely tufted, often with a conspicuous, corm-like rootstock ..... 7. *B. densus*
– Anthers 3.5–5.5 mm long; widest leaf blades 6–16 mm, blades narrowing towards their base; awns 2.5–4.5(–5) mm long; auricles present; plants tufted, conspicuous corm-like rootstock absent ..... 3. *B. attenuatus*

16 Plants with rhizomes; awns absent or up to 3 mm long; longest anthers > 4 mm long ..... 13. *B. inermis*
– Plants caespitose, rhizomes absent; awns 1.5–11 mm long; all anthers < 4 mm long ..... 17
17 Most lower glumes on a plant 1-nerved ..... 18
– Most lower glumes on a plant 3-nerved ..... 22
18 Lower leaf sheaths densely lanate, the hairs matted at the tips ..... 15. *B. lanatipes*
– Lower leaf sheaths pubescent, pilose, or glabrous, never lanate ..... 19
19 Lower glumes (7–)9–11 mm long, linear-lanceolate; lemmas 12–16 mm long, linear-lanceolate, gradually narrowed to apices; spikelets moderately laterally compressed ..... 10. *B. exaltatus*
– Lower glumes 4.9–9.5(–12) mm long, lanceolate; lemmas 7–13.5(–15) mm long, elliptic to lanceolate; spikelets terete to moderately laterally compressed ..... 20
20 Auricles usually present; awns 1–3 mm long; leaf blades 2–4 mm wide; lemmas 7–10 mm long; ligules 0.2–1.6 mm long ..... 1. *B. anomalus*
– Auricles absent; awns 3.1–8 mm long; leaf blades (3–)4–10.5(–13) mm wide; lemmas (9–)10–13.5(–15) mm long; ligules 1.5–4 mm long ..... 21
21 Anthers 1–2.6(–3.4) mm long; awns 3.1–6.5 mm; panicle branches lax, ascending to nodding; plants widespread in México ..... 19. *B. richardsonii*
– Anthers (3–)3.5–4 mm long; awns (6–)6.5–8 mm long; panicle branches stiff, erect to ascending; plants endemic to Coahuila, México ..... 17. *B. pinetorum*
22 Upper glumes 5-nerved; anthers 3.5–5.5 mm long ..... 18. *B. pseudolaevipes*
– Upper glumes 3-nerved; anthers 1.5–3.5 mm long ..... 23
23 Lower glumes (7–)9–11 mm long; upper glumes (9–)11–14 mm long; lemmas 12–16 mm long, linear-lanceolate, gradually narrowed to apices; spikelets moderately laterally compressed ..... 10. *B. exaltatus*
– Lower glumes 4.9–8.5 mm long; upper glumes 6–10.5 mm long; lemmas 7–12(–13) mm long, elliptic to lanceolate, apices acute, obtuse or truncate; spikelets terete to moderately laterally compressed ..... 24
24 Awns 3.5–6 mm; auricles absent; leaf blades 4–6 mm wide; lemmas 9–12 mm long; glumes glabrous, scabrous or minutely pubescent; lower glumes lanceolate; leaf sheaths sparsely to densely pilose ..... 11. *B. frondosus*
– Awns 1–3 mm long; auricles usually present, sometimes absent; leaf blades 2–4 mm wide; lemmas 7–10 mm long; glumes usually pubescent, occassionally glabrous to puberulent; lower glumes triangular or narrowly lanceolate; leaf sheaths glabrous, pubescent or pilose ..... 1. *B. anomalus*

**Clave para las especies de *Bromus* en México y América Central**

1 Espiguillas aplanadas lateralmente; lemas fuertemente aquilladas (sect. *Ceratochloa*) ..... 2
– Espiguillas no aplanadas lateralmente; lemas redondeadas sobre la nervadura media, no fuertemente aquilladas ..... 4
2 Aristas 0–3.5 mm de largo; glumas superiores 9(–11)-nervadas; nervaduras de las lemas usualmente prominentes ..... 6. *B. catharticus*
– Aristas 4–15 mm de largo; glumas superior 5–7-nervadas; nervaduras de las lemas no prominentes ..... 3
3 Gluma superior de longitud similar al lema inferior; lemas generalmente pilosas en los márgenes, dorso piloso o glabro, pelos del margen más largos que los del dorso; panículas con 1–2 espiguillas en cada ramifacacion; espiguillas 1.5–2.5(–2.7) cm de longitud; plantas anuales ..... 2. *B. arizonicus*
– Gluma superior más corta que el lema inferior; lema escabrosa o variadamente pilosa, pelos del margen, cuando presentes, de longitud similar a las del dorso; panículas con 1–3(–9) espiguillas por ramificacion; 2–4 cm de longitud; plantas perennes ..... 5. *B. carinatus*
4 Ápice de la lema conspicuamente bidentado, dientes hialinos; como aristas hasta acuminados; lemas mayoes, generalmente < 2 mm de ancho ..... 5
– Ápice de lema enteros o inconspicuamente bidentado, los dientes usualmente no hialinos; lemas mayores, generalmente > 2 mm de ancho ..... 10
5 Aristas geniculadas y/o retorcidas; espiguillas de elípticas a lanceoladas (sect. *Neobromus*) ..... *B. berteroanus*
– Aristas rectas, no retorcidas; espiguillas de linear-elípticas a cuneadas (sect. *Genea*) ..... 6
6 Lemas usualmente > 20 mm de largo; aristas 30–65 mm largo; glumas superiores 18–35 mm largo ..... 8. *B. diandrus*
– Lemas usualmente < 20 mm de largo; aristas 8–30 mm largo; glumas superiores 7–21 mm largo ..... 7
7 Inflorescencias abiertas, ramifacaciones extendidas hasta caedizas, usualmente unilaterales, a menudo sinuosas, usualmente más largas que las espiguillas; espiguillas 1.5–2(–2.5) cm largo (2.5–3.5 cm incluyendo las aristas) 22. *B. tectorum*
– Inflorescencias densas, ramifacaciones de ascendentes a extendidas, no unilaterales, ni sinuosas, usualmente más cortas que las espiguillas; espiguillas 2–4.5 cm largo (3–6.5 cm incluyendo las aristas) ..... 8
8 Entrenudos de la inflorescencia reduciéndose gradualmente hacia la parte distal, algunas ramifacaciones más largas que las espiguillas, las más cortas 6–24 mm, situadas sobre en el nudo inferior de la inflorescencia, la ramifacaciones más larga del nudo inferior 0–1 veces ramificada; culmos glabros debajo de la inflorescencia; flósculos no superpuestos en la madurez ..... 16. *B. madritensis*
– Entrenudos de la inflorescencia abruptamente reducidos distalmente,ramifacaciones más cortas que las espiguillas, la más

corta del nudo inferior < 6 mm de largo, las más largas del nudo inferior 2–5 veces ramificadas; culmos pubescentes debajo de la inflorescencia; flósculos superpuestas en la madurez ..... 20. *B. rubens*

10 Plantas anuales; gluma inferior con 3(5) nervaduras; gluma superior con 5–9 nervaduras (sect. *Bromus*) ..... 11

– Plantas perennes; gluma inferior con 1(3) nervaduras; gluma superior con 3(5) nervaduras ..... 13

11 Aristas rectas a marcadamente divergente, insertas a 1.5–5 mm del ápice del lema ..... 14. *B. japonicus*

– Aristas rectas, insertas <1.5 mm abajo; ápice de la lema recto ..... 12

12 Lemas densamente pubescentes, nervaduras prominentes; glumas de escasa a densamente pubescentes; la inferior 5.2–7 mm de longitud; superior 6–8.5 mm de longitud; lemas 7.5–9 mm de largo; espiguillas con flósculos no divergentes en fruto, raquillas no visibles; cariopsis plano o ligeramente cóncavo, que se aprecia en sección transversal; panículas usualmente densas ..... 12. *B. hordeaceus*

– Lemas glabras, ocasionalmente escabrosas distalmente, nervaduras lisas, no prominentes; glumas glabras o escabrosas; las inferiores 3.6–4.9 mm de largo; las superiores 4.2–6.1 mm de largo; lemas 6–7.7 mm de largo; espiguillas con flósculos divergentes en la madurez, muchas raquillas visibles cuando la lema envuelve la cariopsis; cariopsis de forma de ¨U¨ ¨ en sección transversal; panículas +/- abiertas ..... 21. *B. secalinus*

13 Lemas con 3(–5) nervaduras (sect. *Mexibromus*) ..... 14

– Lemas con 5–7 nervaduras (sect. *Bromopsis*) ..... 16

14 Aristas 7–13 mm de largo; lemas 14–20 mm de largo; anteras 1.1–2(–3) mm de largo ..... 9. *B. dolichocarpus*

– Aristas < 5 mm de largo; lemas < 14 mm de largo; anteras > 3 mm de largo ..... 15

15 Anteras 6–6.5 mm de largo; láminas más anchas 2–3 mm de ancho, no estrechándose hacia la base; aristas (1–)2–3.5 mm de largo; aurículas ausentes (algunas veces presentes en plantas del Cerro El Potosí, NL); plantas densamente amacolladas, a menudo con una base conspicua semejante a un cormo ..... 7. *B. densus*

– Anteras 3.5–5.5 mm de largo; láminas más anchas 6–16 mm, estrechándose hacia la base; aristas 2.5–4.5(–5) mm de largo; aurículas presentes; plantas amacolladas, sin base conspicua ..... 3. *B. attenuatus*

16 Plantas con rizomas; aristas ausentes o de hasta de 3 mm de largo; anteras más largas > 4 mm largo ..... 13. *B. inermis*

– Plantas cespitosas, rizomas ausentes; aristas 1.5–11 mm largo; todas las anteras < 4 mm de largo ..... 17

17 La mayoría de glumas inferiores con 1-nervadura ..... 18

– La mayoría de glumas inferiores con 3-nervaduras ..... 22

18 Vainas de las hojas inferiores densamente lanosas, los pelos enmarañados en los ápices ..... 15. *B. lanatipes*

– Vainas de las hojas inferiores pubescentes, pilosas o glabras, nunca lanosas ..... 19

19 Glumas inferiores (7–)9–11 mm de largo, linear-lanceoladas; lemas 12–16 mm de largo, linear-lanceoladas, estrechándose gradualmente hacia el ápice; espiguillas moderadamente comprimidas ..... 10. *B. exaltatus*

– Glumas inferiores 4.9–9.5(–12) mm de largo, lanceoladas; lemas 7–13.5(–15) mm de largo, elípticas hasta lanceoladas; espiguillas cilíndricas a moderadamente comprimidas ..... 20

20 Aurículas usualmente presentes; aristas 1–3 mm de largo; láminas 2–4 mm de ancho; lemas 7–10 mm largo; lígulas 0.2–1.6 mm de largo ..... 1. *B. anomalus*

– Aurículas ausentes; aristas 3.1–8 mm de largo; láminas (3–)4–10(–13) mm de ancho; lemas (9–)10–13.5(–15) mm de largo; lígulas 1.5–4 mm de largo ..... 21

21 Anteras 1–2.6(3.4) mm de largo; aristas 3.1–6.5 mm de largo; ramificaciones de la panícula laxas, ascendentes o colgantes; plantas con amplia distribución en México ..... 19. *B. richardsonii*

– Anteras (3–)3.5–4 mm de largo; aristas (6–)6.5–8 mm de largo; ramificaciones de la panícula rectas, erectas hasta ascendentes; plantas endémicas de Coahuila, México ..... 17. *B. pinetorum*

22 Glumas superiores con 5-nervaduras; anteras 3.5–5.5 mm de largo ..... 18. *B. pseudolaevipes*

– Glumas superiores con 3-nervaduras; anteras 1.5–3.5 mm de largo ..... 23

23 Glumas inferiores (7–)9–11 mm de largo; glumas superiores (9–)11–14 mm de largo; lemas 12–16 mm de largo, linear-lanceoladas, estrechándose gradualmente hacia el ápice; espiguillas moderadamente comprimidas ..... 10. *B. exaltatus*

– Glumas inferiores 4.9–8.5 mm de largo; glumas superiores 6–10.5 mm de largo; lemas 7–12(–13) mm de largo, elípticas hasta lanceoladas, ápice agudo, obtuso o truncado; espiguillas cilíndricas a moderadamente comprimidas ..... 24

24 Aristas 3.5–6 mm de largo; aurículas ausentes; láminas usualmente glaucas, 4–6 mm de ancho; lemas 9–12 mm de largo; glumas glabras, escabrosas o escasamente pubescentes; vainas de escasa hasta densamente pilosas ..... 11. *B. frondosus*

– Aristas 1–3 mm de largo; aurículas presentes, raras veces ausentes; láminas no glaucas, 2–4 mm de ancho, lemas 7–10 mm de largo; glumas usualmente pubescentes, ocasionalmente glabras hasta puberulentas; vainas glabras, pubescentes o pilosas ..... 1. *B. anomalus*

1. ***Bromus anomalus*** Ruprecht ex Fournier (1886: 126). Figs. 1–3.

*Bromus anomalus* Rupr. in Galeotti (1842: 236), *nom. nud. Bromopsis anomala* (Rupr. ex E. Fourn.) Holub (1973: 167). *Zerna anomala* (Rupr. ex E. Fourn.) Henrard (1940: 499). Type:—MÉXICO. Estado de México: Teotihuacan, July–August 1865, *Hahn s.n.* (lectotype P-00748832!, designated by Soderstrom & Beaman 1968: 496). We agree with Soderstrom & Beaman that the lectotypes chosen by Shear (1901: 243) [Cerro San Felipe in prov. Oajacensi, 8000 ft, Nov–April 1840, *H. Galeotti 5757* (lectotype P-00624352!, isotypes US-A865510! fragm. ex P, LE-00000752!)] and Wagnon (1952: 469)

[Hidalgo: Real de Monte, *H. Galeotii 5815* (P)] are ambiguous.

*Bromus meyeri* Swallen (1950: 29). Type:—MÉXICO. Nuevo León: Dulces Nombres, and just E of border into Tamaulipas, 24ºN, 99.30'–100.0'W, 1850 m, rhizomatous perennial to 2 ft tall, amongst low thorny shrubs on north hillside, 18 June 1948, *F.G. Meyer & D.J. Rogers 2561* (holotype US-1962983!, isotype MO-1598683!).

Plants perennial, not rhizomatous. Culms up to 110 cm tall, 2–4 mm wide at base, erect or ascending, bases often weakly to strongly decumbent, glabrous, scabrous or pubescent below inflorescences; nodes 2–5, glabrous to pubescent. Leaf sheaths glabrous, pubescent, or pilose, hairs up to 1.5 mm long, midrib distinctly narrowing below the collar; auricles usually present, sometimes absent; ligules 0.2–1.6 mm long, glabrous, erose-lacerate, ciliate; blades up to 35 cm × 2–4 mm, flat, adaxial and abaxial surfaces glabrous or weakly to moderately pubescent or pilose, hairs up to 1 mm long, margins serrulate. Panicles up to 18 cm long, open, nodding, branches ascending or spreading, scabrous, 1–5 spikelets per branch. Spikelets 1.5–2.8 cm long, 4–12-flowered, elliptic to lanceolate, terete to moderately laterally compressed; glumes usually pubescent, hairs up to 0.4 mm long, occassionally glabrous to puberulent, margins hyaline, midnerves glabrous or scabrous; lower glumes 4.9–7.5(–8.5) mm long, triangular or narrowly lanceolate, 1- or 3-nerved, green, purplish-green to purple along and between the nerves; upper glumes 6–10.5 mm long, obovate-lanceolate, 3-nerved, green, purplish-green to purple along and between the nerves, apices obtuse, acute or mucronate, mucros up to 0.6 mm long; lemmas 7–10 mm long, elliptic to lanceolate, rounded over the backs, apices acute, obtuse or truncate, 5–7-nerved, green, purplish-green to purple along and between the nerves, sometimes ± translucent between nerves, marginal nerves sometimes very faint, moderately to densely pubescent to pilose on the backs and margins, hairs up to 0.8 mm long, longest hairs usually along the margins, backs and margins occassionally glabrous to puberulent with hairs up to 0.2 mm long; awns 1.2–3 mm long, inserted < 0.5 mm below the apex of the lemma, straight; paleas shorter and narrower than the lemmas, backs glabrous or pubescent, keels ciliate, cilia up to 0.2 mm long; anthers 1.5–3.2 mm long; caryopses 5−9 mm long, light brown. 2*n* = 14 (Wagnon 1952).

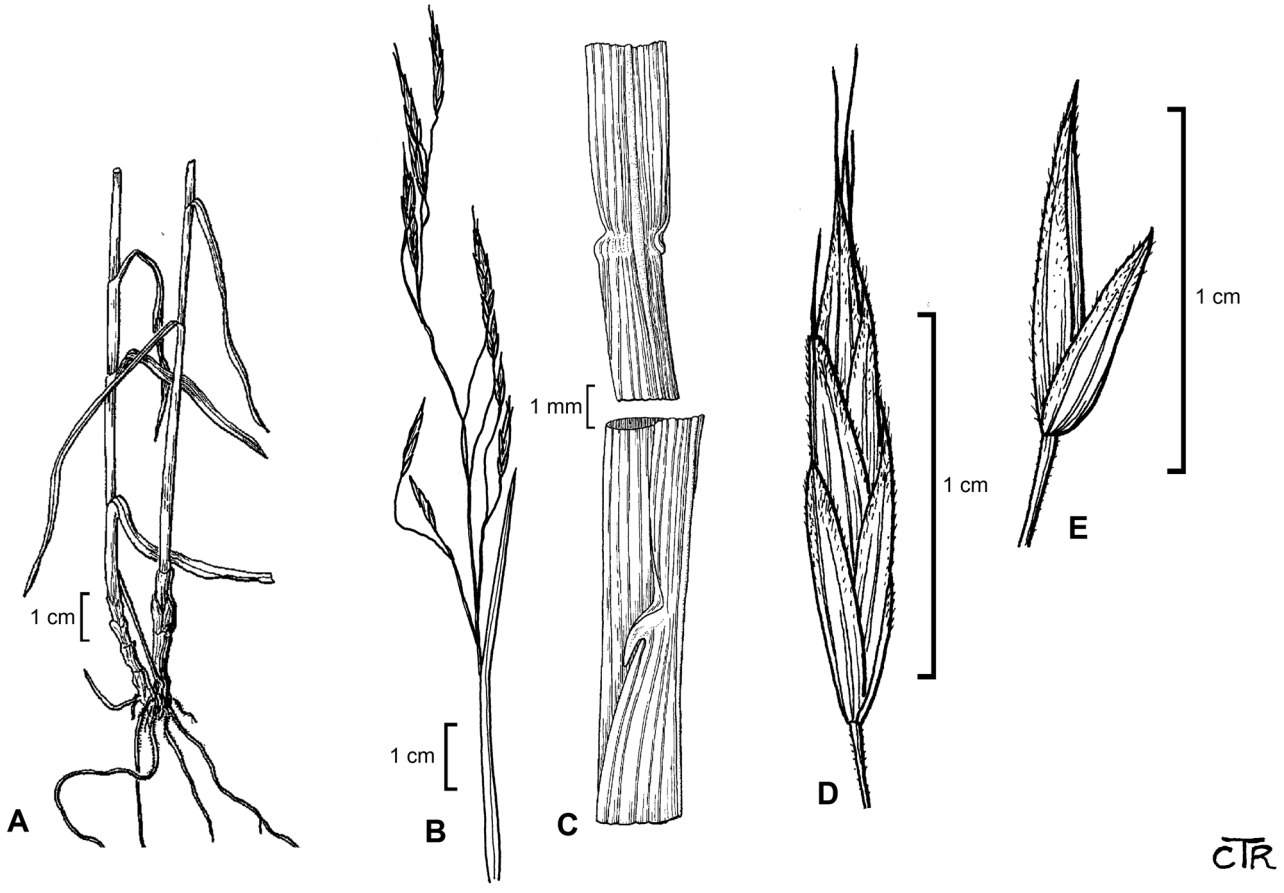


**FIGURE 1.** *Bromus anomalus*. A. Habit. B. Inflorescence. C. Sheath and auricles. D. Spikelet. E. Glumes. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:—**Native. In México *B. anomalus* is known from the states of Aguascalientes, Baja California Sur, Chiapas, Chihuahua, Coahuila, Distrito Federal, Durango, Guanajuato, Hidalgo, Jalisco, Estado de México, Michoácan, Morelos, Nuevo León, Oaxaca, Puebla, Querétaro, San Luis Potosí, Tamaulipas, Tlaxcala, Veracruz and Zacatecas (Fig. 4). It is present in Guatemala in the states of Solola and Quezaltenango, and in Costa Rica in the states of Cartago and San José (Fig. 4). *Bromus anomalus* extends north into western Texas (Pavlick & Anderton 2007) and has also been reported for New México (Allred 1993).

**Ecology:**—This common species occurs in the mountains in pine-oak forests on slopes, forest margins, along creeks and ravines, and on rock outcrops, often in calcareous soils; associated with *Pinus durangensis* Martínez (1942b: 23), *P. cembroides* Zuccarini (1832: 392), *P. rudis* Endlicher (1847: 151), *P. teocote* Schlechtendal & Chamisso (1830: 76), *P. chihuahuana* Engelm. in Wislizenus (1848: 103), *P. johannis* Robert-Passini (1978: 366), *P. ayacahuite* C. Ehrenb. ex Schlechtendal (1838: 492), *Picea engelmannii* Parry ex Engelmann (1863: 212), *Cupressus arizonica* Greene (1882: 64), *Juniperus deppeana* Steudel (1840:835), *J. flaccida* Schlechtendal (1838: 495), *Arctostaphylos pungens* Kunth in Humboldt *et al.* (1819: 278), *Agave montana* Villareal-Quintanilla (1996: 191), *Physocarpus* Cambessèdes (1824: 239) Rafinesque (1838: 73), *Ceanothus* Linnaeus (1753: 195), *Garrya macrophylla* Bentham (1840: 50), *Quercus sideroxyla* Bonpl. in Humboldt *et al.* (1809: 39), *Q. emoryi* Torr. in Emory (1848: 151), *Arbutus xalapensis* Kunth in Humboldt *et al.* (1819: 279), *A. arizonica* (Gray 1886: 317) Sargent (1891: 317), *Cercocarpus montanus* Rafinesque (1832: 146) and *C. ledifolius* Nutt. in Torrey & Gray (1840: 427). Elevation: 3440–3630 m (Costa Rica), 2100–3200 (Guatemala), (790–)1000–3710 m, usually >2000 m (México); sites at elevations below 2000 m are mostly in Coahuila, Nuevo León and Tamaulipas.

**Common Names:—**México brome, nodding brome (English); bromo dormilon (Spanish).

**Comments:—***Bromus anomalus* is the most common and widely distributed species of section *Bromopsis* in México, where it is used as fodder (Saulés & Dávila Aranda 1992). The species was not reported for Guatemala by Swallen & McClure (1955) or Soderstrom & Beaman (1968), but was reported there by Pohl & Davidse (1994); they cited *Smith 658*, as we do here, along with another collection from Guatemala.

*Bromus anomalus* is the smallest species of sect. *Bromopsis* in Mexico. Larger individuals of *B. anomalus* may be confused with *B. richardsonii*. It can be distinguished from *B. richardsonii* by its awns 1.2–3 mm long [vs. 3–6.5 mm long], auricles usually present [vs. absent], lemmas 7–10 mm long [vs. (9–)10–13.5(–15) mm long] and blades 2–4 mm wide [vs. (3–)4–9(–13) mm wide]. A collection from Nuevo León (*Peterson et al. 16765*) with broad leaves (up to 6.5 mm wide), long lemmas (up to 13 mm), awns up to 4 mm long, pubescent lemmas and glumes, and auricles better fits *B. richardsonii*, but we keep it here based on the presence of auricles, which we have not seen in material of *B. richardsonii*. The extreme lengths of the longer awns, longer lemmas and broader leaves observed in this specimen are not included in the key or description, because its placement in *B. anomalus* is uncertain.

On 6 October 2000 the second author was accompanied by two Tarahumara (Gustavo Arturo Palma Aguirre and Juvencio Antonio Bustillos Ramirez) on a short foray along the edge of the Barranca Río Verde (*P.M. Peterson, J. Cayouette, G.A. Palma Aquirre & J.A. Bustillos Ramírez 15372*) to collect *B. anomalus* seed (*basiáhuari*) used to begin the fermentation process to make a corn drink called tesquino (Kennedy 1963). This differs from the species Saulés & Davila Aranda (1992) reported for this purpose (*B. carinatus*).

***Taxonomic status of Bromus meyeri—****Bromus anomalus* is a morphologically variable taxon. Individuals typically have hairy lemmas throughout most of the species' range. Individuals with lemmas glabrous or puberulent from the mountains of Nuevo León and Tamaulipas were described as *B. meyeri* by Swallen (1950), from a collection gathered at Dulces Nombres, Nuevo León. Aside from noting *B. meyeri* to be a taxon with auricles and stating, incorrectly, that *B. latiglumis* (Scribner ex Shear 1900: 40) Hitchcock (1906: 211), a Canadian/U.S.A. taxon that does not occur in México, is the only other known species of *Bromus* to have auricles at the mouths of the sheaths, he did not provide a diagnosis of his new species. Two years after its description, Wagnon (1952) treated *B. meyeri* as a synonym of *B. anomalus*, as have some recent authors (Pavlick 1995, Clayton *et al.* 2002 onwards). *Bromus meyeri* was recognized by Soderstrom & Beaman (1968), who suggested it to be most closely related to *B. texensis* (Shear 1900: 41) Hitchcock (1913: 381), a rare species from southern Texas (Pavlick & Anderton 2007); *B. anomalus* differs from *B. texensis* by its longer awns, fewer-flowered spikelets, shorter glumes and lower sheaths short-pilose (vs. villous). Soderstrom & Beaman (1968) did not mention its similarity to *B. anomalus*. In their key, *B. anomalus* and *B. meyeri* are separated by lemma pubescence: "lemmas glabrous, scabrous, or inconspicuously short hirsute" in the lead to *B. meyeri*, and "lemmas villous over the back or along the margins" in the lead to *B. anomalus*. *Bromus meyeri* has also been recognized by Beetle (1977, 1987), Espejo-Serna *et al.* (2000) and Pavlick *et al.* (2003), all without comment.


**FIGURE 2.** *Bromus anomalus*. *Harvey 8501* (MICH-1119120).

**FIGURE 3.** *Bromus anomalus* inflorescence, Nuevo León, México (*Peterson et al. 23139*). Photo: J.M. Saarela.

We have studied plants in the field, including in the vicinity of the type location, and herbarium, and we agree with Wagnon (1952) in treating *B. meyeri* as a synonym of *B. anomalus*. Although many collections from the Sierra Madre Oriental in Nuevo León have lemmas that are variously glabrous to puberulent (e.g., *Peterson, Valdés-Reyna & Sosa Morales 16699, 16703, 16756, 16760, 16763, 16768, 16780, 16783*, *Peterson & Valdés-Reyna 15872*, *Peterson & Saarela 21100*, *Mueller & Mueller 428, 1168, Harvey 987*) or have short pubescence (e.g., *Peterson & Saarela 21073, 21102*)—character states not found elsewhere throughout the range of *B. anomalus*—the plants otherwise fall within the range of variation of *B. anomalus*. Plants with densely pubscent lemmas are also present in the same areas (e.g., *Peterson & Valdés-Reyna 15824, 15891*; *Peterson, Saarela & Flores Villegas 21373*; *Peterson, Valdés-Reyna & Sosa Morales 16753, 16765, 16778*; *Peterson & Valdés-Reyna, Peterson & Saarela 21103; Mueller 2290; Mueller & Mueller 424, 425, 1058, 1078*). Other specimens are intermediate, with dense pubescence along the margins and lemma backs glabrous to puberulent (e.g., *Peterson & Valdés-Reyna 15863, 15889*). We consider plants previously recognized as *B. meyeri* to be a local form (in the non-taxonomic sense of the word) of *B. anomalus*, consistent with varying lemma pubescence found in several other *Bromus* species, including *B. exaltatus* and *B. richardsonii*.

***Distinguishing Bromus anomalus and B. porteri (Coulter 1885: 425) Nash (1895: 512)***—*Bromus anomalus* and *B. porteri* have long been confused in North America. *Bromus porteri* has been variously recognized as a distinct species (Wagnon 1952, Pavlick 1995, Pavlick & Anderton 2007, Saarela 2008, Saarela & Peterson 2012) or as a synonym of *B. anomalus* (Kearney & Peebles 1960, Hitchcock *et al.* 1969, Jones *et al.* 1997, Douglas *et al.* 2001), and the characters used to distinguish these taxa have not been applied consistently. Hitchcock (1913) recognized only *B. porteri* in México. Wagnon (1952) distinguished *B. anomalus* from *B. porteri* by lower glumes 1- or 3-nerved [vs. consistently 3-nerved], auricles usually present on lower leaves [vs. absent] and the midrib of the culm leaves tapered just below the collar [vs. not tapered just below the collar]. By these criteria, he did not consider *B. porteri* to be present in México. By contrast, Soderstrom & Beaman (1968) recognized both *B. anomalus* and *B. porteri* in México, and their circumscription of the species was different than that of Wagnon (1952). They treated plants with 1-nerved lower glumes, awnless upper glumes and lemmas usually obtuse as *B. anomalus*, and plants with 3-nerved lower glumes, upper glumes awn-tipped and lemmas acute or bifid at the apex

as *B. porteri*, further noting that some specimens have unusual features. Subsequent to the revision of Soderstrom & Beaman (1968), both taxa have been recognized in México (Beetle 1977, 1987, Gould & Moran 1981, Rivera & Aranda 2004).

We find the character states used by Soderstrom & Beaman (1968) to be intermixed among specimens, and conclude that they cannot be used to distinguish two taxa. Our circumscription of taxa follows that of Wagnon (1952), which has been utilized in recent treatments of *Bromus* in North America (Pavlick 1995, Pavlick & Anderton 2007, Saarela 2008, Saarela & Peterson 2012). By these criteria, we have seen no specimens of *B. porteri* in México. *Bromus porteri* is distributed in western North America from Manitoba to British Columbia and south to California and New México (Pavlick & Anderton 2007).

**Specimens Examined:—COSTA RICA. Cartago:** Cantón de Turrialba, Cuenca del Matina, Estación Crestones, [9.4978°N, 83.5°W], 3630 m, 6 November 1996, *Billen Gamboa R. 828*, *E. Alfaro & A. Picado* (INB-60061, MO-5175364). **San José:** Cantón de Pérez Zeledón P.N. Chirripó, 9.4569°N, 83.5106°W, 3460 m, 7 December 1996, *E. Alfaro 1028* (CR-221452, INB-60060); Cantón de Pérez Zeledón P.N. Chirripó, 9.4664°N, 83.4972°W, 3440 m, 17 July 1998, *E. Alfaro 1734* (INB-60059, MO-5652818). **GUATEMALA**. **Solola:** ca. 4 km E of Godinez, [14.7°N, 91.1°W], 2100 m, 5 December 1963, *L.O. Williams, A. Molina R. & T. P. Williams 25190* (F-1652130); cerca la estación de micro-onda de Guatel, Sierra de Chuatroj, Santa Catarina Ixtahuacán, Sololá, 14.74°N, 91.29°W, 3200 m, 17 August 1977, *D.N. Smith 658* (F-185163, F-2069944). **Quezeltenango:** La Esperanza, [14.84°N, 91.52°W], 2400 m, September 1954, *M. de Koninck 50* (US-2151632, US-2153251). **MÉXICO. Aguascalientes:** Ladera N del Cerro San Juan, 5 km al E de Tepezela, [22.2167°N, 102.1667°W], 2300 m, *J. Rzedowski 25009* (MICH-1119140); Mpio. San José de Gracía, 12 km al SW de La Congoja, 22.09°N, 102.63°W, 2700 m, 16–17 October 1973, *J. Rzedowski & R. McVaugh 801* (MICH-1119142, NY, US); Sierra Fria Potosina, at 5.6 mi S of Jtn of road Rancho Cienega de Gallardo, 22.0967°N, 102.7094°W, 2594 m, 30 September 2012, *P.M. Peterson, K. Romaschenko, J. Rodriguez Avalos, M. Herrera-Simoni & K. Garcia Rodriguez 24840* (US). **Baja California Sur:** along trail to El Picacho de la Laguna, Sierra de la Laguna, E of Todos Santos, 23.5333°N, 110.0833°W, 1830 m, 26 December 1947, *A. Carter, A.M. Alexander & L. Kellogg 2395* (MEXU, US-1936958); La Chuparosa, 23.5667°N, 110°W, 17 October 1893, *T.S. Brandegee 73* (US-591101); La Chuparosa, 23.5667°N, 110°W, 2 October 1899, *T.S. Brandegee 27* (US-1009557); La Laguna, Sierra de la Laguna, E of Todos Santos, 23.5667°N, 110°W, 1650 m, 25 December 1947, *A. Carter, A.M. Alexander & L. Kellogg 2341* (US-1936947); La Paz, Sierra La Laguna, Valle, 23.5333°N, 109.9°W, 1800 m, 19 October 1998, *M. Domínguez L. 2632* (ARIZ-351918, SD-143637). **Chiapas:** ca. 15 mi SE of Teopisca, [16.45°N, 92.28°W], 2330 m, 21 August 1953, *J.R. Reeder & C.G. Reeder 2031* (RSA-POM-287190); Mpio. Zinacantán, along Mexican Hwy. 190 at paraje Granadilla, [16.5°N, 93°W], 4500 ft, 1 July 1965, *D.E. Breedlove 10609* (US-3007632). **Chihuahua:** 19.6 km W of Balleza and 74.2 km E of Guachochi, [27.19°N, 106.47°W], 2120 m, 18 September 1991, *P.M. Peterson, C.R. Annable & J. Valdés-Reyna 10753* (US); 30 km de Buenaventura, [29.93°N, 107.18°W], 5 September 1981, *Ma. Elena Siqueiros 1401* (MEXU); Sierra Madre Occidental, 20.3 mi S of Creel on road towards Rocheachic, 27.5387°N, 107.51°W, 2510 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15367* (CAN, MO, US); Sierra Madre Occidental, 9 mi S of Guachochi at edge of Barranca Río Verde 1 km along trail descending into canyon, [26.69°N, 107.06°W], 2470 m, 6 October 2000, *P.M. Peterson, J. Cayouette, G.A. Palma Aquirre & J.A. Bustillos Ramírez 15372* (CAN, US); along drainage of Río Candasneno at Cascada de Basaseachic, ca. 1 mi S of village of Basaseachic along trail leading to cascada, 28.1333°N, 108.25°W, ca. 2000 m, 14 October 1984, *R. & M. Spellenberg 7930* (NY). **Coahuila:** 16 mi S of Saltillo on MEX 57, [25.22°N, 101.1°W], 6800 ft, 21 July 1970, *L. H. Harvey 8501* (MICH-1119120); 21 km SE of Saltillo on Hwy. 57 towards Matehuala, 25.247°N, 100.9061°W, 2460 m, 19 September 2001, *P.M. Peterson & J. Valdés-Reyna 15806* (ANSM, CAN, MO, US); 26 mi E of Saltillo, 25.4167°N, 101.4°W, 2316 m, 3 September 1960, *J.R. Reeder, C.G. Reeder & T.R. Soderstrom 3292* (US-2473591); 4 km E of Los Lirios on road to Laguna de Sánchez, 50 km SE of Saltillo, [25.39°N, 100.41°W], 2600 m, 8 October 1988, *P.M. Peterson & C.R. Annable 06254* (US); Cañón de San Lorenzo, ca. 5 a 6 km al Oriente de Buenavista, paraje de "Los Aguajes", 2000 m, 20 November 1974, *J. Marroquín 3075* (ANSM); El Carmen, 29.15°N, 102.71°W, 26 August 1936, *E.G. Marsh, Jr. 628* (GH); entrance to Monterreal, at 33 mi E of Arteaga, 25.2365°N, 100.4426°W, 2619 m, 27 September 2001, *P.M. Peterson & J. Valdés-Reyna 15942* (ANSM, CAN, MO, US) & *15943* (CAN, US); just above Monterreal on road to Mesa de las Tabla and 34.7 mi E of Arteaga, 25.2291°N, 100.4331°W, 2733 m, 27 September 2001, *P.M. Peterson & J. Valdés-Reyna 15947* (ANSM, CAN, US); Maderas del Carmen, 11.2 mi NE of Los Pilares, 28.9367°N, 102.61°W, 1953 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20954* (CAN, MO, US); Maderas del Carmen, 13.7

mi NW of Pilares and 0.4 mi S of El Cinco Junction, 28.9538°N, 102.5853°W, 2365 m, 7 September 2005, *P.M. Peterson & J. Valdés-Reyna 18900* (CAN, MO, US); Maderas del Carmen, 13.8 mi NE of Los Pilares, 28.9536°N, 102.5854°W, 2335 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20978* (CAN, MO, US); Maderas del Carmen, 28.9899°N, 102.61°W, 2280 m, 8 September 2005, *P.M. Peterson & J. Valdés-Reyna 18917* (ANSM, CAN, MO, US); Maderas del Carmen, 9.5 mi NW of Pilares, 28.9318°N, 102.61°W, 1890 m, 7 September 2005, *P.M. Peterson & J. Valdés-Reyna 18879* (ANSM, CAN, MO, US); Mesa del Rosario, Santiago, 25.4333°N, 101.0167°W, 6 November 1983, *I. Cagral C. 645* (ANSM); Mpio. Arteaga, Sierra Rancho Nuevo, Cañón de San Juan, ca. 2 km al N de San Juan, 25.2614°N, 100.3361°W, 2600 m, 31 August 1997, *M.A. Carranza 2613, L. Zamora M. & D. Sánchez V.* (ANSM); Mpio. Arteaga, Ejido Agua Blanca, [25.44°N, 100.84°W], 2600 m, 22 July 1993, *J. Garza 4* (MEXU); Mpio. Arteaga, Ejido La Efigenia, [25.44°N, 100.84°W], 2460 m, 22 July 1993, *P. Lobato 24* (MEXU); Mpio. Arteaga, Sierra Catana, 40 km SW de Saltillo, [25.15°N, 101.18°W], *J.A. Villarreal Q., M.A. Carranza & J. Valdés R. 6576* (MEXU); Mpio. Arteaga, Sierra de Arteaga, Cañón de Jamé, 3 mi al E de Jamé, 25.35°N, 101.0336°W, 2180 m, 16 September 1989, *P.S. Hoge 225, M.E. Barkworth, J. Valdés-Reyna & J.A. Villarreal Q.* (ANSM); Mpio. Arteaga, Sierra Madre Oriental, 3 km al E de Los Lirios, 25.3669°N, 100.5833°W, 2604–2636 m, 22 October 2009, *J.A. Villarreal 9473, L. Ramírez, M. Zárate & J. Ayala* (ANSM); Mpio. Ocampo, Sierra del Pino, Ejido Acebuches, Cañón La Vaca, 1850 m, 2 October 2000, *M.A. Carranza 4072 & Ramírez* (ANSM); Mpio. Ramos Arizpe, Sierra de la Paila, Ejido el Cedral por el Cañón El Carmen, 1300–1600 m, *J. Valdés-Reyna 2167* (ANSM); Mpio. Saltillo, Sierra de Zapaliname, camino al Penitente, en vista del oso a orilla de camino Oeste de la Sierra, 25.3462°N, 101.95°W, 2953 m, 15 October 2005, *E. Francisco García 155 & S.G. Gómez Pérez* (ANSM); Mpio. Saltillo, Cerro El Penitente, en exposición noroeste de la sierra, 25.3478°N, 100.9022°W, 2035 m, 16 October 2005, *J.A. Encina 1796, F.J. Encina D., J.M. Guillermo E. & S.G. Gómez P.* (ANSM); Mpio. Saltillo, pies del Muerto, 25.355°N, 100.95°W, 2480–2560 m, 4 August 2000, *J.A. Encina 550 & alumnos de la Escuela Técnica Forestal No. 3* (ANSM); Mpio. Saltillo, along trail from camino El Cuatro to El Penitente, 25.3497°N, 100.908°W, 2840 m, 28 September 2007, *P.M. Peterson, J.M. Saarela & S.G. Gómez Pérez 21123* (CAN, MO, US) & *21125* (CAN, MO, US); Mpio. Saltillo, along trail from camino El Cuatro to El Penitente, 25.3548°N, 100.93°W, 1628 m, 28 September 2007, *P.M. Peterson, J.M. Saarela & S.G. Gómez Pérez 21121* (CAN, MO, US); Mpio. Saltillo, along trail from El Cuatro to El Penitente, 25.3494°N, 100.908°W, 2925 m, 28 September 2007, *P.M. Peterson, J.M. Saarela & S.G. Gómez Pérez 21130* (CAN, MO, US); Mpio. Saltillo, Cañón de Santa Rosa - los Aguajes, 25.3294°N, 100.4325°W, 2375 m, 28 June 2001, *J.A. Encina 719 con alumnos de la Escuela Técnica Forestal No. 3* (ANSM); Mpio. Saltillo, above El Penitente on ridge top, 25.346°N, 100.9°W, 3086 m, 28 September 2007, *P.M. Peterson, J.M. Saarela & S.G. Gómez Pérez 21135* (CAN, MO, US); Mpio. Saltillo, above El Penitente, 25.345°N, 100.91°W, 3048 m, 28 September 2007, *P.M. Peterson, J.M. Saarela & S.G. Gómez Pérez 21140* (CAN, MO, US); Mpio. Saltillo, along camino "El Cuatro", E of Saltillo, 25.3689°N, 100.91°W, 2356 m, 3 September 2005, *P.M. Peterson & J. Valdés-Reyna 18814* (ANSM, CAN, MO, US); Mpio. Saltillo, ca. 5 km E of Saltillo (Las Palapas) up camino de Cuatro, then up trail towards cumbre, 25.3576°N, 100.9333°W, 2246 m, 20 September 2003, *P.M. Peterson, J. Valdés-Reyna & R.H. Cárdenas 17865* (ANSM, MO, US); Mpio. Saltillo, E of Saltillo, 25.3468°N, 100.9016°W, 3070 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18799* (ANSM, CAN, US); Mpio. Saltillo, E of Saltillo, 25.3536°N, 100.92°W, 2400 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18782* (ANSM, CAN, MO, US); Mpio. Saltillo, E of Saltillo, 25.3556°N, 100.92°W, 2100 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18776* (US) & *18779* (ANSM, CAN, MO, US); Mpio. Saltillo, Cañon de San Lorenzo, 3 km S of Saltillo, 23.3333°N, 100.9333°W, 2500 m, 29 August 1995, *N. Snow, J. Valdéz Reyna & L. Arce González 6753* (MEXU, MO); Mpios. Cuatro Ciénegas and Ocampo, Cañón del Agua, 27.0611°N, 102.4111°W, 1900 m, 26 July 1977, *T. Wendt & J. Valdés-Reyna s.n.* (ANSM); Predio Santa Anita, en la Sierra de Rancho Nuevo al N de San Juan de los Dolores, en exposición norte de la sierra, 25.4469°N, 100.6025°W, 2880 m, 10 September 2005, *J.A. Encina 1436, F.J. Encina & J. López A.* (ANSM); Santa Rita, 2.5 mi S of La Casita, [25.63°N, 100.34°W], 20 September 1948, *Kenoyer & Crum 2915* (GH); SE of San Antonio de Las Alazanas and SE of Saltillo along road up to Coahuilón, [25.26°N, 100.54°W], 2800 m, 17 October 1989, *P.M. Peterson, J. Valdés-Reyna & J.A. Villarreal 08403* (US); Sierra Catana, 40 km SW de Saltillo, 25.25°N, 101.2°W, *J.A. Villarreal 6577, M.A. Carranza & H. Nieto* (ANSM); Sierra de la Concordia, 6 km al NE del Ejido La Casita, 25.2347°N, 100.3333°W, 2100–2300 m, 10 October 1996, *J.A. Encina & J. Závala B. 282* (ANSM) & *283* (ANSM); Sierra de la Gloria, SE of Monclova, [26.81°N, 101.3°W], 4 March 1939, *E.G. Marsh 1947* (GH, F-1254893); Sierra de Santa Rosa, [28.44°N, 102.06°W], 20 July 1938, *E.G. Marsh 1399* (GH, F-1254623); Sierra del Carmen, Ejido San Francisco, 28.9298°N, 102.47°W, 1490 m, 5 September 2005, *P.M. Peterson, J. Valdés-*

*Reyna & C. Sifuentes 18855* (ANSM, CAN, MO-6192498, US); Sierra El Astillero, 1.8 mi SW of Santa Rosa and 5.4 mi SW of San Pedro at trail head above water pump, 24.6349°N, 101.1132°W, 2550 m, 21 October 2007, *P.M. Peterson, J.M. Saarela & D. Stancik 21448* (CAN, MO, US); Sierra El Jardín, 29.0878°N, 102.63°W, 2214 m, 3 September 2006, *P.M. Peterson & S. Lara-Contreras 19927* (US); Sierra la Encantada, ca. 170 km de Múzquiz, cuesta de Malena, brecha a Boquillas de Carmen, 28.75°N, 102.3333°W, 8 September 1990, *M.A. Carranza C-830 et al.* (ANSM); Sierra Madre Oriental, road towards El Renacer de la Sierra and 36.5 mi E of Arteaga, 25.2206°N, 100.3896°W, 2821 m, 27 September 2001, *P.M. Peterson & J. Valdés-Reyna 15950* (ANSM, CAN, MO, US) & 15952 (CAN, MO, US); 40 mi S of Saltillo, [25.08°N, 100.36°W], July 1880, *E. Palmer 1372* (GH, mixed sheet with *B. densus*); Rancho Los Angeles, 48 km al sur de Saltillo, 25.4333°N, 100.6331°W, 1800 m, 16 July 1977, *F.A. Ibarro s.n.* (ANSM); La Siberia, Sierra de la Marta, cerca del Ejido Sta. Rita, ca. 20 km al SE de San Antonio de las Alzanas, 26.2333°N, 100.4167°W, 2400 m, 22 July 1983, *J. Valdés-Reyna et al. 159* [?] (ANSM); W slope of Sierra del Jardín above (E of) Rancho El Caballo, 29.0083°N, 101.8944°W, 1400–2250 m, 16 September 1972, *F. Chiang, T. Wendt & M.C. Johnston 9293* (NY); Sierra Madre Oriental, 5 mi W of Chapultepec on cutoff road between Hwy. 54 & 57, 23 mi S of Saltillo, 2410 m, 16 October 1995, *P.M. Peterson & M.B. Knowles 13271* (US); Sierra El Pino, 33.5 km W of Rancho El Cimarron,1850 m, 14 September 1991, *P.M. Peterson & C.R. Annable 10651* (US); Bosques de Montana, 5.7 mi E of Highway 57 on road towards Los Lirios, 25.3878°N, 100.7056°W, 2144 m, 19 September 2012, *P.M. Peterson, K. Romaschenko & J. Valdés-Reyna 24574* (US). **Distrito Federal:** 16 mi E of Amecameca on road towards Puebla, in Parque Nacional Izta-Popo, 19.0918°N, 98.68°W, 3390 m, 13 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16167* (CAN, MO, US); a las faldas del Cerro Teuhtli, Delegación Milpa Alta, [19.19°N, 99.02°W], 2470 m, 24 October 1985, *E. Manrique et al. 1239* (MEXU-1110814); Cerro Magdalena, Serranía de Ajusco, 19.2333°N, 99.1667°W, 23 October 1937, *E. Lyonnet & J. Elcoro 1881* (MO, US-1746400); Delegación Tlalpan, Volcán El Pelado, [19.15°N, 99.22°W], 3200 m, July 1985, *A. Miranda et al. 28* (MEXU); faldas del volcán Teuhtli, Delegación Milpa Alta, [19.19°N, 99.02°W], 2510 m, 13 November 1985, *A. Miranda & P. Guerrero 250* (MEXU-1110803); San Angel, [19.34°N, 99.19°W], 12 November 1929, *M. St. Pierre 836* (MICH-1119126); San Salvador Cuauhtenco, cerro San Bartolo Delegación Milpa Alta, [19.19°N, 99.09°W], 3070 m, 10 October 1985, *J.G. Serrano 268* (MEXU); Topilejo, 19.2008°N, 99.1428°W, 5 December 1925, *G. Woronow & S. Juzepczuk 795* (US-1274753); Valle de México, Topilejo, 19.2008°N, 99.1428°W, 2500 m, 3 August 1952, *E. Matuda 26201* (MEXU, US-2119846); vertiente NE del Cerro Pelado, cerca de Parres, delegacíon de Tlalpan, [19.15°N, 99.22°W], 3400 m, 7 August 1983, *J. Rzedowski 38156* (MEXU-849547, MO); Volcán Pelado, *s.d.*, [19.15°N, 99.22°W], *J. López P. et al. PELE35*-2 (MEXU-770226); W of km 30 - Cuernavaca Hwy., [19.13°N, 99.18°W], 7 August 1940, *I.K. Langman 2612* (US-2436903). **Durango:** 0.8 mi S of Francisco I. Madero and 2.3 mi N of Canoas, 22.6482°N, 104.2895°W, 2720 m, 2 October 2001, *P.M. Peterson & M.S. González-Elizondo 16030* (CAN, MO, US); 18.4 mi S of Mezquital on road towards Cuesta Blanca, 23.3475°N, 104.3331°W, 2382 m, 7 September 2006, *P.M. Peterson & F. Sánchez Alvarado 19975* (CAN, US); 2 mi S of Fancisco I. Madero and 1.2 mi N of Canoas, 22.6322°N, 104.2926°W, 2700 m, 1 October 2001, *P.M. Peterson & M.S. González-Elizondo 16012a* (CAN, US); 2.7 mi N of Fancisco I. Madero and 2.4 mi S of Ciemega del Oro, 22.6891°N, 104.2777°W, 2800 m, 1 October 2001, *P.M. Peterson & M.S. González-Elizondo 16025* (CAN, US) & *16026* (CAN, US); 2.8 mi N of Ciénega del Oro and 7.3 mi N of Fancisco I. Madero, 22.7434°N, 104.2525°W, 2780 m, 1 October 2001, *P.M. Peterson & M.S. González-Elizondo 16028* (CAN, MO, US); 20 mi S of El Mezquital, 23.3154°N, 104.3434°W, 2522 m, 11 September 2003, *P.M. Peterson & F. Sánchez-Alvarado 17731* (MO, NY, US); 3.4 mi NE of El Encinal on road towards Minas Promontoria, 25.1802°N, 105.1619°W, 2407 m, 2 October 2002, *P.M. Peterson, M.S. González-Elizondo & L.E. Brothers 16914* (CAN, US); 4.7 mi NE of El Encinal on road towards Minas Promontoria, 25.1885°N, 105.1516°W, 2575 m, 2 October 2002, *P.M. Peterson, M.S. González-Elizondo & L.E. Brothers 16922* (CAN, US); 40.3 mi W of Huejuquilla towards Canoas, 22.6324°N, 104.2204°W, 2430 m, 30 September 2001, *P.M. Peterson & M.S. González-Elizondo 16004* (CAN, MO, US); 5 mi W of La Ventana on road towards La Guajolota, 22.9618°N, 104.4986°W, 2486 m, 12 September 2003, *P.M. Peterson & F. Sánchez-Alvarado 17763* (US); 5 mi W of Llano Grande along Durango-Mazatlan Hwy., 23.8412°N, 105.271°W, 2499 m, 9 September 1967, *J.R. Reeder & C.G. Reeder 4904* (MSC-231763; US-3059166); 53 km W of Durango on Hwy. 40 towards El Salto, 25.9161°N, 104.9904°W, 2460 m, 6 October 2002, *P.M. Peterson & L.E. Brothers 16942* (US); ca. 1.5 km below Santa Bárbara along Arroyo Santa Bárbara, 23.6581°N, 105.4314°W, 2700 m, 16 September 2003, *P.M. Peterson, S. González-Elizondo & G.A. Teña-González 17801* (CAN, MO, US); Coyotes Hacienda, 63 road mi W-SW of central Durango, 23.8167°N, 105.3333°W, 2400–2500 m, 1 September 1951, *J.H. Maysilles 7621* (MICH-119155, US-2119100); Mpio. Mezquital, 19.7 mi S

of Mezquital on road towards Mesa La Gloria, 23.3172°N, 104.3381°W, 2500 m, 19 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19023* (CAN, MO, US); Sierra Madre Occidental, 0.5 mi SE of Los Charcos, 23.016°N, 104.2897°W, 2690 m, 21 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19048* (US); Sierra Madre Occidental, 20 mi S of El Mezquital, 23.3156°N, 104.3433°W, 2522 m, 11 September 2003, *P.M. Peterson & P. Catalán 17731* (RSA-POM-725717); Sierra Madre Occidental, 3.2 mi SW of Las Bayas on road towards Ceballos, [23.53°N, 104.83°W], 2780 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15419* (US); Sierra Madre Occidental, 56 km W of Durango along Hwy. 40 towards El Salto and 0.4 mi E of entrance to Parque El Tecuán, 23.9109°N, 105.0252°W, 2536 m, 3 October 2007, *P.M. Peterson & J.M. Saarela 21251* (CAN, US); Sierra Madre Occidental, 6.8 mi E of Los Canoas on road towards Huejuquilla El Alto, 22.6349°N, 104.2163°W, 2460 m, 21 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19062* (US); Sierra Madre Occidental, 68 km W of Durango on Hwy. 40 towards El Salto, 23.8827°N, 105.122°W, 2720 m, 8 October 2000, *P.M. Peterson & J. Cayouette 15401* (CAN, MO, US); Sierra Madre Occidental, along Hwy. 40 from Durango City to El Salto, 30 mi W of Durango, 2560 m, 24 September 1992, *K.W. Allred 5846, T. Columbus & J. Valdés-Reyna* (ANSM); Sierra Madre Occidental, at 20 km mark up road towards Topia and 19.1 mi NW of Papasquiaro, 25.1158°N, 105.5838°W, 2580 m, 11 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15425* (CAN, MO, US); 14.4 mi S of Casas Blancas, and 2.5 mi N of Unión y Progreso, 25.2567°N, 104.9731°W, 3140–3250 m, 29 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23687* (US); Sierra Madre Occidental, 20 mi SE of Mezquital on road to Charcos, 2450 m, 7 November 1995, *P.M. Peterson, M.B. Knowles, C. Dietrich, S. Braxton & M.S. González-Elizondo 13635-A* (US). **Guanajuato:** 2–4 km E of Guanajuato, 21.0167°N, 101.22°W, 16 October 1952, *E.R. Sohns 291* (US-2116761); ca. 12 mi from Guanajuato on road to Santa Rosa, 21.1°N, 101.13°W, 29 October 1946, *H.E. Moore, Jr. 1331* (US-1963086); ca. 2 km NE of San Miguel, Cerro de la Presa 20.7167°N, 100.6833°W, 31 October 1952, *E.R. Sohns 498* (US-2116916); ca. 2.5 km S of Guanajuato, on the slopes of La Bufa, 20.99°N, 101.25°W, 18 October 1952, *E.R. Sohns 346* (US-2116796); ca. 6 km E of Guanajuato, 21.0167°N, 101.19°W, 17 October 1952, *E.R. Sohns 299* (MICH-1119151, MO, US-2116766); Cerro Culiacán, cerca de la torre de microondas, E de Victoria de Cortázar, [20.65°N, 101.33°W], 2800 m, 31 August 1981, *Rafael Guzmán 4465* (MEXU); Cristo Rey en el Cerro del Cubilete, [21.01°N, 101.37°W], 2 September 1981, *A.A. Beetle 7376* (MEXU-10153); Mpio. Cortázar, Cerro de Culiacan, [20.65°N, 101.33°W], 2800 m, 1 September 1981, *J. Sánchez Castellanos 97-J* (MEXU); Mpio. Dolores Hidalgo, Ejido San Cristóbal, al sureste de la comunidad El Terreno, 20.9033°N, 101.0117°W, 2700 m, 2 July 1997, *J.J. Macías Cuéllar 843-JJMC* (MEXU); Mpio. Guanajuato, camino Valencia-Cubilete, [21.02°N, 101.26°W], 2300 m, 2 September 1981, *J. Sánchez Catellanos 123-J* (MEXU); Mpio. León, Vergel de la Sierra, 21.3197°N, 101.6278°W, 2627 m, 14 July 1997, *S. Rojas Villegas 494* (MEXU); Mpio. Ocampo, Ejido "Laguna de Guadalupe", [21.65°N, 101.48°W], 2210 m, 7 October 1992, *S. Rojas Villegas 11* (MEXU-1089790); 0.5 km E of Jofre, 21.5239°N, 100.4803°W, 2434 m, 16 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni 23423* (US). **Hidalgo:** 13 mi E of Pachuca, 20.1167°N, 98.5333°W, 2621 m, 11 September 1963, *J.R. Reeder & C.G. Reeder 3725* (US-2473588); 20 km al NE de Zimapan, [20.74°N, 99.38°W], 2200 m, 28 October 1965, *L. González Quintero 3287* (MICH-1119149); 4 mi W of Tulancingo, 20.07°N, 98.43°W], 8 September 1962, *F.W. Gould 10164* (MICH-1119137); by Río Panotlan, between Zacualtipán and Olotla on road to Metztitlan, 20.77°N, 98.6667°W, 1600–2000 m, 15 October 1949, *H.E. Moore, Jr. 5343* (MEXU-143526, MICH-1119130, GH); ca. 2 mi S of Barranca de los Marmoles along Pan-American Hwy., 20.9667°N, 99.2°W, 2300 m, 4 August 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1642* (RSA-POM-253209, US-2473575); ca. 46 mi S of Tamazunchale on Hwy. 85, [21.06°N, 99.06°W], 28 September 1976, *F.W. Gould 14835* (MEXU-957936); Jacala, [21.01°N, 99.19°W], 5000 ft, 8 July 1939, *V.H. Chase 7364* (ANSM, MICH-1119281, NY, GH, US-1763084); Mpio. Jacala, 21.0167°N, 99.1833°W, 1372 m, 26 June 1939, *V.H. Chase 7172* (US-1763085); Mpio. Tepeapulco, Cerro del Tecolote, [19.7667°N, 101.8667°W], 2500 m, 19 August 1975, A. *Ventura A. 136* (ANSM); Mpio. Tlanalapán, 3 km al NNE de Tepeapulco, and 1 km al E de la carretera Tepeapulco-Sto. Tomás, 19.7833°N, 98.55°W, 2560 m, 16 September 1976, *S.D. Koch 76160* (MEXU-270644, MO, US-2824599); near Tula, 20.05°N, 99.35°W, 3–4 July 1905, *J.N. Rose, J.H. Painter & J.S. Rose 8357* (US-451850); Pachuca, 20.1167°N, 98.7333°W, 2438 m, 6–7 September 1910, *A.S. Hitchcock 6741* (US-1009554); Real del monte Hidalgo, 20.1333°N, 98.6667°W, 1 October 1910, *I.W. Clokey 1911* (US-726920). **Jalisco:** km 6 carretera La Manzanilla a Mazamitla, La Manzanilla, 19.97°N, 103.19°W, 1800 m, 21 July 1973, *C. Luis Diazhuna 4240* (RSA-POM-302097); N slopes of the Nevado de Colima, W of summit of the N ridge, near junction of the old pack road to Zapotlán with Atenquique-Jazmín road, 19.65°N, 103.5333°W, 2100–2200 m, 15 October 1952,

*R. McVaugh 13509* (MEXU-5983, MICH-1119144, US-2150832); NE slopes of the Nevado de Colima, below Canoa de Leoncito, 19.6167°N, 103.65°W, 2250–2550 m, 13 October 1952, *R. McVaugh 13501* (MICH-1119141, US-2118493); Sierra del Tigre, 3 mi S of Mazamitla, 19.88°N, 103.02°W, 2100–2200 m, 16 September 1952, *R. McVaugh 12969* (MEXU-5984, ICH-1119147, US-2150768); Zapotlán, 19.75°N, 103.5°W, 1524 m, 22–25 September 1910, *A.S. Hitchcock 7241* (US-1009555). **Estado de México:** 50 mi SE of San Juan del Río, Queretaro, on Hwy. 55, 19.76°N, 99.86°W, 2652 m, 6 September 1959, *T.R. Soderstrom 518* (US-2378274); Mt. Popocatépetl, 19.0333°N, 98.6333°W, 2743 m, 5–6 August 1910, *A.S. Hitchcock 6011* (US-1009553); a 3 km sobre la desviación a Rancho Viejo, carretera Toluca-Temascaltepec, 2610 m, 25 October 1983, *Manrique, Jaramillo & Núñez 442* (MEXU-1098033); carretera Tepotzotlán-Villa del Carbón, 1/2 km de la desviación Arcos del Sitio, 19.72°N, 99.46°W, 2300 m, 30 July 1981, *R. Guzmán M. 3938* (MEXU-1110770); carretera Villa Victoria-El Oro, [19.64°N, 100.17°W], 2570 m, 9 August 1981, *R. Guzmán 4246* (MEXU); Cerro La Mesa Ahumada, [19.8342°N, 99.2033°W], 2400 m, 6 September 1980, *Romero & Rojas 410* (MEXU-674482); Chapa de Mota, 19.9914°N, 99.5161°W, 2800 m, 1 November 2000, *Adrian Vega 108* (MEXU); Crucero Sultepec-camino al Nevado de Toluca, [19.14°N, 99.74°W], 7 September 1982, *R. Guzmán 6009* (MEXU); entre Magdalena y Tapaxco, [19.7667°N, 100.0667°W], 9 August 1981, *R. Guzmán 4259* (MEXU); Jilotepec, 19.97°N, 99.53°W, 2200 m, 21 September 1952, *E. Matuda 26709* (MEXU); Mpio. Amecameca, km 20 carretera Amecameca-Tlamacas, [19.09°N, 98.69°W], 2 October 1992, *A. Miranda & G. Villegas 652* (MEXU); Mpio. Donato Guerra, a 1.25 km al N de Las Mesas de San Martín, 19.3478°N, 100.08°W, 2672 m, 29 October 1998, *J.A. García Ruíz 2* (MEXU); Mpio. Huizquiluca, Rancho et Hielo, km 22 carretera Naucalpan-Toluca, [19.36°N, 99.58°W], 3050 m, 1 October 1992, *A. Miranda et al. 587* (MEXU); Mpio. Jocotitlán, ladera SE del Cerro Jocotitlán, [19.74°N, 99.76°W], 3450 m, 17 October 1990, *M. González Ledesma & J. Gracía P. 291* (MEXU-737772); 1 mi W of Río Frio on road to Puebla from México City, 28 July 1950, *J.R. Reeder & C.G. Reeder 1495* (RSA-POM-253392); 1.9 mi W of Chiltepec on Hwy. 12, 18.9268°N, 99.8442°W, 2596 m, 10 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21363* (CAN, US); 12.1 mi NE of San Miguel, SW of Volcán Toluca, 19.0317°N, 99.9102°W, 2826 m, 10 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16140* (CAN, US); 2 km al W de San Miguel Tequixquiac, [19.91°N, 99.15°W], 23 June 1968, 2400 m, *J. Rzedowski 25826* (MICH-1119131, MSC-223039); 2.8 mi E of Ocuilán Arteaga, 18.9808°N, 99.3786°W, 2478 m, 11 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21372* (CAN, MO, US) & *21373* (CAN, US); 20 mi S of México City, [19.14°N, 99.02°W], 1 September 1946, *A.I. Ortonburger, J.B. Paxon & F.A. Barkley 16M741* (F-1408939); 27 mi S of San Juan del Río, [20.09°N, 99.7°W], 28 July 1960, *F.W. Gould 9205* (MICH-1119122); 3 mi W of Avila Camacho, 9000 ft, 9 August 1971, *L.H. Harvey 8791* (MICH-1119292); 3.6 mi S of Aculco on Hwy. 55, 20.0439°N, 99.87°W, 2602 m, 8 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21332* (CAN, MO, P-03216872, US); 5.6 mi NE of La Comunidad along Hwy. 134 towards Toluca, 19.1848°N, 99.87°W, 2980 m, 9 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16134* (CAN, US) & *16135* (CAN, MO, US); 55 km SE México City, 19.0674°N, 98.7858°W, 3200 m, 14 July 1942, *J.N. Weaver 791* (US-2436904); ca. 1 mi W of Río Frio on road to Puebla from México City, 19.35°N, 98.6667°W, 28 July 1950, *J.R. Reeder & C.G. Reeder 1495* (US-2473590); ca. 3 km (air) W of Monte Río Frio Pass, (9 km W of Río Frio), near top of W slope Monte Río Frio, along Pan Am Hwy., 19.35°N, 98.75°W, 2900 m, 18 August 1960, *H.H. Iltis, R. Koeppen & F.S. Iltis 1049* (MICH-1119139, US-2380090); ca. 5 km W of San Andreas, Pedregal de San Angel, 19.37°N, 99.18°W, 13 October 1952, *E.R. Sohns 178* (MICH-1119157, US-2116655); mile S of Tlalnepantla, 19.55°N, 99.1833°W, 17 July 1940, *I.K. Langman 2457* (US); Mpio. Amecameca, Zumpango, carretera al Paso de Cortés, 16 km al E del entronque con la carretera Amecameca-Cuautla, Mor. 9., 19.06°N, 98.7°W, 3300 m, 20 November 1976, *S.D. Koch 76275A* (US-2824582); Mpio. Texcoco, 2 km al SE de San Pablo Ixayoc, sobre el camino hacia el aguaje, 12.5 km al SE de Texcoco, 19.42°N, 98.83°W, 2670 m, 21 October 1976, *S.D. Koch 76213* (MO, US-2824631); Mpio. Texcoco, Lado Sur de la Cañada de Aguas, 13.5 km al SE de Texcoco (11 km al ESE de Coatlinchón, por el camino que pasa., 19.41°N, 98.82°W, 2740 m, 29 July 1977, *S.D. Koch 77111* (US-2832210); near La Cima, along old Cuernavaca Hwy. (Rt. 95) between km 43 and 44, [19.58°N, 99.26°W], 1 September 1961, *E.K. Longpre 417* (MSC-232149); near Toluca, 19.3°N, 99.65°W, 4 September 1903, *J.N. Rose & J.H. Painter 6796* (NY, US-450355); Oro, 19.8°N, 100.1333°W, 2500 m, 28 September 1952, *E. Matuda et al. 27258* (US-2119847); Paso de Cortés, [19.09°N, 98.64°W], 3680 m, 17 September 1958, *J.H. Beaman 2577* (GH, MSC-162396); Tehuacán area, along Tehuacán-Orizaba highway just above Azumbilla, 18.7°N, 97.41°W, 1500–1800 m, 18 July 1961, *C.E. Smith Jr., F.A. Peterson & N. Tejeda 3962* (US-2382355); Temascaltepec District, Tequesquipan, 19.0578°N, 99.9506°W, 2480 m, 18 August 1932, *G.B. Hinton 133* (GH, US-1612064); Toluca, 19.3°N, 99.65°W, 2682 m, 13 September 1910, *A.S. Hitchcock 6895* (US-

1009564); Volcán de Toluca, 19.1014°N, 99.7694°W, 3550 m, 18 October 1953, *E.R. Sohns & E. Matuda 1011* (US-2118917). **Michoácan:** 0.6 mi N of Huajumbaro, 19.6906°N, 100.74°W, 2360 m, 8 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16131* (CAN, MO, US); 1 km al SE de Zíngiro, sobre el camino a Erongarícuaro, [19.56°N, 101.71°W], 2400 m, 2 November 1989, *J. Rzedowski 49209* (F-2120708); 5.8 mi NE of Ario de Rosales off Hwy. 120, up road towards Microondas, 19.2115°N, 101.63°W, 2200 m, 8 October 2001, *P.M. Peterson & O. Rosales 16121* (CAN, MO, US); 9 mi W of Zacapú, 19.82°N, 101.92°W, 2408 m, 18 October 1966, *J.R. Reeder & C.G. Reeder 4747* (US-2982194); above Lago de Pátzcuaro, 22 km (by road) NW of Quiroga on Hwy. 15, 19.75°N, 101.6667°W, 2050 m, 24 September 1965, *K. Roe & E. Roe 2068* (MICH-1119132, US-3115393); ca. 1 km S of El Tren, and km 10 NW from junction with MEX Hwy. 15 (México-Morelia), on road to and SSE of Zinapecuaro, 19.75°N, 100.75°W, 2300 m, 27 September 1978, *H.H. Iltis, J. Doebley & A. Lasseigne 680* (MEXU); ca. 12 mi W of Quiroga, 19.76°N, 101.69°W, 2134–2743 m, 3 October 1953, *E.R. Sohns 801* (US-2118723) & *802* (US-2118724); ca. 20 mi W of Morelia, 19.63°N, 101.47°W, 1524–2134 m, 3 October 1953, *E.R. Sohns 762* (US-2118691) & *765* (US-2118694); cerca del Puerto de los Copales, 8 km al E de Morelia, sobre el camino a Mil Cumbres, 2050 m, 8 October 1986, *J. Rzedowski 40850* (ANSM); Cerro Grande de Cujaruato, al SW de la Piedad, [19.99°N, 102°W], 2500 m, 16 November 1971, *J. Rzedowski & R. McVaugh 552* (MICH-1119146); Cima de Cuernavaca, September 1924, *E. Lyonnet 47* (GH, MO, NY); Mpio. de Tangancicuaro, Las Cañas, estribaciones inferiores noroccidentales del Cerro Patamban, [19.75°N, 102.34°W], 2500 m, 19 November 1971, *J. Rzedowski & R. McVaugh 622* (MICH-1119145, NY); MEX 15, 56 mi W of Morelia, 20.19°N, 102.39°W, 7000 ft, 22 August 1970, *L.H. Harvey 8682* (MICH-1119148); Morelia, Quinceo, 19.7167°N, 101.2333°W, 2800 m, 11 November 1909, *G. Arséne 7286* (US-1000494); Mpio. Ocampo, camino a Tintanueras, Ejido El Rosario, 19.59°N, 100.2656°W, 3400 m, 20 September 2001, *Ma. Guadalupe Cornejo Tencrio & G. Ibarra Manríquez 314* (MEXU-1062900, NY); Parte m s alta de Cerro Grande de Cujaruato, al SW de la Piedad, 20.1°N, 102.2°W, 2500 m, 16 November 1971, *J. Rzedowski & McVaugh 552* (US-3096843, NY); 27 km to Zacapu, [19.82°N, 101.79°W], 27 August 1981, *A.A. Beetle M-7088* (MEXU-1088986, MO); Mpio. Santa Clara del Cobre, Zirahuén, [19.44°N, 101.74°W], 2150 m, 3 September 1985, *J.M. Escobedo 43* (MEXU, RSA-POM-356516). **Morelos:** 14 km antes de llegar a Cuernavaca por la carretera federal, [18.99°N, 99.19°W], 25 July 1980, *G. Andrade & C.H. Ramos s.n.* (MEXU-1089786); Cuernavaca-México City road, km 45[?], N of Tres Cumbres, [19.18°N, 99.16°W], ca. 3100 m, 18 July 1954, *G.B. van Schaack 3418* (ANSM, MICH-1119129); Toro, 19.0939°N, 99.2414°W, 5 August 1924, *G.L. Fisher 120* (MO, NY, US-1207917); Lagunas Zempoala, 19.0494°N, 99.3175°W, 17 September 1938, *E. Lyonnet 2495* (US-1761291). **Nuevo León:** 10.6 mi NE of San Antonia de Peña Nevada on road towards La Siberia, 23.8238°N, 99.8757°W, 2653 m, 22 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16783* (ANSM, CAN, MO, US); 3 mi N of La Siberia on road towards La Encantada, 23.8743°N, 99.8058°W, 2826 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16768* (ANSM, CAN, US) & *16765* (ANSM, CAN, US); 4 km W of Tepehuanes on road towards Zaragoza, 23.9349°N, 99.7312°W, 1980 m, 21 September 2001, *P.M. Peterson & J. Valdés-Reyna 15863* (CAN, MO, US) & *15872* (CAN, US); 4.6 mi NE of Dulces Nombres, 23.9707°N, 99.54°W, 1625 m, 23 September 2001, *P.M. Peterson & J. Valdés-Reyna 15930* (ANSM, US); 54 km W of Linares on Hwy. 3, 24.5229°N, 99.9874°W, 2476 m, 22 September 2001, *P.M. Peterson & J. Valdés-Reyna 15891* (CAN, US); 7.1 mi S of Zaragoza on road towards Ejido La Encantada, 23.9493°N, 99.7934°W, 1848 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16753* (ANSM, CAN, MO, US); 8 km S of La Cruata on Hwy. 3 towards Aramberri, 24.4421°N, 99.9553°W, 2313 m, 22 September 2001, *P.M. Peterson & J. Valdés-Reyna 15889* (ANSM, CAN, US); 9.8 mi S of Zaragoza on road towards Ejido La Encantada, 23.9313°N, 99.7947°W, 2155 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16756* (ANSM, CAN, MO, US); carretera San Roberto-Galeana, km 78, 25.3°N, 100.24°W, 1900 m, 2 September 1997, *M. Castillo B. & P. Jauregui R. 285* (MEXU); Cerro de la Silla, near Monterrey, 25.6333°N, 100.2333°W, 1575 m, 23 June 1939, *L.H. Harvey 987* (MICH-1119271, US-1762719); Chipinque, [25.72°N, 100.38°W], 1 July 1947, *F.A. Barkley, G.L. Webster & C. Rowell 7129* (F-1499765) & *7149* (F-1500318); Hacienda Pablillo, Galeana, [24.8333°N, 100.38°W], 14 August 1936, *M. Taylor s.n.* (F-862670); Hacienda Vista Hermosa, 35 mi S of Monterrey, [25.17°N, 100.31°W], 810 m, 25 June 1939, *L.H. Harvey 1040* (MICH-1119288); La Casita, [25.63°N, 100.34°W], 22 August 1948, *Kenoyer & Crum 3051* (GH); Mpio. Linares, El Pinal-Las Palmas, 1500 m, 10 October 1980, *J. Ortiz E. s.n.* (ANSM); near Chipinque, on Sierra Anáhuac, S of Monterrey, [25.72°N, 100.38°W], 1800 m, 8 June 1952, *F.W. Gould 6324* (MICH-1119133, RSA-POM-108458); on Chipinque, Sierra Madre Mountains behind Monterrey, 25.9167°N, 100.3833°W, 7 September 1948, *G.L. Webster & E. Aguirre 2941* (US-2078874); Puerto del Aire, Santiago, 790 m, 22 May 1983, *I. Cabral C. 305*

(ANSM); road to La Tinaja, 23.8873°N, 99.7956°W, 2500 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16763* (ANSM, CAN, MO, US); S of Zaragoza on road towards Ejido La Encantada, 23.9276°N, 99.7978°W, 2171 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16760* (ANSM, CAN, MO, US); Sierra La Lagunita, 11.8 mi SE of Aramberri on road towards Agua Fría, 24.065°N, 99.737°W, 1817 m, 19 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16703* (ANSM, CAN, US); Sierra La Lagunita, 9.5 mi SE of Aramberri on road towards Agua Fría, 24.0605°N, 99.7599°W, 1450 m, 19 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16699* (ANSM, CAN, US); Sierra Las Cautivas, 1.0 mi W of Dulces Nombres, 24.013°N, 99.5746°W, 1983 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21083* (CAN, US); Sierra Las Cautivas, 10.6 mi E of Zaragoza on road towards Dulces Nombres, 23.992°N, 99.6846°W, 2270 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21112* (CAN, US); Sierra Las Cautivas, 12.0 mi E of Zaragoza on road towards Dulces Nombres, 24.0001°N, 99.6747°W, 2088 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21103* (CAN, MO, US); Sierra Las Cautivas, 31.6 mi W of Ejido Guayabas and 5.4 mi W of Dulce Nombres, 23.9775°N, 99.5561°W, 1833 m, 25 September 2007, *P.M. Peterson & J.M. Saarela 21073* (CAN, US); Sierra Las Cautivas, 7.7 mi E of Zaragoza on road towards Dulces Nombres, 23.9784°N, 99.7005°W, 2578 m, 27 September 2007, *P.M. Peterson & J.M. Saarela 21114* (CAN, MO, P-03631105, US); Sierra Las Cautivas, 8.7 mi SW of Dulces Nombres and 18.1 mi E of Zaragoza, 23.9501°N, 99.6473°W, 2385 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21100* (CAN, US); Sierra Madre Mts., Monterrey, 25.52°N, 100.21°W, 15 July 1933, *C.H. Mueller & M.T. Mueller 425* (GH, US); Sierra Madre Mts., Monterrey, 25.52°N, 100.21°W, 23 July 1933, *C.H. Mueller & M.T. Mueller 428* (GH); Sierra Madre Oriental, 16 km NE of Sandia on road to La Ascension, 24.3071°N, 99.9921°W, 2000 m, 19 September 2001, *P.M. Peterson & J. Valdés-Reyna 15824* (CAN, US); Sierra Madre Oriental, ascent to Mesa de la Camisa, ca. 15 mi SW of Galeana, [24.61°N, 100.04°W], 22 July 1934, *C.H. Mueller & M.T. Mueller 1168* (F-938865, GH, MICH-1119159); Sierra Madre Oriental, beyond Pablillo toward Santa Clara, ca. 15 m SW of Galeana, [24.62°N, 99.74°W], 18 July 1934, *C.H. Mueller & M.T. Mueller 1078* (GH); Sierra Madre Oriental, Dulces Nombres, Nuevo León, and just E of border into Tamaulipas, 25.1583°N, 98.81°W, 1700 m, 14 July 1948, *F.G. Meyer & D.J. Rogers 2778* (US-1962989); Sierra Madre, near Monterrey, 25.52°N, 100.21°W, 30 June 1888, *C.G. Pringle 2052* (US-1009570); W slopes of the Cerro, 23.8267°N, 99.8667°W, 2900 m, 22 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16780* (CAN, US); W slopes of the Cerro, 23.8267°N, 99.87°W, 2900 m, 22 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16778* (CAN, US); ca. 11 mi S of San Antonio in pine forest, [24.21°N, 99.63°W], 6 October 1976, *F.W. Gould, K.W. Allred & C. Clark 14973* (MEXU-842648); Sierra Madre Oriental, 2 mi S of Los Mimbres and 2.6 mi N of Ejido La Lagunita, 24.9509°N, 100.26°W, 2470 m, 10 September 2005, *P.M. Peterson & J. Valdés-Reyna 18959* (ANSM, CAN, US); Mpio. San Pedro Garza Garcia, Parque Ecológico Chipinque, vereda El Empalme, 25.6064°N, 100.96°W, 1266–1291 m, 6 October 2005, *J.A. Encina 1539, F.J. Encina & I. Ramírez* (ANSM); Sierra Las Cautivas, 7.6 mi SW of Dulces Nombres and 19.2 mi E of Zaragoza, 23.9459°N, 99.64°W, 2450 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21098* (CAN, US); Mpio. de Galeana, Arroyo Hondo, Hacienda San José de Raíces, 31 July 1935, *C.H. Mueller 2290* (F-886780, GH, MICH-1119283, NY, P-02630113, US-1645342); Cerro Potosí, at NE summit of mountain, ca. 3650 m, 13 September 1960, *J.H. Beaman 4467* (GH, MSC-171507, US-2381745); Mpio. Santa Catarina, edge of Parque Nacional Cumbres de Monterrey, slopes above Puerto del Conejo, 25.4931°N, 100.5839°W, 2650 m, 6 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Valdés-Reyna & I. Cabral C. 23139* (US); 7.7 mi E of Hwy. 57 on MEX 31 towards Linares, 24.6828°N, 100.1725°W, 2850 m, 8 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23199* (US); Sierra Madre Oriental, 3 mi W of Dieciocho de Marzo up road towards Cero Potosi, 2200 m, 18 October 1995, *P.M. Peterson & M.B. Knowles 13326* (US). **Oaxaca:** 13.5 km W of San Juan Mixtepec and 1.6 km E of San Martín, [16.26°N, 96.44°W], 2480 m, 03 September 1990, *P.M. Peterson, A. Campos-Villanueva 09766* (US); 15 kms de San Miguel Peras, [16.94°N, 97.02°W], 21 July 1979, *P. Guerrero 86* (MEXU-1099493); después de Río Oro 2 km delante de Tamazulapa rumbo a México, 1850 m, 21 June 1980, *A.A. Beetle M-4584* (MEXU-1098040); Mpio. Tepelmeme al N de El Rodeo ladera W de Cerro Verde (Jaderoaria), 18.07°N, 97.31°W, 11 September 1990, *J. Sánchez-Ken, P. Tenorio L. & A. Salinas T. 172* (RSA-POM-544635, F-2128583); Sierra de San Felipe, 17.1°N, 96.85°W, 10,000 ft, 1894, *C.L. Smith 942* (F-1524351, US-1009559); Sierra de San Felipe, 17.1°N, 96.85°W, 9500 ft, 18 September 1894, *C.G. Pringle 4898* (CAN-159611, GH, MO, MSC-4592, NY, P-02630110, US, 3 sheets). **Puebla:** 23.4 E of Amecameca on road towards Puebla in Parque Nacional Izta-Popo, 19.0897°N, 98.6064°W, 3330 m, 13 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16169* (CAN, US); 3.2 mi W of Xalitzintla and 27 mi E of Amecameca, 19.0795°N, 98.5629°W, 2950 m, 13 October

2001, *P.M. Peterson & Y. Herrera-Arrieta 16176* (CAN, MO, US); 8 km de Tehuacán rumbo a Orizaba, 18.46°N, 97.39°W, 2200 m, 14 October 1985, *I. Núñez et al. 110* (MEXU-1110773); 9 mi E of paso de Cortés, 19.0801°N, 98.5592°W, 2904 m, 12 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21401* (MO, US); along Tehuacán-Orizaba highway just above Azumbilla, [18.68°N, 97.47°W], 1500–1800 m, 18 July 1961, *C.E. Smith, Jr., F.A. Peterson & N. Tejeda 3962* (F-1555797); ca. 16 mi W of Texmelucan near the continental divide, 19.32°N, 98.5333°W, 2980 m, 31 August 1953, *J.R. Reeder & C.G. Reeder 2206* (RSA-POM-287293, US-2473581); vicinity of San Luis Tulitlanapa, Cerro de Baxtle [Paxtle], 18.15°N, 97.4°W, July 1907, *C.A. Purpus 2898* (F-243754, GH, MO, NY, US-1009561, US-840693); Chalchicomula, 18.9833°N, 97.45°W, 2700 m, 19 August 1910, *A.S. Hitchcock 6277* (US-1009560); Chalchicomula, 18.9833°N, 97.45°W, 2700 m, 19 August 1910, *A.S. Hitchcock 88*2 (GH, 2 sheets, F-715979, MO, NY); Esperanza 18.8667°N, 97.4°W, 2591 m, 28 August 1910, *A.S. Hitchcock 6484* (US-1009563); Esperanza, 18.8667°N, 97.4°W, 2660 m, 17 August 1905, *H. Pittier 424* (US-570819); Hacienda Guadalupe, barranca de la Alseseca, vicinity of Puebla, 18.8333°N, 97.7333°W, 2120 m, 26 September 1907, *G. Arséne 1505* (MO, NY, US-1002657); Hacienda Santa Bárbara, vicinity of Puebla, 18.8333°N, 97.7333°W, 2150 m, 2 June 1907, *G. Arséne 7193* (US-1000495); Iztaccihuatl, E side of mtn. above San Augustín, W of Texmelucan, 19.17°N, 98.64°W, ca. 3570 m, 12 September 1958, *J.H. Beaman 2540* (GH, MSC-162395); Malinche, [19.074°N, 98.11°W], 3000 m, 9 November 1965, *W. Boege 14* (GH, MEXU-9432); Mpio. Cholula, 30 km al E de Cholula, [17.03°N, 96.78°W], 3000 m, 30 June 1989, *P. Dávila 396* (MEXU-645154); Mpio. Nopalucan, 3 km antes de Huamantla por la carretera Amozoc Libres, 19.05°N, 98.22°W, 2420 m, 2 August 1981, *L. Román M. 39* (MEXU-1098037) & *45* (MEXU-1098038); Mpio. Oriental, carretera Oriental-San Antonio Virreyes, faldas del cerro denominado "Tres Cerros", 19.4°N, 97.6347°W, 2350 m, 22 September 1993, *Sergio Aguirre y C. S-129* (MEXU); Mpio. S. Nicolás de los Ranchos, Buenavista, a 5 km al E de Xalítzintla, 19.1°N, 98.55°W, 3300 m, 15 February 1988. *P. Tenorio L. 15100* (MEXU-548960, US-3183529); Mpio. San Miguel Canoa, Xaxalpa, a 7 km al NE de San Miguel Canoa, 19.15°N, 98.22°W, 16 September 1988, *P. Tenorio L. 15144* (MEXU-551278, RSA-POM-513693); Mpio. San Nicolás de los Ranchos, Paso de Cortés, 2 km S of the rd to Amecameca, México, sobre la brecha Volcán Ixtaccihuatl, 19.12°N, 98.63°W, 3710 m, 1 November 1976, *S.D. Koch 76246* (MO, US-2824587); Mpio. Santiago Mihuatlán, 3 km de la desviación a Nicolás Bravo, 2060 m, 6 August 1981, *S. Morales 64* (MEXU-1110788); Mpio. Tetla, Ejido José María Morelos, 19.06°N, 98.2°W, 2600 m, 30 October 1985, *A. Miranda 193* (MEXU-1110783); Mt. Orizaba, 19.0167°N, 97.2667°W, 2438 m, 17–18 August 1910, *A.S. Hitchcock 6264* (US-1009566); Rancho Posadas, vicinity of Puebla, 19.0333°N, 98.1833°W, 2180 m, 6 August 1908, *G. Arséne 1603* (MO, US-1002637, US-2306185) & *2288* (US-1002632, US-3466183); San Marcos, 18.4°N, 97.35°W, 2591 m, 29 August 1910, *A.S. Hitchcock 6516* (US-1009562); Sierra Negra, above Serdán, Cabecero, 19.05°N, 97.39°W, 2850 m, 25 September 1944, *A.J. Sharp 441027* (US-1939454); vicinity of Puebla, Rancho Posadas, 19.04°N, 98.21°W, 2180 m, 6 August 1908, *G. Arséne 1603* (GH) & *9368* (GH); Rancho Posadas, vicinity of Puebla, 19.0333°N, 98.1833°W, 67 m, 10 April 1909, *Br. Nicolás & G. Arséne 270* (NY, mixed sheet with *B. carinatus* var. *marginatus*). **Querétaro:** Hwy. between Jalpan and Vizzarrón, at pass call Pinal de Amoles, 38 km SW of Jalpan, [21.14°N, 99.63°W], 8 October 1985, *R. Spellenberg, J. Zimmerman, N. Zucker & G. Cunningham 8319* (MEXU-560704); Mpio. Landa de Matamoros, Lobo, [20.7346°N, 100.202°W], 24 August 1982, *R. Guzmán 5962* (MEXU-1097975); Jardín Botánico Regional de Cadereyta "Ing. Manuel González de Cosío", [20.5875°N, 100.3928°W], 2150 m, 8 May 1992, *R. Hernández M., J. Orozco H. & C. Orozco L. 9826* (MEXU-631628); Mpio. Cadereyta, 4 km al sur de Vizarrón, carretera Cadereyta-Jalpan, 20.85°N, 99.7167°W], 2180 m, 17 September 1993, *Jaramillo, Villegas & Miranda 788* (MEXU-1110794); Mpio. Pinal de Amoles, Alrededores del poblado Pinal de Amoles, [21.135°N, 99.63°W], 2300 m, 29 September 1994, *N. Rincón & L.G. Mora 204* (MEXU); Mpio. Pinal de Amoles, Caseta Forestal Pinal de Amoles, 21.1333°N, 99.6267°W, 26 November 1981, *A. Mora Benítez & Fco. J. Ramírez Rodriguez 468-AMB* (MEXU); just below Cerro El Zamorano, 20.9328°N, 100.1839°W, 3191–3250 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24677* (US); near Cerro El Zamorano, 20.9331°N, 100.18°W, 3250–3373 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24694* (US); 1.5 mi N of Los Trigos, 20.9192°N, 100.1967°W, 2795 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24708* (US); Sierra del Doctor, Cerro El Espolon, 20.7908°N, 99.565°W, 3140–3250 m, 26 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24756* (US); Sierra del Doctor, at 2 mi W of El Doctor, 20.8583°N, 99.5992°W, 2867 m, 27 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24769* (US); just below Cerro El Zamorano, 20.9328°N, 100.1839°W, 3191–3250 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24678-B* (US). **San Luis Potosí:** 1876, *Schnaffner 1076* (MEXU); 1876, *J.G. Schaffner 129/1075* (GH, NY, US-

397109, US-821125); Álvarez, [22.0333°N, 100.6167°W], 13–23 July 1904, *E. Palmer 171* (GH); in mountains ca. 19 mi SW of San Luis Potosí on road to Aguascalientes, 21.94°N, 100.8°W, 19 July 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1398* (US-2473579); between Puerta Huerta and Río Verde in the Sierra de Álvarez, 21.91°N, 100.1°W, 1150–2200 m, 11 September 1954, *E.R. Sohns 1196* (US-2154452); Canyon del Lobo, Sierra de San Miguelito, 22.133°N, 100.983°W, 1900–2350 m, 10 September 1954, *E.R. Sohns 1163* (US-2154425); Canyon del Muerto, ca. 3 km W of Rodrigo, in the Sierra de San Miguelito, 21.8833°N, 100.98°W, 1800–2200 m, 18 September 1954, *E.R. Sohns 1326* (US-2154564); Charcas, 23.1°N, 101.0333°W, July–August 1934, *A.F. Whiting 887* (MICH-1119291, US) & *980* (MICH-1119128, US); Charcas, Aguila Mt., 23.3833°N, 101.5333°W, July–August 1934, *A.F. Whiting 831* (MICH-1119156, US-1646157); exposición norte del Cerro del Lobo Villa de Arriaga, [21.91°N, 101.38°W], 2250 m, 16 November 1994, *J.L. Villalpando P. 204* (MEXU); in mountains ca. 15 mi SW of San Luis Potosí on road to Aguascalientes, 22°N, 100.82°W, 18 July 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1380* (US-2473578); near Puerta Huerta in the Sierra de Álvarez, 21.91°N, 100.1°W, 2200–2400 m, 4 September 1954, *E.R. Sohns 1032* (US-2154311) & *1040* (US-2154374); near the Minas de San Rafael in the Sierra de Guadalcázar, 22.2°N, 100.2833°W, 1900–2100 m, 3 October 1954, *E.R. Sohns 1512* (US-2154705); near the village of San Francisco in the Sierra de San Miguelito ca. 25 km SW of San Luis Potosí, 22°N, 101.14°W, 2200–2400 m, 5 September 1954, *E.R. Sohns 1067* (US-2154344) & *1069* (US-2154346); Puerto Huerta, camino San Luis–Río Verde, 21.91°N, 100.1°W, 2200 m, 29 July 1954, *J. Rzedowski 161* (US-2566609); Mpio. Guadalcázar, Ejido Minas de Plata, [22.62°N, 100.43°W], 1500 m, 18 November 1981, *H. Bravo 37* (MEXU); Mpio. Villa de Zaragoza, Ejido San Francisco, 22.12°N, 100.74°W, 1800 m, 12 October 1981, *A. Bolaños 183* (MEXU); San Luis Potosí, [22.16°N, 100.99°W], *Schaffner 10361* (MEXU-5768); 5.7 mi E of Wadley, Sierra de Catorce, 23.59°N, 100.9031°W, 2131 m, 10 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23278* (US); Sierra del Jórdan, Sierra de Catorce, 23.5358°N, 100.8467°W, 2013 m, 11 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23312* (US); E of Wadley, Sierra de Catorce, 23.5664°N, 100.8661°W, 2300–2688 m, 11 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23307* (US); E of Wadley, Sierra de Catorce, 23.5722°N, 100.8842°W, 2300–2688 m, 11 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23294* (US); 6.3 mi SE of Villa Zaragoza on road towards La Salitrera, 21.99°N, 100.6694°W, 1793 m, 14 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni 23368* (US); Cerro de la Luz, W of La Trinidad, 21.4078°N, 99.1022°W, 2795 m, 23 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23586* (US); Cerro de la Luz, W of La Trinidad, 21.4078°N, 99.1022°W, 3250–3373 m, 23 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23585* (US) & *23586* (US); Cerro El Pinon Blanco, 22.5206°N, 101.68°W, 2291–2744 m, 2 October 2012, *P.M. Peterson & K. Romaschenko 24881* (US). **Tamaulipas:** 11 mi S of Palmillas on the road to Tula, 23.2°N, 99.64°W, 18 September 1960, *J. Crutchfield & M.C. Johnston 5633B* (MICH-1119150, US-2462956); 14.6 mi NE of Dulces Nombres, 23.9983°N, 99.47°W, 1748 m, 23 September 2001, *P.M. Peterson & J. Valdés-Reyna 15918* (CAN, US); carretera de Ciudad Victoria a Jaumave, 23.6283°N, 99.2044°W, 1060 m, 12 October 2007, *F.O. Zuloaga et al. 9706* (ANSM); Filo y lado este de la Sierra Peña Nevada, [23.78°N, 99.66°W], 3500–3600 m, 5 July 1985, *McDonald 1673* (MEXU-1088981); Jaumave road ca. 13 mi SW of Ciudad Victoria, near summits of Sierra Madre, [23.58°N, 99.23°W], 1000 m, 13 May 1949, *R. McVaugh 10533* (MICH-1119125, NY); Mpio. Bustamante, El Capulín camino de terracería, 23.2167°N, 99.6833°W, 1610 m, 23 May 1994, *R. López 221* (MEXU); Mpio. Miquihuana, Ej. El Aserradero, [23.56°N, 99.78°W], 2650 m, 3 September 1981, *R. Carranco 84* (MEXU); Mpio. Tula. Cañon de la Lagartija, [22.99°N, 99.66°W], 1400 m, 21 October 1982, *G. Villegas 542* (MEXU-1089016); Mpio. Victoria, Sierra Madre rumbo a Jaumave, [23.42°N, 99.39°W], 1200 m, 8 September 1981, *R. Carranco 91* (MEXU-1089013); Mpio. Victoria, Victoria-Atlas Cumbres, [23.73°N, 99.14°W], 1200 m, 21 July 1993, *J. Franco 142* (MEXU); on E and S slopes and summit of Peña Nevada, 23.7°N, 99.8°W, 19 July 1949, *L.R. Stanford, S.M. Lauber & L.A. Taylor 2575* (RSA-POM-72561, GH, MO, NY, US-2013061); Sierra Las Cautivas, 19.6 mi W of Ejido Guayabas along road to Dulces Nombres, 23.9978°N, 99.47°W, 1755 m, 25 September 2007, *P.M. Peterson & J.M. Saarela 21057* (CAN, US) *& 21059* (CAN, MO, US); 3 mi N of Miquihuana, [23.57°N, 99.76°W], 15 July 1949, *L.R. Stanford, S.M. Lauber & L.A. Taylor 2480* (GH, MO, RSA-POM-74021). **Tlaxcala:** 15 km N of Apizaco, 19.5417°N, 98.15°W, 23 September 1953, *E.R. Sohns 617* (US-2118588); between San Cristóbal and Calpulalpan, 19.5833°N, 98.61°W, 2134–2743 m, 22 September 1953, *E.R. Sohns 564* (MEXU-171735, P-02630112, US-2118545); ca. 3 mi NE of Tlaxco, 19.65°N, 98.08°W, 2743–3048 m, 23 September 1953, *E.R. Sohns 595* (US-2118570); Cerro Zotoluca, al NE de Calpulalpan, 19.57°N, 98.56°W, 2600 m, 20 October 1985, *A. Miranda 186* (MEXU-1089003); hills at Contadero Station, 19.4333°N, 98.5167°W, 2591 m, 30 August 1901, *C.G.*

*Pringle 8597* (CAN-159558, GH, MEXU, MO, MSC-4687, NY, RSA-POM-206109, US-396387, US-821087, US-967967, US-1009565); Mpio. Calpulalpan, Aserradero, 19.59°N, 98.57°W, 6 September 1985, 2300 m, *J. González Estevez s.n.* (MEXU-946222); near Huamantla, E slope of La Malinche, 19.3°N, 98°W, 24 September 1953, *E.R. Sohns 641* (US-2118607); summit of Mt. Tlacuapanga, 19.2833°N, 98.15°W, 2774 m, 21 August 1944, *A.J. Sharp & E. Hernández-Xolocotzi 44488* (US-1939427). **Veracruz:** Mpio. Perote, 1.75 km al sur de el Conejo, [19.56°N, 97.25°W], 3570 m, 10 September 1992, *B.V. Hernández 56* (MEXU-1089766); Mpio. Perote, 5.5 km al ESE de Perote, 19.5372°N, 97.2°W, 2990 m, 10 September 1992, *H.R. Sandoval 121* (MEXU); Tlaxcala, ca. 14 mi SW of Mendoza, 18.72°N, 97.31°W, 2040 m, 17 August 1953, *J.R. Reeder & C.G. Reeder 2011* (RSA-POM-287185, US). **Zacatecas:** Sierra Madre Occidental, 13 mi SW of Valparaíso and 13.8 mi NE of Huejuquilla, 22.6924°N, 103.71°W, 2180 m, 30 September 2001, *P.M. Peterson & M.S. González-Elizondo 15968* (NY, RSA-POM-732008, US); Sierra Madre Occidental, 3.5 mi W of Monte Escobedo at Uma Temoc A.C, 22.3152°N, 103.6°W, 2450 m, 3 October 2001, *P.M. Peterson & M.S. González-Elizondo 16051* (MO, RSA-POM-732040, US); Sierra Madre Occidental, 8.6 mi NW of Monte Escobedo at Uma Temoc A.C, 22.3666°N, 103.61°W, 2480 m, 3 October 2001, *P.M. Peterson & M.S. González-Elizondo 16044* (MO, NY, RSA-POM-732042, US); Cuajimalpa, La Venta, 19.3558°N, 99.3011°W, 2600 m, 19 September 1930, *M. St. Pierre 916* (MICH-1119127, US-1537812); Mpio. Guadalupe, ladera norte del cerro de la Vírgen, 2490 m, August 1988, *J. Balleza C. 1573* (ANSM); Mpio. Miguel Auza, 2.5 km al W de la Col. Emilio Carranza, por la brecha a la Sierra de Santa María, [22.1833°N, 101.8333°W], 2200 m, 2 September 1988, *J.J. Balleza C. 1889* (ANSM); Pedregal de San Angel, cerca de Coyoacán, 19.3°N, 99.18°W, 2 August 1952, *J. Rzedowski 1391* (US-2079374); San Angel, Briqueteri, 19.3733°N, 99.225°W, 2350 m, 12 September 1929, *M. St. Pierre 836* (US-1537811); Sierra de los Morones, near Plateado, 21.6667°N, 103.2°W, 1 September 1897, *J.N. Rose 2727* (US-301655, US-821068); Sierra Los Cardos, Rancho El Robles, 17.8 mi NW of Jerez on road towards Monte de las Garcia, 22.6898°N, 103.2°W, 2820 m, 20 October 2007, *P.M. Peterson, J.M. Saarela & D. Stancik 21436* (CAN, MO, US); 9.5 mi W of Sombrerete, [23.63°N, 103.65°W], 7900 ft, 18 August 1969, *J. Taylor & C. Taylor 6256* (NY); 4 km E of Salaverna on the highway to Concepción del Oro, 24.1028°N, 100.9139°W, 2800 m, 1 July 1973, *M.C. Johnston, T.L. Wendt & F. Chiang C. 11547* (NY).

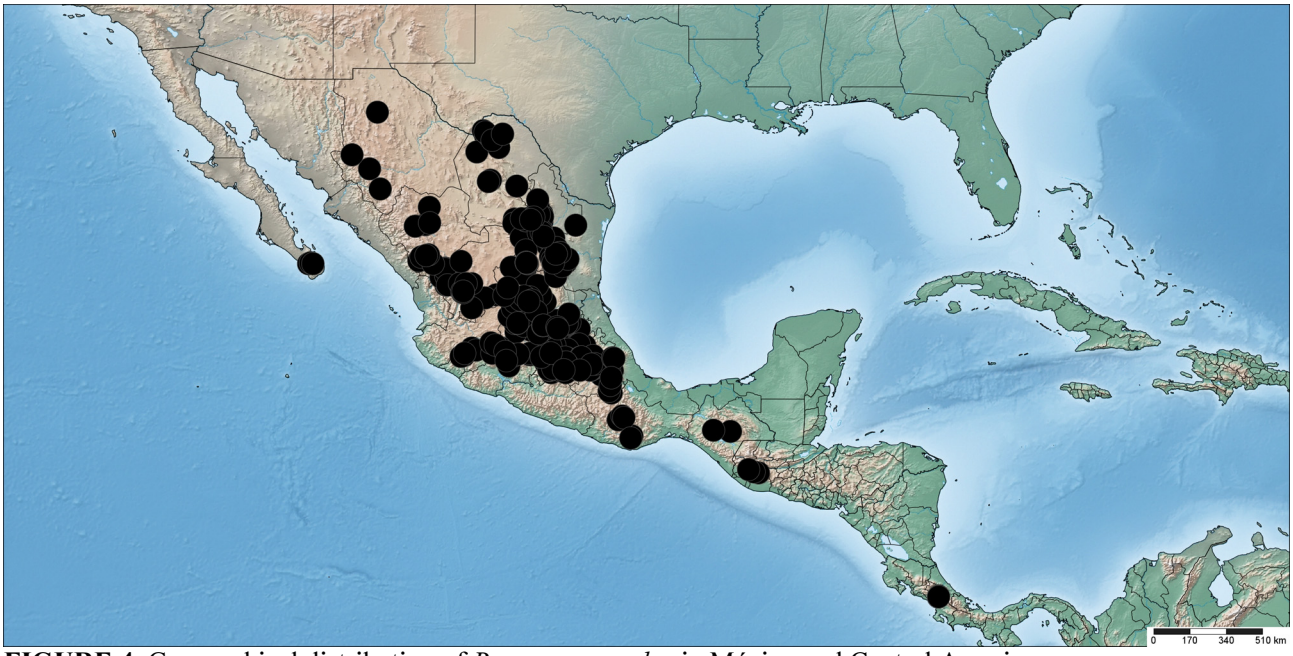


**FIGURE 4.** Geographical distribution of *Bromus anomalus* in México and Central America.

2. ***Bromus arizonicus*** (Shear) Stebbins in Stebbins *et al.* (1944: 309). Figs. 5, 6.

Basionym: *Bromus carinatus* var. *arizonicus* Shear (1900: 62). *Ceratochloa arizonica* (Shear) Holub (1973: 170). Type:—UNITED STATES OF AMERICA. Arizona: Pima Co., Tucson, Santa Cruz Valley, 3 May 1884, *C.G. Pringle s.n.* (holotype US-81568!, isotypes GH-00023238!, MIN-1000471!, PH-01038760!, PH-01050337!).

Plants annual, tufted. Culms (8–)30–90 cm tall, (1–)1.5–2 mm wide at base, erect, glabrous below inflorescences; nodes 2–4, glabrous or weakly pubescent. Leaf sheaths puberulent to pubescent, hairs up to 1 mm long; ligules

1–2.1(–3) mm long; auricles absent; blades up to 30 cm × (1.5–)2–6 mm, flat, abaxial and adaxial surfaces pilose, sometimes glabrous, hairs up to 0.6 mm long, margins serrulate. Panicles (3–)5–30 cm × 1–2(–3) cm, erect, ± contracted, at least when young, branches erect to ascending, scabrous, often shorter than spikelets, 1–2 spikelets per branch. Spikelets 1.5–2.5(–2.7) cm long, 4–9-flowered, elliptic to lanceolate, strongly laterally compressed; glumes glabrous or scabrous, margins hyaline, midnerves glabrous proximally, scabrous distally, apices acute; lower glumes (6–)8–13 mm long, lanceolate, 3–5-nerved, green to purplish-green along and between nerves; upper glumes (7–)9–15 mm long, ± equal in length to the lowest lemma, ovate-lanceolate, 5–9-nerved, green to purplish-green along and between the nerves; lemmas 9.5–14 mm long, lanceolate, strongly keeled, apices acute, margins usually weakly to moderately pubescent throughout or distally, sometimes scabrous to short-pubescent, hairs up to 0.5 mm long, backs glabrous, scabrous or pubescent, hairs usually shorter than those along margins, midnerves glabrous to scabrous distally, margins hyaline; awns (4–)7–15 mm long, inserted up to 0.5(–0.6) mm below the lemma apex, straight; paleas shorter and narrower than lemmas, backs glabrous, keels ciliate, cilia up to 0.1 mm long; anthers 0.4–0.5 mm long; caryopses 8−9.5 mm long. 2*n* = 84 (Stebbins *et al.* 1944, Klos *et al.* 2009).

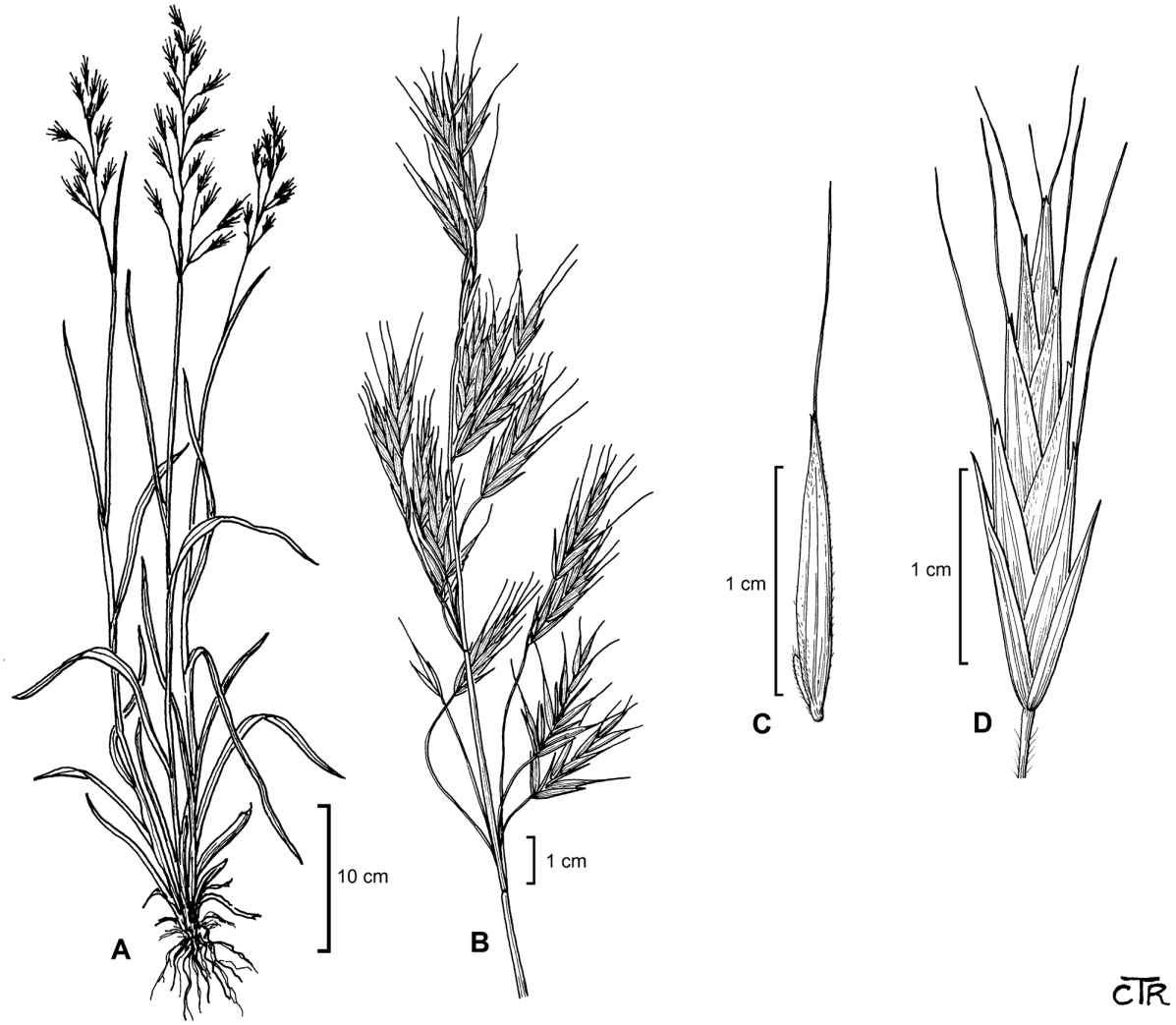


**FIGURE 5.** *Bromus arizonicus.* A. Habit. B. Inflorescence. C. Lemma D. Spikelet. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution**:—Native. In México this species is known only from Baja California and Sonora (Fig. 7). Its range includes California, southwest Nevada and New México (Pavlick & Anderton 2007). There are numerous collections of *B. arizonicus* on the border of Sonora and Arizona (R. Felger, pers. comm. 2014). Its distribution in Sonora is likely broader than shown here. In addition to Baja California and Sonora, Espejo-Serna *et al.* (2000) reported this species from Coahuila; this report is likely based on a misidentification. For example, *Palmer 266*, collected in Saltillo, Coahuila, and determined as *B. arizonicus* by Beetle in 1972, was found to be *B. carinatus* upon examination.


**FIGURE 6.** *Bromus arizonicus*. *Wiggins 5241* (MICH-1119179).


**FIGURE 7.** Geographical distribution of *Bromus arizonicus* in México.

**Ecology:**—This species is a winter-spring ephemeral and occurs in stabilized sand dunes, on slopes, along dried creek bottoms and roadsides often on volcanic soils; associated with *Fouquieria columnaris* (Kellogg 1860: 101) Kellogg ex Curran (1885: 133) and *Ambrosia dumosa* (A. Gray in Frémont 1845: 316) Payne (1964: 422). Elevation: 10–1124 m.

**Common Names:—**Arizona brome (English).

**Comments:—***Bromus arizonicus* is a duocecaploid, and Stebbins *et al.* (1944) hypothesized that it may be an intersubgeneric allopolyploid derived from *B. catharticus* (sect. *Ceratochloa*) and the hexaploid *B. berteroanus* (sect. *Neobromus*), or an unknown close relative of the latter. It can be difficult to distinguish from *B. carinatus* (octoploid), from which it differs by its annual habit, upper glumes that are approximately equal in length to the lowest lemmas and lemmas usually with hairs along the margins. Also, most branches are shorter than their spikelets, resulting in erect and narrow inflorescences. This latter characteristic is not helpful for distinguishing the species in Baja California, as most individuals of *B. carinatus* from this region also have narrow, short-branched inflorescences. Elsewhere in México panicles of *B. carinatus* are more open with longer branches.

Some authors have treated *B. arizonicus* as a synonym of *B. carinatus*. Soderstrom & Beaman (1968) were not able to distinguish the taxa in Baja California, and treated all plants as *B. carinatus*, including two cited in the protologue of *B. arizonicus*: *Wiggins 5291* and *Epling & Stewart s.n.* Several specimens at SD determined as *B. carinatus* var. *arizonicus* by F.W. Gould in 1978, but later determined as "*Bromus carinatus* H. & A., near *B. marginatus* Nees" by G.L. Stebbins in 1980 (Gould & Moran 1981), are readily identifiable as *B. arizonicus* (*Gentry & Cech 8875*, *Purer 7166A*, *Moran 16999*, *16930*, *16880*, *6551*). Specimens from the Sonoran desert in Arizona were recently found to be difficult to distinguish, except as ephemeral (annual) vs. perennial (R. Felger pers. comm. 2014, Felger 2014; also see comments of J.R. Reeder in Halvorson & Guertin 2003).

**Specimens Examined:—MÉXICO. Baja California:** 2.0 km N of Colonia Guerrero, [30.75°N, 116°W], 80 m, 3 April 1958, *P.H. Raven, H. Lewis & H. Thompson 12141* (GH); 16 km SE of El Rosario, 30°N, 115.6167°W, 210 m, 18 April 1958, *P.H. Raven, M. Mathias & J. Turner 12496* (GH); 24.3 mi E of Rosario, 32.3333°N, 116.62°W, 11 April 1931, *I.L. Wiggins 5291* (GH, MICH-1119175, NY, RSA-POM-265012, US); 7–8 mi S of Punta Prieta, 28.86°N, 114.2833°W, 29 March 1973, *H.S. Gentry & F. Cech 8875* (MICH-1119163, RSA-POM-5688867, SD-86524, US-2079818); Arroyo Agua Amarga, southern San Pedro Mártir, 30.75°N, 115.2167°W, 823 m, 13 May 1941, *I.L. Wiggins 9952* (US-1842711); Isla del Norte, Los Coronados, [32.4167°N, 117.25°W], 20 March 1966, *R.N. Philbrick & E.R. Blakley B66-223* (RSA-POM-638847); Isla San Martín, [30.5°N, 116.1167°W], ca. 60 m, 1 April 1988, *R.F. Thorne 63172* (RSA-POM-500962); Rosario Wash, 10 April 1931, *I.L.*

*Wiggins 5241* (MICH-1119179, NY, GH, US-1721766); S Coronado Island, [32.4167°N, 117.25°W], 50 ft, 19 March 1966, *E.R. Blakley 6702* (RSA-POM-638849); Santa Catarina Landing, [29.5926°N, 115.258°W], 10 March 1930, *I.L. Wiggins 4425* (MICH-1119180, US-1721772); San Quintín, 17 April 1958, [30.5602°N, 115.9425°W], 30 m, *P.H. Raven, M. Mathias & J. Turner 12346* (GH); San Quintín, [30.5602°N, 115.9425°W], 5 April 1936, *C. Epling & Wm. Stewart s.n.* (MICH-1119270); Arroyo Socorro, Socorro wash, 16 mi E of Hwy. 1, [30.3167°N, 115.8167°W], 24 April 1984, *P.M. Peterson & C.R. Annable 02273* (CAN, US); 1 km E of El Morro, 32.2583°N, 116.9792°W, 10 m, 27 March 1982, *R. Moran 30069* (SD-110770); Santo Tomás, near Paloma Rch Trailer Park, [31.57°N, 116.52°W], 180 m, 16 September 1979, *J.R. Reeder & C.G. Reeder 7215* (SD-116029); Tijuana River bottom, 32.5333°N, 117.0167°W, 20 m, 18 April 1981, *R. Moran 29552* (SD-108517); Coronado Islands, N Island, on top, 32.4375°N, 117.3°W, 100 m, 20 March 1958, *R. Moran 6551* (SD-49332); S of Playa Hotel, Ensenada, 31.8667°N, 116.6167°W, 25 March 1937, *E.A. Purer 7166A* (US-1648131, SD-39682); 2 mi SE of El Progreso, 29.4667°N, 115.1667°W, 490 m, 25 March 1970, *R. Moran 16880* (SD-76758); Puerto Santa Catarina, 29.5167°N, 115.2667°W, 5 m, 27 March 1970, *R. Moran 16999* (SD-76828); Arroyo Santa Catarina, Ammonite area 5 mi N of the mouth of arroyo, 29.5833°N, 115.2333°W, 75 m, 26 March 1970, *R. Moran 16930* (SD-76816); Coronado Islands, N Grande Island, [32.4467°N, 117.2983°W], 25 March 1990, *T. Oberbauer 90-30* (SD-162832); Coronado Islands, E slope above landing on N island, 32.4467°N, 117.2983°W, 50 m, 3 March 1970, *R. Moran 16795* (SD-76240); Mpio. Ensenada, City of Ensenada, 31.8606°N, 116.6178°W, 31 March 2007, *F. Casillas 73* (SD-182569); Ensenada, Todos Santo Bay, 31.8606°N, 116.6178°W, 21 March 1948, *H.S. Gentry 7911* (RSA-POM-364157); Cuesta de Jarahuai and vicinity, 732–914 m, 31.6°N, 116.3833°W, 6 April 1950, *H.S.Gentry & F. Cech 9005* (ARIZ-265015, MICH-1119162, US-2810955, US-2079823); Arroyo Cataviña, in bed of arroyo near the mouth, 29.4167°N, 115.1°W, 10 m, 29 March 1970, *R. Moran 17048* (MSC-276930, SD-76825). **Sonora:** Mpio. Elías Calles. 16.6 km on Mex. Hwy 8 SW of Sonoyta, 31º47'30"N, 112º59'15"W, 415 m, 29 April 1991, *Felger 91-56* (ARIZ-327325, det. R. Felger, 2014); Imuris, 30.7833°N, 110.8583°W, 840 m, 31 May 1995, *T.R. Van Devender 95-546* (ARIZ-319529, det. R. Felger 2014).

3. ***Bromus attenuatus*** Swallen (1950: 397). Figs. 8, 9.

Type:—MÉXICO. Nuevo León: Dulces Nombres, and just E of border into Tamaulipas, 24ºN, 99º30'–100º30'W, alt. 1900 m, in rich humus on ledges above dry stream course in canyon on E side of Cerro Linadero, 11 August 1948, *F.G. Meyer & D.J. Rogers 2937* (holotype US-1962991!, isotypes E-00373825!, G-00099283!, MO-1598493!, P-03630120!).

Plants perennial, not rhizomatous. Culms up to 150 cm tall, (1–)2–3 mm wide at base, erect or ascending, bases sometimes decumbent, glabrous below inflorescences; nodes 2–4, glabrous or sparsely pubescent. Leaf sheaths glabrous or pubescent, hairs up to 0.2 mm long; auricles present; ligules 0.4–0.6 mm long, glabrous, sometimes with a ring of pilose hairs arising at the base of the blade beneath and above the ligule; blades up to 60 cm × 4–16 mm, conduplicate to involute proximally, flat distally, attenuate, gradually narrowed to the base, adaxial surfaces glabrous between the nerves, pubescent on the nerves, hairs up to 0.5 mm long, abaxial surfaces moderately to densely scabrous on and between the nerves, margins serrulate. Panicles 15.5–24 cm long, open, nodding, branches erect to spreading, scabrous, 1–2(–3) spikelets per branch. Spikelets 2–3 cm long, 6–8-flowered, linear-lanceolate, terete to moderately laterally compressed; glumes glabrous, margins hyaline, miderves glabrous to scabrous distally; lower glumes 6.5–9.8 mm long, lanceolate, 1-nerved, green along the nerve, apices acute; upper glumes 8.6–11 mm long, obovate-lanceolate, 3-nerved, green along the nerves, light green-translucent between the nerves, apices obtuse or acute to mucronate, mucros up to 1 mm long; lemmas 11–14 mm long, linear-lanceolate, rounded over the back, apices acute, 3-nerved, the nerves strong, glabrous, green along the nerves, light green-translucent between the nerves, nerves glabrous to scabrous distally; awns 2.5–4.5(–5) mm long, inserted up to 0.5 mm below lemma apex, straight; paleas shorter and narrower than lemmas, backs glabrous or puberulent, keels glabrous or ciliate, cilia up to 0.1 mm long; anthers 3.5–5.5 mm long; caryopses 9−10 mm long. 2*n* = unknown.

**Distribution**:—Native. *Bromus attenuatus* is endemic to the southern Sierra Madre Oriental in northeastern México, in Nuevo León, Tamaulipas, San Luis Potosí and northwestern Hidalgo (Fig. 10).

**Ecology:**—The species grows on rocky to gentle slopes in pine-oak forests, often on calcareous soils; associated with *Liquidambar styraciflura* Linnaeus (1753: 999), *Juniperus flaccida* Schlechtendal (1838: 495), *Carya* Nuttall (1818: 220), *Arbutus xalapensis*, *Pinus pseudostrobus* Lindley (1839: Misc. 63), *Picea martinezii* Patterson (1988: 131), *Abies vejari* Martínez (1942a: 629), *Tilia* Linnaeus (1753: 514), *Ulmus* Linnaeus (1753:

225), *Triniochloa stipoides* (Kunth in Humboldt *et al.* 1815 [1816]: 131) Hitchcock (1913: 303), *Polypodium* Linnaeus (1753: 1082), *Adiantum* Linnaeus (1753: 1094), *Cornus stolonifera* Michaux (1803a: 92) and *Quercus* Linnaeus (1753: 994) spp. Elevation: 1809–2250 m.


**FIGURE 8.** *Bromus attenuatus*. A. Spikelet. B. Lemma. C. Habit. D. Ligule and proximal leaf blade. Based on *Moore, Jr. 5066* (MICH-1119164). Illustration by Paulette Dennis © Paulette Dennis.


**FIGURE 9.** *Bromus attenuatus*. *Moore, Jr. 5066* (MICH-1119164).

**Comments:—**This is the first report of the species from San Luis Potosí, where we collected it in 2010 on Cerro de la Luz. There is a large gap in distribution between the San Luis Potosí and Hidalgo populations to the south and the Nuevo León populations to the north.

*Bromus attenuatus* is one of three Mexican species with three-nerved lemmas. It is easily distinguished from *B. dolichocarpus* by its glabrous lemmas, shorter awns and wider leaf blades that narrow towards their bases, and from *B. densus* by its longer awns, shorter anthers and wider leaf blades that narrow towards their bases. Wagnon (1952) and Soderstrom & Beaman (1968) suggested that *B. attenuatus* is probably more closely related to *B. dolichocarpus* than it is to *B. densus*. Accordingly, in a molecular phylogenetic study, Saarela *et al.* (2007) found *B. attenuatus* and *B. dolichocarpus* to be closely-related and comprise a unique lineage in *Bromus*, which is here newly recognized as sect. *Mexibromus. Bromus attenuatus* and *B. dolichocarpus* have stronger lemma nerves than *B. densus*.

The epithet *attenuatus* refers to the morphology of the leaf blades; blades that narrow distinctly at both ends do not occur in any other *Bromus* species in North America.

**Specimens Examined:—MÉXICO. Hidalgo:** Barranca de San Vicente near km 238 on highway between Zimapan and Jacala, [20.87°N, 99.28°W], 1800–2000 m, 24 September 1949, *H.E. Moore, Jr. 5066* (MEXU-143525, MICH-1119164). **Nuevo León:** S of Zaragoza on road towards Ejido La Encantada, 23.9276°N, 99.7978°W, 2171 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16759* (ANSM, CAN, MO, US) & *16762* (ANSM, CAN, US); Sierra La Lagunita, 13.5 mi SE of Aramberri on road towards Agua Fría, 24.0417°N, 99.7333°W, 2250 m, 20 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16722* (CAN, US); Sierra La Lagunita, 13.5 mi SE of Aramberri on road towards Agua Fría, 24.0423°N, 99.7345°W, 2170 m, 20 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16717* (ANSM, CAN, MO, US). **San Luis Potosí:** 1.3 km W of La Trinidad, 21.40494°N, 99.0816°W, 2200 m, 23 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23558* (US); Cerro de la Luz, W of La Trinidad, 21.40792°N, 99.1023°W, 2300–2688 m, 23 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23574* (US). **Tamaulipas:** Sierra Las Cautivas, 21 mi W of Ejido Guayabas on road to Dulces Nombres, 23.9871°N, 99.48°W, 1830 m, 25 September 2007, *P.M. Peterson & J.M. Saarela 21060* (CAN, MO, US); 13.8 mi NE of Dulces Nombres, 23.9866°N, 99.48°W, 1809 m, 23 September 2001, *P.M. Peterson & J. Valdés-Reyna 15926* (CAN, MO, US).


**FIGURE 10.** Geographical distribution of *Bromus attenuatus* in México.

4. ***Bromus berteroanus*** Colla (1836: 25, pl. 58). Figs. 11, 12.

Type:—CHILE. Cachapoal: Rancagua, 1830, *Bertero 117* (holotype TO-8207!, isotypes P, SGO, US-1645128! with three fragment packets: one ex P, two ex MPU).

*Trisetum litorale* Philippi (1858: 92). *Trisetum trinii* var. *litorale* (Phil.) Louis-Marie (1928: 243). Type:—CHILE. cerca Coquimbo, en la piedras marítimas, 1837, *Gay* (holotype SGO-PHIL-063594! [Herb. Chil. No. 148, barcode SGO000000778]).

*Avena paupercula* Philippi (1858: 94). Type:—CHILE. Concepción: prope Tomé unicum specimen invenit, November 1855, *Germain s.n.* (holotype SGO-PHIL-63589! [barcode SGO000000093], isotype BAA-00001524!).

*Trisetum barbatum* var. *major* Vasey (1893: 60). *Bromus barbatoides* var. *sulcatus* Beal (1896: 615), *nom. illeg. superfl. Trisetum trinii* var. *majus* (Vasey) Louis-Marie (1928: 243). Type:—MÉXICO. 1888, *E. Palmer 667* (holotype US-1009576!, isotypes NY-1645070!, NY-16465076!, P-02630826). The US specimen and the protologue indicate only "México" as the locality, whereas the NY and P specimens identify the location as "Lower California, Guadalupe Island."

*Bromus barbatoides* Beal (1896: 614), replacement name. Replaced name: *Trisetum barbatum* Steudel (1854: 229), *nom. illeg.* Blocking name: *Trisetum barbatum* Nees (1841: 345). Type:—CHILE. Quillota, October 1829, *Bertero 860* (holotype P-00624386!, isotypes BAA-00004161!, MO-2114333!).

*Bromus bicuspis* Nees ex Steudel (1854: 322). *Danthonia pseudo-spicata* Müller (1856: 348), *nom. illeg. superfl*. Type:—CHILE. Valparaíso, *Cuming 466* (holotype B-10 0250740!, isotypes CGE, K-308532!, K-308533!, US-103017! fragm. ex B, US-103016! fragm. ex CGE, W-0026507!).

*Bromus trinii* Desvaux (1853: 441), replacement name. Replaced name: *Trisetum hirtum* Trinius (1836b: 300). Blocking name: *Bromus hirtus* Lichtenstein ex Roemer & Schultes (1817: 654). *Trisetobromus hirtus* (Trin.) Nevski (1934: 15). Type:—CHILE: Chil. austr. Andes de Antuco, *Poeppig*, Pl. Chili III 33 (lectotype W-0026498!, **designated here**, isolectotypes W-18890242057!, W18890242058!, W-1889003750!, US-820872! fragm. ex P); Trinius cited two collections in the protologue of *T. hirtum*, the one chosen as the lectotype and "Chil. bor., in campis ad Concon, *Poeppig s.n.* (W-0026497!)."

*Bromus trinii* var. *effusa* Desvaux (1853: 442). *Trisetum trinii* var. *effusum* (E. Desv.) Louis-Marie (1928: 243). Type:—CHILE: Elqui: sobre las colinas maritimas en Coquimbo, por setiembre, *Gay s.n.* (lectotype P, designated by Pavlick *et al.* 2003: 187). Two syntypes were cited in the protologue, the lectotype and "Andes de Odessa, en noviembre, *Gay s.n.* (P-00625385!)". Pavlick *et al.* (2003) noted the collection from Coquimbo to be the holotype; this is treated as an error to be corrected to lectotype under Article 9.9 of the Code. We did not find this specimen among the images available online via the P website (accessed 19 July 2013).

*Bromus trinii* var. *manicata* Desvaux (1853: 441). *Trisetum trinii* var. *manicatum* (E. Desv.) Louis-Marie (1928: 243). Type:—CHILE. Biobío: Antuco, *Poeppig s.n.* (holotype B-10 0248068!, isotypes BAA-00001635!, P-00625388!).

*Bromus trinii* var. *micranthera* Desvaux (1853: 441). *Trisetum trinii* var. *micrantherum* (E. Desv.) Louis-Marie (1928: 243). Type:—CHILE. Valparaíso: Valparaíso, Anon. (holotype P-00625389!).

*Bromus trinii* var. *pallidiflorus* Desvaux (1853: 441). *Trisetum trinii* var. *pallidiflorum* (E. Desv.) Louis-Marie (1928: 243). Type:—CHILE. Santiago: Santiago, *C. Gay s.n.* (lectotype P-00625390!, **designated here**).

*Bromus trinii* var. *stricta* Desvaux (1853: 442). *Trisetum trinii* var. *strictum* (E. Desv.) Louis-Marie (1928: 243). Type:—CHILE. Elqui: Coquimbo, 1838, *C. Gay s.n.* (lectotype P-00625387!, **designated here**, isolectotypes BAA-00001638!, US-865475!).

*Bromus trinii* var. *excelsus* Shear (1900: 25). *Bromus berteroanus* var. *excelsus* (Shear) Pavlick (1995: 128). Type:—UNITED STATES OF AMERICA. California: Inyo Co., Panamint Mountains, 1700 m, 31 March 1891, *F.V. Coville & F. Funston 522* (holotype US-81596!).

Plants annual, often tufted, not rhizomatous. Culms (8–)15–85 cm tall, 1–3(–4) mm wide at base, erect, usually glabrous below inflorescences, sometimes scabrous to pubescent; nodes 2–4, glabrous or pubescent. Leaf sheaths pubescent to pilose, hairs up to 1.5 mm long, or glabrous; auricles absent; ligules 1–3 mm long, glabrous or pubescent, erose-lacerate; blades up to 14 cm × 2–6 mm, flat, adaxial surfaces glabrous to pilose, hairs up to 2.5 mm long, abaxial surfaces glabrous to pubescent, hairs up to 0.5 mm long, sometimes restricted to margins, margins serrulate. Panicles (5–)8–20 cm long, ± open, branches erect to ascending, glabrous or scabrous, 1–2(–4) spikelets per branch. Spikelets 1.5–2.1 cm long, 3–7(–8)-flowered, elliptic to lanceolate, terete to moderately laterally compressed; glumes glabrous, margins hyaline, midnerves glabrous, sometimes scabrous distally; lower glumes 6–12 mm long, lanceolate, 1(3)-nerved, green to purplish-green along the nerve(s), apex acute to attenuate; upper glumes 8–16 mm long, obovate-lanceolate, 3(5)-nerved, green to purplish-green along and between the nerve(s), apex mucronate, mucros up to 0.8 mm long; lemmas 6–15 mm long, lanceolate to linear-lanceolate, rounded over the backs, apices strongly bifid, teeth 2–3(–4) mm long, acuminate to awn-like, 7-nerved, light green to purplish-green along and between the nerves, variously pubescent to pilose, hairs up to 0.9 mm long; awns (7–)10–20 mm long, arising 1.5 mm or more below the lemma apex, bent, twisted below middle; paleas narrower and shorter than the lemma, backs glabrous or scabrous, keels ciliate, cilia up to 0.3 mm long; anthers 1.5–2.5 mm long; caryopses 7−8.5 mm long. $2n = 42$ (Knowles 1944, Bowden & Senn 1962, Klos *et al.* 2009).

**Distribution:—**In México this species is known from Baja California and the Sierra Pinacate in Sonora (Fig. 13). In the adjacent United States it is present in California, Oregon, Nevada, southern Utah and Arizona (Pavlick

& Anderton 2007). It is native to South America, but its status in North America is unclear. Some authors have reported this species to be introduced in North America (Hitchcock 1951, Villaseñor & Espinosa-García 2004, Pavlick & Anderton 2007), while others have considered it to be native (Stebbins 1981, Peterson & Soreng 2007). Felger (2000) suggested that the Sierra Pinacate population may be a native Pleistocene relict.

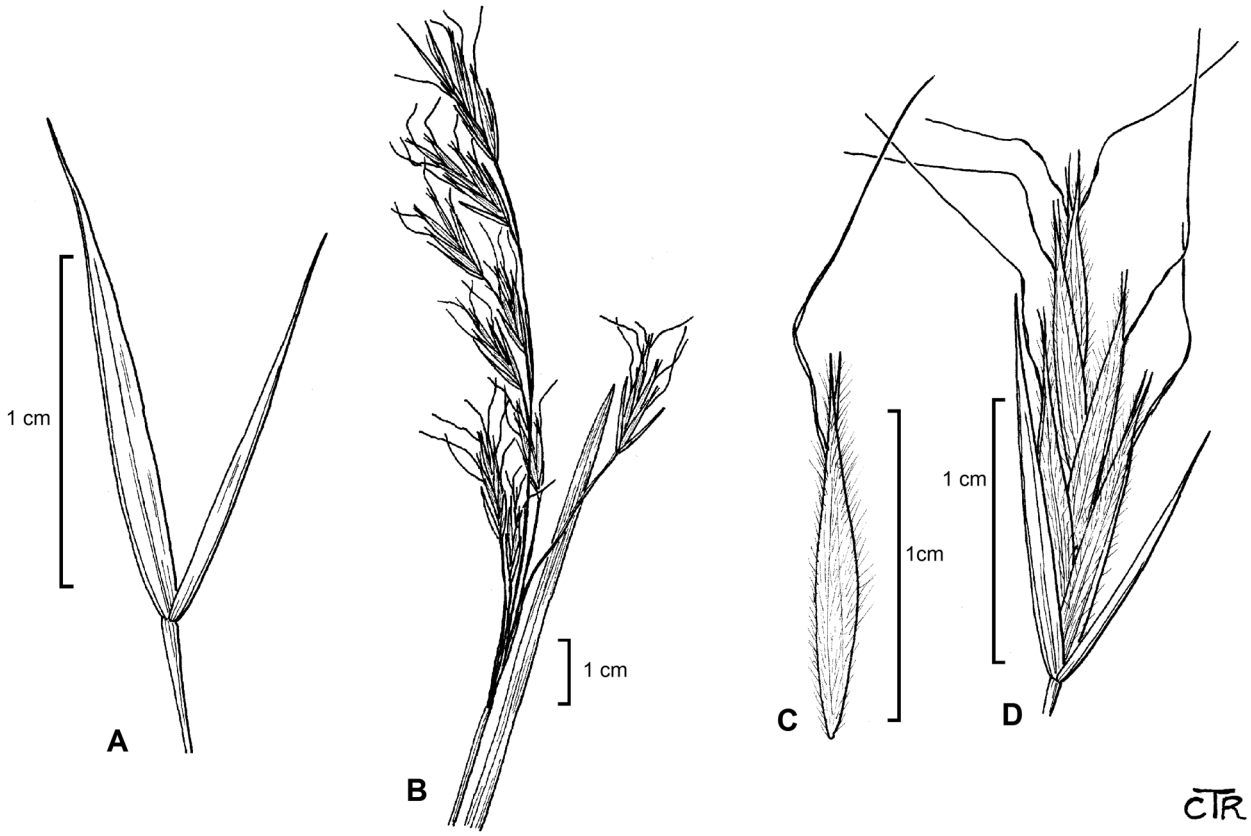


**FIGURE 11.** *Bromus berteroanus.* A. Glumes. B. Inflorescence. C. Lemma D. Spikelet. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Ecology:**—Dry, open areas in sandy or gravelly, granitic or volcanic soils; associated with *Fouquieria columnaris*, *Pachycereus pringlei* (Watson 1885: 368) Britton & Rose (1909: 422) and sclerophyllous shrubs. The species is a winter-spring ephemeral (annual) (Felger 2000). Elevation: 10–1300 m.

**Common Names:—**Chilean Chess (English).

**Comments:—**The epithet *berteroanus* was given in honour of Italian botanist Carlo Luigi Giuseppe Bertero (1780–1831), who collected the type specimen. In the Sierra Pinacate in Sonora *B. rubens* may be displacing *B. berteroanus* (Felger 2000). This species is readily distinguished by its twisted and geniculate awns, character states that do not occur in any other *Bromus* species in North America. It is one of two species of sect. *Neobromus*, and the only one present in North America; the other, *B. gunckelli* Matthei (1986: 62), is native to Chile.

**Specimens Examined:—MÉXICO. Baja California:** 2 mi N of Parador Santa Ines, 27.0667°N, 111.9833°W, 670 m, 26 March 1979, *J.R. Reeder & C.G. Reeder 7104* (SD-116039, US-2861045); 3 mi SE of Consuelo, 30.15°N, 115.7667°W, 75 m, 24 March 1970, *R. Moran 17845* (SD-76756); 3 mi WSW of El Socorro, 30.9583°N, 115.6875°W, 1050 m, 9 May 1978, *R. Moran 25786* (SD-100664); 5.3 km NE of Rancho Aguajito, 480 m, 19 April 1958, *P.H. Raven, M. Mathias & J. Turner 12537* (GH); Cedros Island, 28.22°N, 115.25°W, 18–20 March 1889, *E. Palmer 659* (GH, NY, 2 sheets); Cedros Island, copper mine canyon 1.5 mi from N end, [28.3667°N, 115.2167°W], 350 m, 27 March 1973, *R. Moran 20332* (SD-86929); Cedros Island, N of Cañon Grande, top of Sern pine ridge, 28.1833°N, 115.2°W, 525 m, 30 March 1978, *R. Moran 25417* (SD-99680); Cedros Island, Punta Norte, 28.35°N, 115.2167°W, 510 m, 14 April 1983, *T. Oberbauer, H. Wier & E. Wier 111* (SD-127654); Cedros Island, northern part of island in the vicinity of El Faro, 28.2833N, 115.25W 17 March 1994, *J.P. Rebman, T. Nash, J. Delgadillo et al. 2417* (ASU-0010747), Cerro San Luis, 29.3167°N, 114.1167°W, 1300 m, 2 March 1963, *R. Moran & J. Henrickson 10320* (RSA-POM-165017, SD-54520); E end of Sierra San Luis, 26–30


**FIGURE 12.** *Bromus berteroanus*. *Moran 6700* (SD-47590).

mi N of Punta Prieta, 29.36°N, 114.2833°W, 914–1097 m, 1 April 1950, *H.S.Gentry & F. Cech 8912* (ASU-0010746, DES-00009272, MICH-1119289, US-2820899); Ensenada, [31.78°N, 116.6°W], 11 April 1882, *M.E. Jones s.n.* (RSA-POM-112737); Guadaloupe Ranch, 32.5°N, 116.6°W, 6 April 1886, *C.R. Orcutt s.n.* (US); Guadalupe Island, [29.04°N, 118.28°W], 1875, *E. Palmer 99* (GH, NY, 3 sheets, one mixed with *B. tectorum*); Guadalupe Island, [29.04°N, 118.28°W], 1889, *E. Palmer 658* (GH, MEXU-5964, NY, 2 sheets) & *667* (P-002630826); Guadalupe Island, [29.04°N, 118.28°W], 29 March 1889, *E. Palmer 898* (F-716074, GH, NY, P-02632079); Guadalupe Island, along canyon leading W from Lobster Camp, [29.04°N, 118.28°W], 29 April 1958, *I.L. Wiggins & W.R. Ernst 205* (GH); Guadalupe Island, canyonside W of S Bluff, 28.8875°N, 118.275°W, 100 m, 27 April 1958, *R. Moran 6700* (SD-47590); Guadalupe Island, Melpomene drainage, [29.03°N, 118.275°W], 300 m, 29 April 1958, *R. Moran 6729* (SD-47591); Guadalupe Island, near mouth of Long Canyon, 29.0083°N, 118.2333°W, 100 m, 16 April 1970, *R. Moran 17369* (SD-74762); Guadalupe Island, S zone, [29.04°N, 118.28°W], 25 March 1982, *A.E. Meling 37* (SD-119488); Guadalupe Island, W Anchorage, 28.975°N, 118.2917°W, 20 m, 9 February 1957, *R. Moran 5616* (SD-46922); Guadalupe Island, [29.04°N, 118.28°W], 1 April 1889, *E. Palmer 899* (F-716073, GH, NY, P-02632080); Hassler Cove, San Martín Island, 30.4833°N, 116.1083°W, 10 m, 10 April 1963, *R. Moran 10498* (SD-54331, US); N slope of Cerro San Juan de Dios, 30.1333°N, 115.1333°W, 1100 m, 1 May 1973, *R. Moran 10687* (RSA-POM-26201, SD-87045); near San Juan Mine, 28.7167°N, 113.6333°W, 1200 m, 29 March 1960, *R. Moran 8130* (SD-60614); near Vallecito, 32.3833°N, 116.8833°W, 5 April 1886, *C.R. Orcutt s.n.* (US-1009578); San Pedro near La Bocana, 28.4667°N, 113.4167°W, 250 m, 11 March 1966, *R. Moran 12520* (SD-63135); Santa María Plains 10–20 mi S of Hamilton Ranch, 30.4°N, 115.8833°W, 6 April 1931, *I.L. Wiggins 5199* (GH, MICH-1119290, NY, RSA-POM-26595, US); Sierra San Borja, hillside near San Juan Mine, 28.7167°N, 113.6333°W, 1200 m, 29 March 1960, *R. Moran 8130* (RSA-POM-172594, US-2461509); ca. 0.5 km off of Hwy. 3 between Ensenada and H. de la Independencia, 0.2 km N of km 87, 31.75°N, 115.8333°W, 1150 m, 12 August 1995, *N. Snow & T. Prinzie 6421* (MEXU); ca. 100 km S of Ensenada on Rt. 1 near San Vicente, [31.11°N, 116.14°W], April 1967, *Stephenson s.n.* (MSC-368365); Volcán Sureste, 12 km SW of Lázaro Cárdenas, 30.520742°N, 115.927466°W, 80 m, 21 February 2001, *M.A. Baker & A. Pineda 13895* (ASU-0010745); San Quintín [Quentin] Bay, 30.560278°N, 115.9425°W, January 1889, *E. Palmer 688* (NY) & *686* (P-02630823). **Sonora:** Sierra Pinacate, summit of Pinacate Peak, [31.77°N, 113.49°W], 1290 m, 24 March 1970, *R.S. Felger, T. Hansen, A. Woodin & J. Woodin 19449* (RSA-POM-444025, SD-190690); summit of Pinacate Peak, [31.77°N, 113.49°W], ca. 1250 m, 1 March 1987, *R.S. Felger, C. Baker & G. Joseph 87-52* (RSA-POM-444057).

5. ***Bromus carinatus*** Hooker & Walker Arnott (1840: 403).

*Ceratochloa carinata* (Hook. & Arn.) Tutin in Clapham *et al.* (1952: 1458). Type:—UNITED STATES OF AMERICA. California: Monterrey or San Francisco, at no great distance from the coast, 1833, *D. Douglas s.n.* (lectotype BM-000555843!, designated by Pavlick 1995: 40, isolectotypes E-00064818!, US-865522A fragm. ex BM, MO-2957183!, NY-346213!).

*Festuca pendulina* Sprengel (1825: 356), replacement name. Replaced name: *Bromus pendulinus* Sessé ex Lagasca (1816: 4), *nom. illeg.* Blocking name: *Bromus pendulinus* Schrader (1810: 70). *Bromus hookeri* var. *pendulinus* (Spreng.) Fournier (1886: 128). Type:—Habitat in Nueva Hispania [México] unde semina advexit D. Sessé ann. 1804 [grown from seeds collected by Sessé in "Nova Hispania"] (holotype MA-14058, isotypes M, US-865450! fragm. ex M).

*Bromus luzonensis* Presl (1830: 262). *Triticum luzonense* (Presl) Kunth (1833: 446). Type:—California or British Columbia: *Haenke s.n*. (holotype PR!). See Veldkamp (1990: 660) for typification and discussion of label errors. Also see comments below.

*Bromus hookerianus* Thurber (1874: 493), replacement name. Replaced name: *Ceratochloa grandiflora* Hooker (1840: 253). Blocking name: *Bromus grandiflorus* Weigel (1772: 9), *nom. illeg. superfl. Bromus carinatus* var. *hookerianus* (Thurb.) Shear (1900: 60). Type:—UNITED STATES OF AMERICA. Oregon: plains of the Columbia River, 1826, *D. Douglas s.n.* (lectotype K, designated by Shear 1900: 61, isolectotype US-865712! fragm. ex K).

*Bromus oregonus* Nuttall ex Hooker (1856: 18), *nom. nud. Bromus oregonus* Nuttall ex Shear (1900: 59), *nom. inval.*, as syn. of *Bromus carinatus*. Type:—UNITED STATES OF AMERICA. Upper Missouri and Oregon territories, *Geyer 244.*

*Bromus virens* Buckley (1862: 98). Type:—UNITED STATES OF AMERICA. Rocky Mountains and Columbia River, *Nuttall s.n.* (holotype PH-00008640!, isotypes BM-000578894!, US-865484 fragm.).

*Bromus hookeri* var. *schaffneri* Fournier (1886: 127). *Bromus schaffneri* (E. Fourn.) Scribner & Merrill (1901: 30). Type:—MÉXICO: secus margines agrorum ubi Mays consit*a*, *J.G. Schaffner 42* (holotype P-00647229!, isotype US-865501! fragm. ex P).

*Bromus hookeri* var. *schlechtendalii* Fournier (1886: 127). *Bromus proximus* var. *schlechtendalii* (E. Fourn.) Shear (1901: 245).

MÉXICO. San Luis de Potosí, August 1891, *Virletii 1420* (lectotype P-02632337!, **designated here**, isolectotype P-02632340!). The lectotype is chosen from among the five syntypes listed by Fournier (1886).

*Bromus virens* var. *minor* Scribner ex Beal (1896: 614). Type:—UNITED STATES OF AMERICA. Oregon, 30 May 1884, *T. Howell s.n.* (holotype US-1007683!).

*Bromus carinatus* var. *californicus* Shear (1900: 60). Type:—UNITED STATES OF AMERICA. California: San Diego, 24 May 1884, *C.R. Orcutt 511a* (lectotype US-1007777!, **designated here**). An annotation by P.M. Peterson in 2002 on the specimen indicates the lectotype is designated in "Contr. U.S. Natl. Herb. 2003 in ed.," but the lectotypification does not appear there.

*Bromus carinatus* var. *densus* Shear (1900: 61). Type:—UNITED STATES OF AMERICA. California: Channel Islands, San Nicholas Island, about Opuntia, April 1897, *B. Trask 12* (isotype US-340331!).

*Bromus carinatus* var. *linearis* Shear (1900: 61). Type:—UNITED STATES OF AMERICA. California. 1875, *Vasey* (holotype US-81566!).

*Bromus laciniatus* Beal (1896: 615). *Ceratochloa laciniata* (Beal) Holub (1973: 170). Type:—MÉXICO. Oaxaca: Sierra de San Felipe, alt. 9500 ft, 17.1°N, 96.85°W, 1894, *C.G. Pringle 4897* (holotype MSC-4813!, isotypes E-00373824, GH, JE-00006481, K, MEXU-5884!, MO-2957787, NY, US-250847!).

*Bromus subvelutinus* Shear (1900: 52). Type:—UNITED STATES OF AMERICA. Nevada: Reno, 1887, *S.M. Tracy 249* (holotype US-81594!).

Plants short-lived perennials, not rhizomatous. Culms up to 150 cm tall, 2–6 cm wide at base, erect, glabrous or pubescent below inflorescences; nodes 3–6, glabrous or pubescent. Leaf sheaths glabrous or pubescent to pilose, hairs up to 2 mm long, throats glabrous or pubescent; auricles absent; ligules (1–)2–3(–4) mm long, glabrous or pubescent, lacerate-erose; blades up to 33 cm × (2–)3–6(–11) mm, flat, abaxial and adaxial surfaces glabrous or pubescent, midveins narrowing beneath the collar, margins serrulate. Panicles 5–30 cm long, open, branches erect, ascending or spreading, 4–22 cm long including spikelets, pedicels longer or shorter than spikelets, glabrous, scabrous, or pubescent, 1–3(–9) spikelets per branch. Spikelets 2–4 cm long, 4–11-flowered, elliptic to lanceolate, strongly laterally compressed; glumes glabrous or pubescent, green to purple along and between the nerves, margins hyaline, midnerves glabrous to scabrous distally; lower glumes 6.5–12 mm long, lanceolate, 3–7-nerved, apices acute; upper glumes 9–15 mm long, shorter than the lowest lemma, obovate-lanceolate, 5–9-nerved, apices acute to acuminate; lemmas 11–20 mm long, lanceolate, laterally compressed, strongly keeled distally, apices acute to obtuse, 7–9-nerved, nerves usually not raised, glabrous, scabrous, or pubescent, hairs sometimes restricted to margins, hairs up to 0.5 mm long; awns 2–15 mm long, inserted 0–0.5 mm below the lemma apex, straight; paleas shorter than the lemmas, backs glabrous or pubescent, keels ciliate, cilia up to 0.2 mm long; anthers 0.5–4.5 mm long; caryopses 9−11 mm long. $2n = 56$ (Pohl & Davidse 1971).


**FIGURE 13.** Geographical distribution of *Bromus berteroanus* in México.

**Distribution:—**Native. *Bromus carinatus* s.l. is widespread in México (Fig. 14).

**Ecology:—**Meadows, pastures, barrancas and slopes; associated with *Pinus arizonica*, *P. jeffreyi* Balf. in Murray (1853: pl. s.n.), *Abies religiosa* (Kunth in Humboldt *et al.* 1817: 5) Schlechtendal (1830: 77), *Pseudotsuga menziezii* (Mirbel 1825: 63) Franco (1950: 74), *Juniperus deppeana*, *Cupressus arizonica*, *Quercus* spp., *Q. rugosa* Née (1801: 275), *Arbutus xalapensis*, *Fallugia paradoxa* (Don 1825: 576) Endl. ex Torr. in Emory (1848: 139), *Arctostaphylos pungens*, *Salvia* Linnaeus (1753: 23), *Baccharis* Linnaeus (1753: 860) and *Ceanothus*. Elevation 1500−3200 m.

**Common Names:—**California brome (English); basicuaáre, bromo de California, masiyague, pipillo (Spanish).

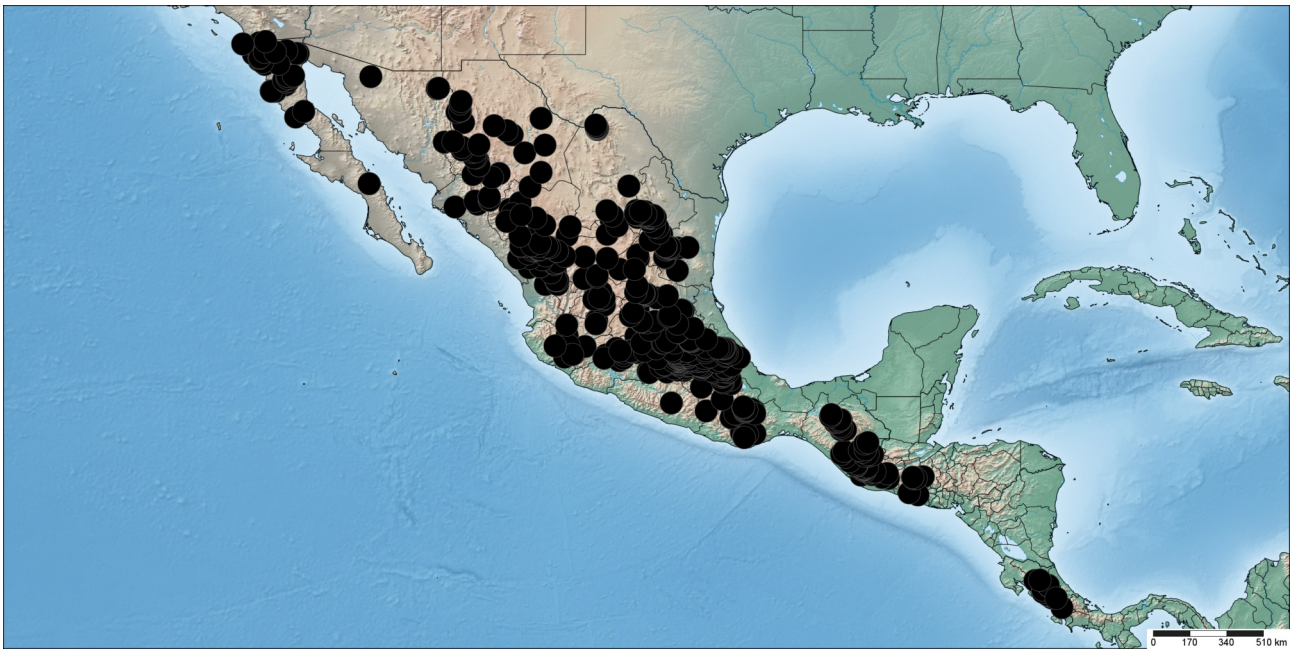


**FIGURE 14.** Geographical distribution of *Bromus carinatus s.l.* in México and Central America.

**Comments:—***Bromus carinatus* is used as fodder in México (Saulés & Dávila Aranda 1992). *Bromus carinatus* seeds are used to make tejino or tesgüino, and when there is shortage of food they are apparently used as corn (Saulés & Dávila Aranda 1992). Tejino is "… a thick, milky, nutritious brew made from corn fermented with a local grass seed (*basiáhuari*)" (Kennedy 1963).

***Variation in the Bromus carinatus complex in North America—****Bromus* sect. *Ceratochloa* comprises the hexaploid (6x) *B. catharticus* complex native to South America, the octoploid (8x) *B. carinatus* complex native to North America, the North American duodecaploid (10x) *B. arizonicus* (Stebbins 1981), and recently discovered duodecaploid taxa from South America similar in morphology to *B. ayacuchensis* Saarela & P.M. Peterson in Saarela *et al.* (2006: 919), for which the chromosome number is unknown (Williams *et al.* 2011). There is extensive morphological variation within each of the hexaploid and octoploid complexes, which has led to multiple, often-conflicting taxonomic treatments for each. Recent genetical and morphological study of the *B. catharticus* complex supported recognition of two polymorphic species (Massa *et al.* 2001, 2004). Similar revisionary work is necessary to better characterize morphological and molecular variation in the *B. carinatus* complex throughout its natural range.

The *B. carinatus* complex ranges throughout much of western North America, from Alaska to Central America. It has been introduced elsewhere, including Europe (Verloove 2012), China (Liu *et al.* 2006) and New Zealand (Stewart 1996). It comprises primarily cleistogamous plants and is extremely variable. Multiple taxa have been described in it on the basis of such characters as duration (i.e., annual, perennial, biennial), pubescence of the leaves and spikelets, blade width, panicle size and awn length (Hitchcock *et al.* 1969). In the early part of the twentieth century, multiple narrowly circumscribed taxa were generally recognized in western North America north of México (Piper 1906, Jepson 1912, Millspaugh & Nuttall 1923, Tidestrom 1925, Hitchcock 1951), whereas

in more recent decades most authors have tended to recognize fewer taxa, often including much of the variation in a single species, *B. carinatus*, usually with infraspecific taxa (Hitchcock *et al.* 1969, Stebbins 1981, Jones *et al.* 1997, Pavlick & Anderton 2007). Pavlick (1995), however, recognized six taxa in North America north of México, distinguished primarily by differences in the vestiture of leaf sheaths and blades and panicle size: *B. sitchensis* Trin. in Bongard (1832: 173), *B. aleutensis* Trin. ex Griseb. in Ledebour (1852: 361), *B. maritimus* (Piper 1905: 148) Hitchc. in Jepson (1912: 177), *B. carinatus* (including vars. *carinatus* and *marginatus*), *B. polyanthus* Scribner ex Shear (1900: 56) and *B. subvelutinus* Shear (1900: 52). Pavlick & Anderton (2007) recognized the same taxa in the Flora of North America, except *B. subvelutinus* was included in *B. carinatus* var. *carinatus*.

Numerous authors have commented on the extensive morphological variation in the complex, and have noted that there is considerable intergradation among taxa throughout the range of the complex (Shear 1900, Hitchcock 1951, Hitchcock *et al.* 1969, Pavlick 1995). Given the variation and difficulties in delimiting taxa in the *B. carinatus* complex, Stebbins (1981) suggested that all taxa be treated as a single species. No treatment so far has taken this approach. An AFLP study of *B. carinatus* s.l., based on 30 accessions collected throughout western North America, identified four major genetic lineages and five unique accessions, but the authors did not comment on morphological variation within the major lineages, or whether or not the lineages correspond to previously-recognized taxa in the complex (Massa & Larson 2005). Barkworth *et al.* (2006) studied morphological and geographical variation in *B. carinatus* s.s., *B. marginatus* and *B. polyanthus*. Their results supported recognition of *B. carinatus* with two varieties, and *B. polyanthus*. Barkworth *et al.* (2006) considered Massa & Larson's (2005) molecular results for the complex and noted that, upon examination of the voucher specimens used in the AFLP study, the three accessions in Massa & Larson's (2005) "group 4" are *B. polyanthus*, while the others are *B. marginatus* (=*B. carinatus* var. *marginatus*).

Several taxa in the complex were described from México in the 19th century, including *B. pendulinus*, *B. hookeri* var. *schaffneri*, *B. hookeri* var. *schlechtendalii* and *B. laciniatus*. Shear (1900) recognized *B. laciniatus* in México, whereas Hitchcock (1913) recognized two species: *B. carinatus*, from Baja California, and *B. pendulinus* (syn. *B. laciniatus*), distributed throughout México. Hitchcock later recognized the taxon in Central America and México as *B. laciniatus*, realizing that the name he used earlier, *B. pendulinus* Sessé, is a later homonym of *B. pendulinus* Schrad. (Hitchcock 1930, 1935, 1951). Other authors also recognized Central American plants as *B. laciniatus* (Standley 1937, Swallen & McClure 1955). It is not clear in any of these treatments how to distinguish *B. laciniatus* from plants of the *B. carinatus* complex from north of Mexico. Johnston (1943) treated plants in the group from Coahuila as *B. schaffneri* and *Bromus* sp. (two unnamed taxa). Soderstrom & Beaman (1968) considered *B. laciniatus* to be a synonym of *B. carinatus*, a treatment followed by subsequent workers (Beetle 1977, Pohl 1980, Gould & Moran 1981, McVaugh 1983, Pohl & Davidse 1994, Espejo-Serna *et al.* 2000, Morales 2003, Pavlick *et al.* 2003). Soderstrom & Beaman (1968) included *B. arizonicus* in their concept of *B. carinatus*, a view with which we do not agree (also see Stebbins 1981). We recognize all plants in México and Central America as *B. carinatus*, maintaining current usage of the name (Pavlick & Anderton 2007, Saarela & Peterson 2012). Within *B. carinatus* we recognize two varieties, distinguished by awn length, as in Barkworth *et al.* (2006) and Pavlick & Anderton (2007). Not all of the specimens examined for this study were determined to variety; those determined only to species are listed below as *B. carinatus s.l.*

Although *B. carinatus* is the most widely-used name in the complex, the little-used name *B. luzonensis* Presl (1830: 262) has priority for plants currently treated under this name. *Bromus luzonensis* was described from a collection made by Haenke that was reported to have come from Luzon, Philippines. Veldkamp (1990) pointed out that there are no *Bromus* species in the Malesian lowlands, and that the specimen matches *B. breviaristatus* (=*B. carinatus* var. *marginatus*) from western North America. He suggested there was a labelling error on the specimen, as Merrill (1922) noted earlier, and that the specimen came from either British Columbia or California, where Haenke collected (Sterling 1997). *Bromus luzonensis* has not been included in most treatments of *Bromus* in the United States (see Table 1 in Barkworth *et al.* 2006), probably because it was thought to represent a non-American species. Pavlick (1995) recognized *B. luzonensis* as a synonym of his resurrected *B. subvelutinus* (even though *B. luzonensis* is an earlier name), a species that most later authors, including Pavlick & Anderton (2007), have included in *B. carinatus*. If *B. luzonensis* and *B. carinatus s.l.* are considered to be the same species, the correct name for the species is *B. luzonensis*.

Given the current circumscription of taxa in the complex, there are two options for resolving this nomenclatural problem: the species could be recognized as *B. luzonensis*, which would require new combinations

for all infraspecific taxa in the group, or conservation of the widely-used and familiar name *B. carinatus* against *B. luzonensis* could be argued for. We feel it is premature to argue for conservation pending a more detailed study of variation and species boundaries in the entire *B. carinatus* complex, and particularly resolution of the status of *B. sitchensis*. If addititional data support recognition of a single species in the *B. carinatus* complex, the correct name for the species would be *B. sitchensis*—the oldest name in the complex. Boivin (1967) took this approach in his list of Canadian plants, at least in part, as he treated *B. marginatus* as variety of *B. sitchensis*. If *B. sitchensis* (type from Sitka, Alaska, representing a form with large, open panicles with long branches) is supported as a distinct species, as recognized in current treatments, the next oldest available name is *B. luzonensis*.

***Morphological variation in Bromus carinatus in México and Central America*—**Panicle size in *B. carinatus* varies dramatically throughout the region, ranging from narrow with very short and almost non-existent ascending-appressed branches, to large and open with branches up to 21 cm long. Most plants from Baja California have narrow panicles with short ascending-appressed branches, densely pubescent sheaths and blades and pubescent spikelets. Such plants correspond to the taxon described by Shear as *B. subvelutinus*, which was recognized by numerous earlier authors (sometimes as *B. breviaristatus*) and more recently by Pavlick (1995), but included in *B. carinatus* in more recent treatments (see Table 1 in Barkworth *et al.* 2006). Many plants from the Sierra Madre Occidental and Sierra Madre Oriental have glabrous sheaths and blades and lemmas that are glabrous across the back and short-pubescent along the margins, but there is considerable variation in each of these characters, which vary independently among collections. The following examples have the character states as listed above, unless otherwise mentioned: *Sharp 44418* (GH) from Puebla and *Molina R. & Montalvo 21822* (GH) from El Salvador have pubescent or short-pilose sheaths; several specimens have lemmas that are more or less evenly pubescent across the back (*Marsh 1439*, GH, from Coahuila; *Rose & Painter 6750*, GH, from Hidalgo; *Kenoyer 2047*, GH, from Guanajuato); *Palmer 346* (GH) from Durango has pubescent lemmas and sheaths and blades pubescent along the margins; *Palmer 171* (GH) from Durango has essentially glabrous lemmas and pilose sheaths; and *Harvey 6380* (GH, MICH) from Sinaloa has glabrous lemmas.

Plants from the Sierra Madre Occidental and Sierra Madre Oriental generally have panicles with the longest lower branches including the spikelets ranging in length from (5–)8–12 cm, but there are numerous collections from throughout the region with slightly to much longer branches, ranging from 12.5–21 cm long. Examples include: *Pringle 13243* (GH) from México (branches 12.5 cm long), *Harvey 8538* (MICH) from México (16 cm), *Botteri 727* (GH) from México (19 cm), *Nicolás & Arséne 270* (GH) from Puebla (21 cm), and *Williams et al. 26394* (F) from Guatemala. *LeSueur Mex-110* (GH) from Chihuahua has lower panicle branches up to 14.5 cm long, glabrous glumes and glabrous sheath collars. The latter two characters fit *B. polyanthus*, a taxon known from the adjacent U.S.A., but the panicle branches in this species are reported to be <10 cm long (Pavlick & Anderton 2007); we keep this specimen in *B. carinatus.* In Pavlick & Anderton (2007), plants with lower branches greater than 10 cm would key to *B. sitchensis*, a taxon distributed primarily along the coast from the Aleutian Island through British Columbia and to southern California, and characterized by its large, open panicles with lower panicle branches 10–20 cm long. Verloove (2012) has recently reviewed in detail the differences between *B. carinatus* and *B. sitchensis* reported in the literature. The boundaries between *B. carinatus* and *B. sitchensis* are unclear and are seemingly arbitrary given the variation in panicle size throughout the range of the *B. carinatus* complex (J.M. Saarela, personal observation). Plants with very large panicles are scattered throughout México and Central America, and we include these in *B. carinatus*.

**Specimens Examined (*Bromus carinatus* s.l.):—COSTA RICA**. **Alajuela:** in and around Zarcero, Cantón Alfaro Ruíz, Hwy. 15, [10.1833°N, 84.4°W], 1700–2000m, 3 September 1966, *A.S. Weston 2154, D.F. Weston & J. Weston* (CR-82588). **Cartago:** km post 19 along road to the crater of Volcán Irazú, [9.97°N, 83.85°W], 2600m, 1 August 1968, *R.W. Pohl 10807 & G. Davidse* (CR-47121); carretera al Volcán Irazú, cerca del Santorio Durán, [9.97°N, 83.85°W], 2340 m, 2 November 1968, *J.J. Códoba 1013* (CR-74092); Oreamuno, P.N. Volcán Irazú, Cuenca del Sarapiquí, 9.9858°N, 83.8425°W, 3200–3300 m, 2 May 2003, *E. Alfaro 4304 & K. Quirós* (CR-0252396, INB, MO); Volcán Irazú, within 1 km radius of Sanitoria Durán, [9.97°N, 83.85°W], 2300–2450m, 21 November 1966, *A.S. Weston 3385, D.F. Weston & J. Weston* (CR-81823); along road to crater of Volcán Irazú, [9.97°N, 83.85°W], 2600 m, 7 August 1966, *R.W. Pohl 10235 & C. Calderon* (CR-141103, MO); Cartago, Paraíso, Orosi, 9.5571°N, 83.708°W, 14 February 2008, *S. Lobo 1970, J. Guerra A. & K. Romoleroux s.n.* (CR). **Puntarenas:** Térraba, 23 January 1943, *J. León 1118* (CR). **San José:** Dota, Copey, 9.5778°N, 83.8019°W, 2343 m, 22 February 2001, *A. Estrada 2785, J. Sánchez, J. Solano et al.* (CR-22749); Dota, Cerca de Providencia,

9.59°N, 83.8835°W, 2785 m, 3 July 2000, *S. Simis 309* (INB); León Cortés, Cuenca del Pirrís-Damas, 9.55°N, 83.7875°W, 2100 m, 15 November 1998, *J.F. Morales 6716* (INB, MO) & *6717* (CR-0243248); Pérez Zeledón, Cuenca Térraba-Sierpe, Cerro de la Muerte, 9.4636°N, 83.7025°W, 1650m, 23 September 2005, *D. Santamaría A. 3153, A. Antonelli & C. Persson* (INB, MO). **GUATEMALA. Quezaltenango:** Chiquilaja, 2340 m, [14.8°N, 91.67°W], 24 June 1954, *M. de Koninck 71* (US-2151637). **Solola:** Volcán Atitlan, near summit, ca. 3535 m, [14.58°N, 91.19°W], 10 August 1960, *J.H. Beaman 4060* (F-2208205, MSC-171813). **MÉXICO**. **Aguascalientes:** Mesa Potrero Viejo, Calvillo, [21.85°N, 102.72°W], September 1988, *E. Lugo 277* (MEXU-1110801); Mpio. Aguascalientes, Aguascalientes, [21.89°N, 102.29°W], 8 August 1978, *E. de la Cerda s.n.* (MEXU-272092); Mpio. Aguascalientes, La Cantera, [21.83°N, 102.37°W], 29 November 1978, *G. Calvillo Michaus s.n.* (MEXU-304337); Mpio. Aguascalientes, Pabellón, [ 21.6167°N, 102.28°W], 17 December 1978, *J. Romo D. s.n.* (MEXU-272147); Mpio. Aguascalientes, Panteón La Cruz, 21.8867°N, 102.3083°W, 1979, *F. Flores A. s.n.* (MEXU-300735); Mpio. San José de Gracía, Laguna Seca, [22.15°N, 102.42°W], 2650 m, September 1991, *O. Sánchez Herrera 79* (MEXU). **Baja California:** carretera vieja Tijuana-Ensenada a la altura de Santa Rosa, [32.1°N, 116.86°W], 28 April 1981, *R. Guzmám 1233* (MEXU-1069520); Ensenada, [31.87°N, 116.59°W], 27 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 82* (MEXU-1098001); San Martín Island, trail up to top, 30.5°N, 116.1167°W, 10 January 1983, *T. Oberbauer 135* (SD-127651). **Chihuahua:** Mpio. Guachochic, Cusárare, near old church, 27.6167°N, 107.5333°W, 6900 ft, 4 August 1974, *R.A. Bye 6771* (MEXU-821133); Mpio. Bocoyna, Ejido San Ignacio Arareco, km 85 carretera Balleza-Guachochic, [26.91°N, 106.94°W], 24 September 1981, *M.E. Siqueiros 1607* (MEXU-1098006); Mpio. Madera, 1.5 km de Colonia Chuhuichupa, [29.62°N, 108.4°W], 2240 m, 13 October 1990, *O. Bravo Bolaños 1894* (MEXU-583327); Mpio. Madera, Ejido Madera, [29.19°N, 108.13°W], 2400 m, 8 September 1977, *Blanco 06/77* (MEXU-1035076); near the airstrip SE of Creel, [27.81°N, 107.63°W], 7300 ft, 5 August 1972, *R.A. Bye Jr. 2689* (MEXU). **Coahuila:** Arteaga, 25.44°N, 100.85°W, 1660 m, 20 July 1993, *P. Moya 432* (MEXU-1099496); Mpio. Ramos Arizpe, Predio La Esmeralda, 25.5353°N, 100.96°W, 1390 m, 16 June 1994, *E. Pérez 51* (MEXU-1099439); Sierra Zapalinamé, Cerro El Penitente, en exposición noroeste de la sierra, 25.3483°N, 100.9047°W, 2990 m, 15 September 2005, *J.A. Encina, F.J. Encina & J.M. Guillermo E. 1476* (ANSM). **Distrito Federal:** a las faldas del Cerro Teuhtli, Delegación Milpa Alta, [19.19°N, 99.02°W], 2470 m, 24 October 1985, *E. Manrique et al. 1224* (MEXU-1110815); Ajusco, Rancho Viejo Cuilotepec Tlalpan, [19.2075°N, 99.2581°W], 2730 m, 19 September 1985, *E. Manrique et al. 1145* (MEXU-1110822); camino al Volcán Guadalupe, Delegación Tláhuac, [19.27°N, 99.02°W], 10 October 1985, *A. Miranda & P. Guerrero 46* (MEXU-1110784); Cerro del Ajusco, "Tierra y Libertad" Delegación Tlalpan, 19.2069°N, 99.2597°W, 3260 m, 19 September 1985, *E. Manrique 1154* (MEXU); Delegación Contreras, [19.31°N, 99.24°W], 23 February 1984, *G. Villegas 1621* (MEXU-1110809); Delegación Tlalpan, Centro de Educación Ambiental Ecoguardas, [19.28°N, 99.18°W], 2550 m, 6 September 1996, *N. Velázquez, B. González & J.L. Castillo 19* (MEXU); desvación al Xitle, Delegación Tlalpan, [19.28°N, 99.18°W], 2870 m, 24 October 1985, *E. Manrique et al. 1175* (MEXU-1110802); Lomas de Santa Fe, [19.36°N, 99.27°W], September 1927, *n.c. 174* (MEXU-240276); Molina de la Clor [Flor], Texcoco, Valle de México, 19.5333°N, 98.8167°W, 2300 m, 6 August 1950, *E. Matuda 18938* (MEXU, US-2040909); Pedegral de San Angel, [19.39°N, 99.09°W], 2200 m, 14 July 1967, *de Lourdes Segura 15* (MEXU-822136, MO); Pedegral de San Angel, [19.39°N, 99.09°W], 2200 m, 15 May 1966, *N. Diego 812* (MEXU-368903); Valle de México, 19.4°N, 99.15°W, 3000 m, 3 July 1951, *E. Matuda 21304* (MEXU, US-2043390); Valle de México, Ajusco, [19.32°N, 99.16°W], 3500 m, 9 December 1951, *E. Matuda 25750* (MEXU); Xochimilcho, [19.26°N, 99.11°W], *Noriega s.n.* (MEXU-5056). **Durango:** Barranca de los Mimbres, at route 40 bridge over the river, 25.86°N, 105.78°W, 14 July 1964, *M. & W. Johnson 1800* (MEXU); El Temascal, [23.405°N, 104.2822°W], 31 July 1984, *S. González 2989* (ANSM); Mpio. Durango, areas Agric., Ejido Belisario Domínguez, 23.9958°N, 104.5131°W, 1860 m, June 1997, *R. Rangel 280* (MEXU); Mpio. Durango, Ejido Echeverría de la Sierra, [23.8°N, 105.05°W], 2400 m, *Ochoa-Vazquez 316* (MEXU); Mpio. Durango, Ejido Echeverría de la Sierra, [23.8°N, 105.05°W], 2500 m, *B. Durango 341* (MEXU-1110771); Mpio. Durango, Ejido Gabino Santillán, [23.9864°N, 104.5878°W, 1920 m, June 1994, *D.E. Aceval A. 503* (MEXU-1063359); Mpio. Durango**,** Gabino Santillán a Dolores Hidalgo, 23.9989°N, 104.5694°W, 1840 m, October 1995, *T.A.S. Aguirre T. 173* (MEXU-1087406). Mpio. San Juan de Michis, Reserva La Michilia, 80 km al SE de Durango, [23.62°N, 104.02°W], 11 October 1980, *A. Carrillo S. 75* (MEXU-300759); Mpio. Tepehuanes, 17 km al O de Los Altares, [25.59°N, 106.19°W], 2250 m, 19 September 1985, *P. Davila, P. Tenorio & I Solis 96* (MEXU). **Guanajuato:** Cerro Culiacán cerca de la torre de microondas, E de Victoria de Cortázar, 2800 m, 31 August 1981, *R. Guzmán 4467* (MEXU-1098039, US-

2381745); Mpio. Cortázar, faldas del cerro del Culiacán, [20.33°N, 100.97°W], 2300 m, 29 October 1992, *J.J. Macias Cuellar 70* (MEXU); Mpio. Guanajuato, Mesa de los Hernandez, El Corral, 21.154°N, 101.18°W, 2415 m, 28 September 1997, *J. Martínez-Cruz 682* (MEXU-847075); San Diego de la Unión, 2100 m, 21.45°N, 100.88°W, 21 August 1980, *J. Sánchez C. 7/J* (MEXU-1089792). **Hidalgo:** Mpio. Acaxochitlan, San Francisco, [ 20.07°N, 98.38°W], 2000 m, 30 May 1985, *A. Villa Kamel 184* (MEXU-774329); Mpio. El Chico, Las Ventanas 6 km al N de Pachuca, [20.1217°N, 98.7358°W], 2900 m, 2 November 1983, *M. Medina Cota 2481* (MEXU-573961); Mpio. Zapotlán de Juárez, Cerro Colorado, 20°N, 98.8833°W, 2340 m, 7 July 1995, *J.A. Montaño Morales 28* (MEXU); Valle de México, Real del Monte, 20.1333°N, 98.6667°W, 2600 m, 12 August 1951, *E. Matuda 21641* (MEXU-91087, US-2041602). **Jalisco:** 12–14 km al NNE de Minatitlan, 1–3 km al NNE de El Terrero, 19.4525°N, 103.9344°W, 2100–2200 m, 13 October 1988, *R. Cuevas & L. Guzmán 3339* (MEXU-723320); 18 km despues Del Fresnito rumba al Nevado, [19.94°N, 103.75°W], 1920 m, 19 October 1988, *M.L. Román 1052* (MEXU); Mpio. Ayutla, Paraje Las Iglesias, campamento de silvicultura de occidente S. A. [20.98°N, 102.6°W], 2140 m, 13 August 1979, *E. Guizar N. 518* (MEXU-246621); Mpio. Cocula, Cerro de las Microondas de Quililla, [20.36°N, 103.83°W], 2000 m, 16 September 1993, *R. Acevedo R., M. Cházaro B., J. Lomelí S. & M. Huerta M. 1447* (MEXU); N slopes of Nevada de Colima, 19 September 1980, *A.A. Beetle & R. Guzmán M. M-5403* (MEXU). **Estado de México:** 3 km al N del Volcán Gordo, [19.12°N, 99.82°W], 3300 m, 29 September 1987, *J. García Aldape 6* (MEXU-1110817); entre Magdalena y Tapaxco, 9 August 1981, *R. Guzmán 4260* (MEXU); entre Raíces y Las Peñas, as S de Toluca, [19.12°N, 99.69°W], 3304 m, 1 August 1981, *R. Guzmán 3989* (MEXU-1110807); Mpio. Coacalco, Coacalco de Berreozabal, Colonia Ejidal Coacalco, 2340 m, 21 November 1993, *R. Bye & E. Linares 18877* (MEXU-821076); Mpio. Huizquiluca, Rancho el Hielo, km 22 carretera Naucalpan-Toluca, [19.36°N, 99.34°W], 3050 m, 1 October 1992, *A. Miranda et al. 581* (MEXU-1110827); Mpio. Temamatla, 3 km de Temamatla, [19.2°N, 98.87°W], 2250 m, 15 October 1980, *S. Becerra M. 115* (MEXU-684702); Mpio. Temascaltepec, [19.05°N, 100.23°W], 30 July 1987, *L. Oguin P. 20* (MEXU); Mpio. Texcoco, Molino de la Flor, Texcoco, Valle de México, 19.51°N, 98.88°W, 2300 m, 6 August 1950, *E. Matuda 18938* (MEXU); Mpio. Tezoyuca, Río Papalotla, cerca del puente de la carretera-Tepexpan, [19.6°N, 98.92°W], 2240 m, 29 June 1980, *A. González Ramírez 86* (MEXU-799986); por el camino S Valle de Bravo, a 1 km al NNW de Temascaltepec, 19.04°N, 100.22°W], 1660 m, 3 August 1981, *R. Guzmán 4094* (MEXU). **Michoácan:** 1 km al SW de Zíngiro, sobre el camino a Erongarícuaro, [19.5833°N, 101.7167°W], 2400 m, 2 November 1989, *J. Rzedowski 49202* (MEXU-649339); a 12 km al N de Uruapan, carretera a Carapan, [19.53°N, 102.08°W], 2075 m, 22 August 1980, *J.C. Soto Núñez 2393* (MEXU); a 2.5 km al SO de Angahuan, [19.54°N, 102.22°W], 2200 m, 14 August 1990, *J.C. Soto Núñez, G. Silva R., F. Soto Román & R. Acosta 13842* (MEXU-650596); a 28 km al W de Pátzcuaro, carretera a Uruapan, [19.49°N, 101.84°W], 2200 m, 22 December 1977, *J. C. Soto Núñez, R. Hernánzez & R.L. Andrade 491* (MEXU-759020); Mpio. Angahuah, en derrame de laval, entre el llano Capatzi y el Cerro Capatzi, ca. 2.5 km al SO de Annahuan, [19.54°N, 102.22°W], 2200 m, 14 August 1990, *J.C. Soto Núñez 13847* (MEXU-833657); Mpio. Morelia, cerca del Balneario Cointzio, [19.7°N, 101.2°W], 1900 m, 19 August 1986, *J. Rzedowski 40415* (MEXU-684139); Mpio. Pátzcuaro, ca. 1 km E of Colonia Nueva, along MEX 14, 19.5417°N, 101.5°W, 2100 m, 10 March 2002, *V.W. & P.I. Steinmann 2371* (MEXU, NY); Mpio. Santa Fé, Santa Fé, Colonia Los Nogales, 19.5333°N, 101.6°W, 2100 m, 29 August 2001, *V.W. Steinmann 1886b* (MEXU-1085340, NY); Mpio. Quiroga, Cerro El Chino, al N de Quiroga, [19.67°N, 101.53°W], 2360 m, 23 July 1980, *J. Caballero & C. Mapes 1201* (MEXU-325953); Mpio. Zitácuaro, Macho de Agua, 7 km al E de Zitácuaro, carretera Zitácuaro-Toluca, [19.45°N, 100.29°W], 2700 m, 27 August 1982, *P. Tenorio L. 1573, R. Torres C. & C. Romero de T.* (MEXU, MO). **Morelos:** carretera Tlayacapan-Xochimilco 6 km después de la desviacióa Tlalnepantla, [19.01°N, 98.99°W], 12 December 1986, *A. Miranda & P. Guerrero 406* (MEXU-1110850); Mpio. Morelos, 6 km de CICITEC, 27 March 1981, *G. Ayala A. 51* (MEXU-1110816); Mpio. San Gregario, San Gregario, [19.34°N, 98.896°W], 2200 m, 1 April 1951, *E. Matuda 21017* (MEXU-109688); Mpio. Tlalnepantla, 5 km al N de Tlalnenantla, [18.95°N, 98.2333°W], 2159 m, 29 September 1982, *A. Sotelo G. 352* (MEXU-336839). **Oaxaca:** 15 km antes de San Miguel Peras, [16.94°N, 97.02°W], 2800 m, 21 July 1979, *P. Guerrero 81* (MEXU-1099510); 42 km de Putla rumbo a Tlaxiaco, 2360 m, 23 June 1980, *A.A. Beetle M-4720* (MEXU-1099509); carretera Huajapan de León-Oaxaca, 8 km sobre la desviación a Coixtlahuaca, [17.07°N, 96.75°W], 2210 m, 11 September 1979, *P. Guerrero 246A* (MEXU); Distr. Juxtlahuaca, faldas y cima del cerro de la torre de microondas de El Manzanal, 17.2203°N, 98.0547°W, 2395 m, *J. Ismael Calzada 21334* (MEXU-988958, MO); Mpio. Ixtlán, ca. 5 km E of church in Ixtlán de Juárez, [17.32°N, 96.48°W], 2100 m, 8 April 1981, *J. Martín 504* (MEXU, MO); Mpio. San Juan Mixtepec, Miahuatlán, 16.2767°N, 96.03°W,

2050 m, 13 August 1997, *E. Hunn 1443* (MEXU); Mpio. San Juan Mixtepec, Miahuatlán, [16.32°N, 96.59°W], 24 January 1997, *E. Hunn OAX-732* (MEXU-959354); Mpio. Suchixtlahuaca, 2.5 km de Suchixtlahuaca, sobre la carretera a Tejupan, 17.7069°N, 97.3885°W, 2150 m, 29 June 2003, *J. Ismael Calzada 24077* (MEXU); Mpio. Tontontepec, road between Ayutla and Totontepec, at turnoff to Villa Alta, 17.2333°N, 96.07°W, 2370 m, 5 May 1986, *R.E. Gereau, A. Flores & G.I. Manzanero M. 2103* (MEXU-451741, MO); Santiago Juxtlahuaca, San Martín Peras, a km de la intersección a Coicoyán de Las Flores, 17.2963°N, 96.18°W, 2570 m, 17 October 1994, *J.L. Panero & I. Calzada 5116* (MEXU-831481). **Puebla:** entronque comunidad La Trinidad, camino a African-Tecali de Herrera, [18.92°N, 98.07°W], 4 October 1988, *E. Coyote E-35* (MEXU-1110836); km 17 carretera Sta. Ma. Del Monte, rumbo a Coxcatlán, [18.54°N, 97.2°W], 14 August 1985, *I. Núñez et al. 13*0 (MEXU-1110797); Mpio. Santiago Mihuatlan, 4.5 km de San Bernardino Lagunas rumbo a Nicolás Bravo, [18.61°N, 97.31°W], 2480 m, 6 August 1981, *S. Morales 67* (MEXU-1099440); Mpio. Zoquitlán, 13 km de Zoquitlán rumbo a Coxcatlán, [18.35°N, 97.02°W], 4 August 1981, *S. Morales 47* (MEXU-1110772). **San Luis Potosí:** Mpio. Villa de Zaragoza, Villa de Zaragoza, rancho El Sumidero, 22.06°N, 100.72°W, 3 December 1997, *M.A. Reyes Ch. 835* (MEXU). **Tamaulipas:** Mpio. Güémez, Los San Pedros, [23.98°N, 99.23°W], 2100 m, 18 September 1980, *G. Villegas 439* (MEXU-1007323). **Tlaxcala:** Mpio. Atlangatepec, Laguna de Atlanga, [19.53°N, 98.2°W], 2320 m, 31 July 1981, *L. Román M. 20* (MEXU-1099504); Mpio. Huamantla, Volcán La Malinche, [19.38°N, 98.05°W], 4200 m, 4 December 1988, *R. Acosta Pérez 2450* (MEXU); Mpio. Tlaxco, cerro de la Víbora, del poblado de Acopinalco del Peñón, [19.62°N, 98.19°W], 16 January 1990, *P. Moya 23* (MEXU-1099503); Mpio. Tzompantepec, San Miguel Buenavista, [19.37°N, 98.09°W], 2600 m, 16 September 1988, *A. Carcaño V. 142* (MEXU-661366); Tlaxcala, [19.31°N, 98.24°W], 3000 m, 13 July 1966, *G.B. Van Schaack 3381* (MEXU-813569); Zacatelco, [19.21°N, 98.24°W], 5 December 1980, *H. Vibrans s.n.* (MEXU-995621). **Veracruz:** between Xalapa and Perote, 19.62°N, 97.0697°W, 2300 m, *S.J. Darbyshire & M. González-Ledesma 4792* (DAO-811330); camino terracería Astacinga-Tehuipango, 18.525°N, 97.0506°W, 2400 m, 18 April 1997, *H. R. Sandoval 468* (MEXU-1098024); Mpio. Acajete, La Joya, 19.61°N, 972.0333°W, 2100m, 9 September 1980, *T. Mejía S. 199* (MEXU-401697); Mpio. Atzalan, 3 km al noreste de Atzalan, 19.81°N, 97.22°W,1400 m, 16 October 1991, *H.R. Sandoval 187* (MEXU-1110791) & *198* (MEXU-1110792); Mpio. Calcahualco, 10 km al O de Escola, Rincon de Atotonilco, 19.12°N, 97.08°W, 2200 m, 25 April 1985, *J.L. Martínez 75* (MEXU); Mpio. Coatepec, Coatepec (Briones), 19.47°N, 96.9333°W, 1250 m, 9 October 1980, *T. Mejía S. 398* (MEXU-401699); Mpio. Coatepec, Xalapa-Coatepec, 19.45°N, 96.9333°W, 1500 m, 7 October 1980, *T. Mejía S. 367* (MEXU-401698); Mpio. Coscomatepec, comunidad La Candelaria, carretera Huatusco-Coscomatepec, [19.15°N, 96.99°W], 1300 m, 18 June 1996, *H.R. Sandoval 394* (MEXU-1099500); Mpio. Perote, camino al Cofre de Perote, 19.4967°N, 97.1475°W, 4040 ft, 28 March 1995, *P.J. Parroquín 91* (MEXU); Mpio. Perote, por la vereda de Los Altos de la Laguna Tilapa, Parque nacional Cofre de Perote, 19.45°N, 97.2°W, 3400 m, *H. Narave F. & F. Vazquez B. 773* (MEXU-687983); Mpio. Rafael Ramírez, Cañón del Río Huichila, [19.6314°N, 97.1133°W], 2000 m, 6 July 1973, *M. Cházaro & J. Dorantes 213* (MEXU-743298); Mpio. Rafael Ramírez, entrada a Las Lajas, 19.6314°N, 97.1133°W, 2470 m, 28 March 1995, *P.J. Parroquín 66* (MEXU-1097973); Tanillas [?], limite del Estado de Veracruz con el Estado de Hidalgo, 2500 m, 19 July 1971, *Géómez-Pompa 1773* (F-19123234); Totozimpa, "La Rancheria" camino al Pico de Orizaba (por Coscomatepec), [19.07°N, 97.05°W], 2200 m, 22 July 1982, *R. Guzmán, A. Beetle & E. Manrique 5819* (MEXU-1110776);

**Key to the varieties of *Bromus carinatus*:**

1. Most awns > 7 mm long ..... 5a. *B. carinatus* var. *carinatus*
– Most awns ≤ 7 mm long ..... 5b. *B. carinatus* var. *marginatus*

5a. ***Bromus carinatus*** var. ***carinatus.*** Figs. 15A–D, 16.

Awns 7.1–10 mm long.

**Distribution:—**This variety is not as widespread as var. *marginatus*. It is known from Costa Rica (Cartago, Heredia, San José), Honduras (Ocotepeque) and Mexico (Baja California, Coahuila, Chiapas, Chihuahua, Distrito Federal, Durango, Guanajuato, Jalisco, Estado de México, Michoácan, Nuevo León, Oaxaca, Puebla, San Luis Potosí, Sinaloa, Tamaulipas, Tlaxcala and Veracruz) (Fig. 17).


**FIGURE 15.** *Bromus carinatus* var. *carinatus*. A. Spikelet. B. Lemma. C. Inflorescence. D. Ligule. *Bromus carinatus* var. *marginatus*. E. Spikelet. F. Lemma. G. Inflorescence. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.


**FIGURE 16.** *Bromus carinatus* var. *carinatus*. *Gould 11621* (MICH-1119195).

**Comments:—**Elsewhere in North America awns in this variety range to 15–17 mm long (Pavlick & Anderton 2007, Saarela & Peterson 2012). In México and Central America we have not seen specimens with awns greater than 10 mm long.

**Specimens Examined:—COSTA RICA. Cartago:** 6 km SW of Pacayas, [9.8°N, 84.08°W], 1700 m, 10 August 1968, *R.W. Pohl & G. Davidse 10893* (CR-46403, F-1732776); km post 19 along road to the crater of Volcán Irazú, [9.97°N, 83.85°W], 2600 m, 1 August 1968, *R.W. Pohl & G. Davidse 10807* (F-1733610); Volcán Irazú, 9.9769°N, 83.8542°W, 16 August 1964, *W.E. Booth 166* (US-3480655). **Heredia:** Volcán Irazu, [9.97°N, 83.85°W], 1912, *A.M. Brenes s.n.* (NY). **San José:** at km post 51 along the carretera Interamericana, N of Empalme, 1980 m, 22 August 1968, *R.W. Pohl & G. Davidse 11005* (CR-47205, F-1731856, US-3578264); **HONDURAS. Ocotepeque:** Mt. Cocal of Cordillera Merendon 20 km NW of Ocotopeque, [14.49°N, 89.04°W], 1800 m, 25 August 1968, *A. Molina R. 22140* (F-1675844, NY). **MÉXICO. Baja California:** Ensenada, 31.8606°N, 116.6178°W, 7 April 1882, *Jones s.n.* (RSA-POM-112248); Ensenada, 32.5°N, 116.6°W, 7 April 1886, *C.R. Orcutt s.n*. (US-1009472); Sierra de Juárez, Parque Nacional Constitución de 1857, Laguna Hanson, 26 May 1987, [32.05°N, 115.9167°W], 1610–1700 m, *R.F. Thorne, A. Strid, K. Tan, F. Ehrendorfer & A. Liston 62392* (NY, RSA-POM-394998, F-2047437); just below head of Prado del Corona, 1 mi above end of road from oak pasture and Melling Ranch, [30.75°N, 115.5167°W], 7400 ft, 6 September 1962, *J.D. Olmsted 4737* (RSA-POM-170872); Laguna Hanson, Constitución National Park, Sierra de Juárez, [31.97°N, 115.83°W], 1610–1625 m, 28 May 1983, *R.F. Thorne, W. Wisura, W. Steinmetz et al. 55756* (RSA-POM-310370); Northern Lower California, April 1886, *C.R. Orcutt s.n.* (GH, MSC-4710, NY); Lower California, 1886, *C.R. Orcutt s.n.* (NY); Sierra San Pedro Mártir, La Grulla, 30.8917°N, 115.4833°W, 2050 m, 8 June 1982, *R. Moran 30920* (SD-111378); Sierra de Juárez, Constitución National Park, Laguna Hanson, N end of lake, [32.05°N, 115°W], 1610–1625 m, 28 May 1983, *R.F. Thorne, W. Visura, W. Steinmetz et al. 44803* (SD-123836); below Rancho Jatay, 32.025°N, 116.8542°W, 80 m, 11 June 1980, *R. Moran 28792* (SD-105409); W shore of Laguna Hanson, 32.0542°N, 115.075°W, 1610 m, 21 June 1980*, R. Moran 28864* (SD-105489); Sierra San Pedro Mártir, La Joya, on Valladares Creek, above creek, 30.925°N, 115.6°W, 1500 m, 31 May 1976, *R. Moran 2332* (SD-96979); Sierra Juárez, 1 km SE of Rancho San Pedro 32.1667°N, 115.4833°W, 1675 m, 22 June 1980, *R. Moran 28908* (SD-105488); Sierra San Pedro Mártir, Parque Nacional San Pedro Mártir, at entrance to park in recently burned area, [31.13°N, 115.19°W], 2040 m, 27 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R. Noyes 5027* (CAN, US). **Coahuila:** Sierra Zapalinamé, 25.3468°N, 100.908°W, 2800 m, 20 September 2003, *P.M. Peterson, J. Valdés-Reyna & R.H. Cárdenas 17871* (CAN, MO, US); Portrero Valley, [26.65 °N, 112.05°W], June 1899, *C.R. Orcutt s.n.* (US-1009475); Todos Santos Bay, 31.7667°N, 116.6167°W, 1882, *F.E. Fish 12* (US-90886). **Chiapas:** Mpio. Tenejapa, in the paraje of Pahal Ton, 16.85°N, 92.45°W, 2286 m, 1 October 1965, *D.E. Breedlove 12608* (DS, US-2999875); Mpio. Venustiano Carranza, in the sitios of Aguacatenango, 16.45°N, 92.4667°W, 1768 m, 22 July 1965, *D.E. Breedlove 11226* (DS, MICH-1119255, US-2999853); Mt. Tacana, 15.1333°N, 92.1°W, 1000–2000 m, August 1938, *E. Matuda 2444* (F-1004956, GH, MICH-1119182, US-1724501, NY); Mpio. Tenejapa, Paraje Shohleh, 16.86°N, 92.49°W, 2499 m, 4 April 1966, *A.S. Ton 724* (MICH-1119253, US-3005102); 2 mi SE of Pueblo Nuevo Solist, 17.07°N, 92.86°W, 1585 m, 26 July 1965, *E. Lathrop 5971* (RSA-POM-196173, US-2463686). **Chihuahua:** Majalca (Pilares), 28.85°N, 106.3333°W, 2080 m, 12 August 1939, *L.H. Harvey 1485* (CAN, GH, mixed sheet with *B. frondosus*, MICH-1119267, MO, US-1762718); Cerro Mohinora, 10 mi S of Guadalupe y Calvo, 26.1°N, 107.06°W, 2300–2500 m, 13 August 1960, *R.M. Straw & M. Forman 2034* (RSA-POM-178217, mixed sheet with *B. carinatus* var. *marginatus*). **Distrito Federal:** 10 mi SW of México City, [19.29°N, 98.95°W], 9000 ft, 10 August 1947, *F.A. Barkley, B.L. Westlund & J.B. Paxson 572* (F-1405758); Mixcoac, Barranca del Manicomio, 19.3833°N, 99.1833°W, 2280 m, 11 August 1913, *G. Arséne 8801* (F-484987, US-1003469); 10 mi E of Amecameca on road towards Paso de Cortés, in Parque Nacional Izta-Popo, 19.0764°N, 98.71°W, 2840 m, 12 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16163* (CAN, MO, US); San Lorenzo, delgacíon de Milpa Alta, 2600 m, 21 March 1976, *A. Ventura A. 1191* (ANSM); Lomas de Mixcoac, 19.3833°N, 99.1833°W, 17 October 1937, *E. Lyonnet & J. Elcoro 1731* (MO, US-1746365); Piedregal, Ajusco-Tlalpan, 19.2833°N, 99.1667°W, 2600 m, 16 July 1950, *E. Matuda 19091* (US-2040915); . Valle de México, Topilojo, 19.2008°N, 99.1428°W, 2500 m, 3 August 1952, *E. Matuda 26199* (US-2119848). **Durango:** Paraje de Potrillos, entre el Alto de Caballos y el Alto de Potrillos, [25.4°N, 106.1°W], 2500 m, 6 September 1989, *A. Benítez P. 814* (ANSM); along road between El Salto and Durango, [24.08°N, 105.15°W], November 1968, *Stephenson 68-556* (MSC-391573); Predio particular Las Cebollitas, 1 August 1990, *A. Benítez 1715* (ANSM); 14.3 mi E of La Ventana and 2.7 mi W of Los Charcos,

23.0054°N, 104.3234°W, 2875 m, 13 September 2003, *P.M. Peterson & F. Sánchez-Alvarado 17766* (CAN, US). **Guanajuato:** Mpio. Acambaro, Obrajuelos, Altura, [20°N, 100.71°W], 1850 m, 27 October 1992, *J.J. Macias Cuellar 36* (MEXU). **Jalisco:** 1–2 mi E of Tapalpa, 19.94°N, 103.76°W, 2100–2200 m, 30 October 1960, *R. McVaugh 20490* (MICH-1119170); Mpio. Valle de Juáre, Cerro del Tigre, 97 km al NE de Cd. Guzmán, [24.76°N, 105°W], 2700 m, 9 September 1988, *M. Fuentes O. 698* (MICH-1119187); Mpio. Valle de Juáre, 19.5667°N, 103.6°W, 19 September 1980, *A.A. Beetle & R. Guzmán M. M-5370* (SD-122031); 11.7 mi SW of Ciudad Guzmán, 19.5924°N, 103.5372°W, 2165 m, 5 October 2001, *P.M. Peterson & O. Rosales 16081* (CAN, MO, US); 23.5 mi SW of Ciudad Guzmán, El Refugio, NE slopes of Nevado de Colima, 19.5871°N, 103.5972°W, 3345 m, 6 October 2001, *P.M. Peterson & O. Rosales 16095* (CAN, MO, US); 6.3 mi SW of Mazamitla along Hwy. 110 towards Colima, 19.894°N, 103.084°W, 1900 m, 7 October 2001, *P.M. Peterson & O. Rosales 16111* (CAN, MO, US); Parque Nacional Volcán Nevado de Colima, near 2.5 km mark from entrance up road to Observatorio Volcanologico, 19.6252°N, 103.5474°W, 2008 m, 22 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19088* (CAN, MO, US). **Estado de México:** Toluca, 19.3°N, 99.65°W, 9000 ft, 28 August 1941, *W. & M. Leavenworth 1926* (F-1248973, GH, MICH-1119176, MEXU-155026, MEXU-5884, MO, NY, US-1815927); 2 mi W of state line and ca. 20 mi SE of México City on Puebla highway, [19.33°N, 98.62°W], 9 September 1965, *F.W. Gould 11621* (MICH-119195); 18 mi W of Toluca, 19.1083°N, 99.7583°W], 15 August 1961, *F.W. Gould 9601* (US-2432890); 300 m al W de Tanango del Aire [19.16°N, 98.86°W], 2350 m, 14 August 1968, *A. Pineda R. 342* (MICH-1119199); 1 mi W of Avila Camacho, 9200 ft [2804 m], 31 July 1970, *L.H. Harvey 8538* (MICH-1119242); 27 km SW of Toluca on road to Temaxcaltepic, 19.11°N, 100°W, 2800 m, 9 July 1964, *G. Mick & K. Roe 232* (MICH-1119247, US-2630326); 2 mi above junction of MEX 130 and road to Volcán Nevado de Toluca, [19.1083°N, 99.7583°W], 10400 ft, 22 October 1972, *L.H. Harvey & J.T. Witherspoon 9473* (MICH-1119121); Temascaltepec Dist., Nanchititla, 18.8667°N, 100.4667°W, 10 November 1933 or 11 October 1933, *G.B. Hinton 4984* (GH, US-1867861); 400 m al W de Tanango del Aire, [19.16°N, 98.86°W], 2350 m, 14 July 1968, *A. Pineda R. 368* (MSC-234697); 10.5 mi N of Aculco on Hwy. 55 towards San Juan del Río, 20.2247°N, 99.9°W, 2208 m, 8 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21322* (CAN, MO, US); 1.7 mi E of Hwy. 10 along road to Nevado de Toluca, 19.1347°N, 99.8°W, 3688 m, 9 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21349* (CAN, MO, US); Mpio. Donato Guerra, a 1.25 km al N de Las Mesas de San Martín, [19.31°N, 100.14°W], 2672 m, 29 October 1998, *J.A. García Ruíz 6* (MEXU); Campo Experimental de la Universidad Autonoma Chapingo, 2260 m, 1 November 1990, *O. Arana s.n.* (ANSM); Amecameca, 8600 ft, August 1904, *O. Kuntze 23667* (NY); Popo Park, 19.0333°N, 98.6333°W, 4–8 August 1910, *A.S. Hitchcock 5964* (US-1009500); 2.8 mi E of Ocuilán Arteaga near cornfield, 18.9808°N, 99.38°W, 2478 m, 11 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21374* (CAN, MO, US). **Michoácan:** 14 mi N of Aguililla on road to Dos Aguas, 1570 m, 8 August 1972, *M.F. Denton 2036* (MICH-1119171); at km 56–57 above Quiterio on road from Pátzcuaro to Tacambaro, 19.4°N, 101.5°W, 2700 m, *H.E. Moore, Jr., E. Hernández X. & H. Porras H. 5593* (GH, US-1983689); Estacíon Chincua, Reserva de la Biósfera Mariposa Monarca, 19.6792°N, 100.2853°W, 3030 m, 5 August 2000, *Ma. G. Cornejo Enotrio, S.R. Luna & G.I. Manríquez 65* (ANSM, MEXU); 10 km al S de Indaparapeo, sobre el camino a Las Peras, [19.72°N, 100.9181°W], 2250 m, 23 December 1986, *J. Rzedowski 42310* (ANSM); Mpio. de Queréndaro, alrededores de San José Lagunillas, 2750 m, 24 August 1986, *J. Rzedowski 40468* (ANSM); Mpio. Huaniqueo, NE del pedregal pequeño, .5 km al W de Tendeparacua, 2060 m, 22 August 1992, *P. Silva-Sáenz 75* (ANSM); ca. 18 mi S of Pátzcuaro, 19.31°N, 101.66°W, 2713–2743 m, 20–25 November 1961, *R.M. King & T.R. Soderstrom 5178* (NY, mixed sheet with *B. dolichocarpus*); ca. 2 km al N de AJuno, Cerro La Taza, 2280 m, 2 September 2003, *M.E. Molina 327* (ANSM); Lieux inondes a' l'ouest, vicinity of Morelia, 19.7167°N, 101.1833°W, 1800 m, 7 October 1909, *G. Arséne 3166* (MO, US-1002651); near Zacapú, 19.8167°N, 101.7833°W, 28 September 1946, *E. Hernández-Xolocotzi, J. Ruppert & J. Guevara X-2825* (US-1962215); ca. 15 mi E of Mil Cumbres on road from Morelia to Toluca, 24 July 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1477* (RSA-POM-253305, US-2473569). **Nuevo León:** road to La Tinaja from roadside in disturbed area, 23.8873°N, 99.7956°W, 2500 m, 21 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16765a* (ANSM, CAN, US); Sierra Infiernillo, Cañón San Francisco, ca. 15 km al NE de Pablillo, 24.55°N, 99.9°W, 1800–1900 m, 4 September 1993, *J. Valdés-Reyna 2321, M.A. Carranza & R. Banda S.* (ANSM); Sierra Las Cautivas, 8.7 mi SW of Dulces Nombres and 18.1 mi E of Zaragoza, 23.9501°N, 99.6473°W, 2385 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21099* (CAN, MO, US). **Oaxaca:** 1.2 mi E of San José del Pacífico on road towards San Sebastián, 16.1698°N, 96.4898°W, 2641 m, 22 September 2008, *P.M. Peterson & J.M.*

*Saarela 22352* (CAN, US); 1.5 mi W of San Juan Chicomezuchitl, 17.3026°N, 96.5016°W, 1535 m, 19 September 2008, *P.M. Peterson & J.M. Saarela 22286* (CAN, US); 2.7 mi SW of San Angustín Mixtepec on road toward Cieneguilla, 16.2509°N, 96.3507°W, 2560 m, 28 September 2006, *P.M. Peterson & R. Garcia 20244* (CAN, MO, P-03328784, US). **Puebla:** 5 mi E of Río Frio, 19.34°N, 98.59°W, 2800 m, 20 July 1953, *J.R. Reeder & C.G. Reeder 1915* (SD-101483, US); Parada Oligui, entre Teziutlán y Tlapacoyan, 3 June 1968, [19.82°N, 97.36°W], 1850 m, *D. García Saucedo 95* (MICH-1119193, MSC-234698); Mayorazgo, sur l'Atoyac, vicinity of Puebla, 19.033°N, 98.2°W, 2120 m, 18 July 1907, *G. Arséne 1405* (US-1002644) & *1407* (MO, US-1002658); SW slopes of Volcán Citlaltépetl (Pico de Orizaba), below Tesmalaquilla, 18.95°N, 97.29°W, 2970 m, 26 September 1962, *D. Ugent & R. Flores-C. 2334* (RSA-POM-264936, US-2543174). **San Luis Potosí:** ± 39 km carretera S.L.P. to Rioverde S.L.P., 22 August 1961, *A. Gómez 190* (ANSM); Álvarez, [22.0333°N, 100.6167°W], 23–23 July 1904, *E. Palmer 171* (NY); 3 mi N of Los Hornos, along road to Ocurahui, [25.6833°N, 108.4833°W], 6500 ft, 2 October 1970, *D.E. Breedlove & R.F. Thorne 18417* (RSA-POM-222535). **Sinaloa:** Ocurahui, Sierra Surotato, 6000–7000 ft, 1–10 September 1941, *H.S. Gentry 6380* (GH, MICH-1119177, MO, NY); 3 mi N of Los Ornos, along road to Ocurahui, [25.6833°N, 108.4833°W], 6500 ft, 2 October 1970, *D.E. Breedlove & R.F. Thorne 18417* (RSA-POM-222535). **Tamaulipas:** Sierra Las Cautivas, 0.3 mi W of Dulces Nombres at edge of community, 24.0031°N, 98.81°W, 1984 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21074* (CAN, MO, NY, US); Sierra Las Cautivas, 23.1 mi W of Ejido Guayabas along road towards Dulces Nombres, 23.9756°N, 99.49°W, 1844 m, 25 September 2007, *P.M. Peterson & J.M. Saarela 21061* (CAN, US). **Tlaxcala:** Mpio. Cuapiaxtla, 2405 m, 24 July 1974, *E. Hernández X. et al. R-79* (ANSM); Contadero, 19.4333°N, 98.5167°W, 3 August 1901, *J.N. Rose & R. Hay 5966* (NY, US-395757). **Veracruz:** Mpio. Altotonga, Nahualaco, 19.76°N, 97.24°W, 1750 m, 24 November 1969, *F. Ventura A. 108* (MICH-1119202, MSC-234831); Mpio. Calcahualco, 9.5 km by road W of Escola along Coscomatepec-Escola-Jacal road, 19.1167°N, 97.08°W, 2600 m, 15 November 1981, *M. Nee 23173* (F-1975254, MO, NY); Orizaba, [18.51°N, 97.06°W], August 1853, *F. Müller 2114* (NY); Jalapa, 19.5333°N, 96.9167°W, 1402 m, 2–4 September 1910, *A.S. Hitchcock 6592* (US-1009524).


**FIGURE 17.** Geographical distribution of *Bromus carinatus* var. *carinatus* in México and Central America.

5b. ***Bromus carinatus*** var. ***marginatus*** (Nees) Barkworth & Anderton in Barkworth *et al.* (2006: 240). Figs. 15E–G, 18, 19.

Basionym: *Bromus marginatus* Nees in Steudel (1854: 322). *Bromus hookeri* var. *marginatus* (Nees) Fournier (1886: 127). *Forasaccus marginatus* (Nees) Lunell (1915: 225). *Bromus sitchensis* var. *marginatus* (Nees) Boivin (1967: 521). *Ceratochloa marginata* (Nees ex Steud.) Weber in Weber *et al.* (1981: 325). Type:—Columbia River, *Douglas s.n.* (isotype US-865445! fragm.)

*Bromus breviaristatus* Buckley (1862: 98). *Bromus marginatus* var. *brevaristatus* (Buckley) Beetle (1984: 209). Type:—Rocky Mountains, *Nuttall s.n.* (holotype PH-01065398!). There are multiple collections on the sheet; the holotype on the left side of the sheet has the barcode PH00025202.

*Bromus flodmanii* Rydberg (1909: 538). Type:—UNITED STATES OF AMERICA. Montana: Sheep Creek, 8 August 1896, *Flodman 187* (holotype NY-346200!, isotypes NY-346221!, US-865490 fragm. ex NY).

*Bromus marginatus* var. *latior* Shear (1900: 55). *Bromus latior* (Shear) Rydberg (1917: 89). Type:—UNITED STATES OF AMERICA. Washington: Walla Walla Co., 29 June 1899, *C.L. Shear 1615* (holotype US-81607!, isotype NY-00346228!).

*Bromus marginatus* var. *seminudus* Shear (1900: 55). Type:—UNITED STATES OF AMERICA. Oregon: Wallowa Co., on open mountain side 5 mi above Wallowa Lake, 23 August 1899, Washington, *C.L. Shear 1811* (holotype US-81608!).

Awns 2–7 mm long.

**Distribution:—**Costa Rica (Alajuela, Cartago, San José), El Salvador (San Salvador, Santa Ana), Guatemala (Chimaltenango, El Quiché, Guatemala, Huehuetenango, Quezaltenango, Sacatepéquez, San Marcos, Solola, Totonicapán), Honduras (Ocotopeque), México (Aguascalientes, Baja California, Chiapas, Chihuahua, Coahuila, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, Estado de México, Michoácan, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Queratero, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, Tlaxcala, Veracruz and Zacatecas) (Fig. 20).

**FIGURE 18.** *Bromus carinatus* var. *marginatus* growing in a grassy wet meadow with *Nassella tenuissima* (Trinius 1836a: 36) Barkworth (1990: 612), *Muhlenbergia wrightii* Vasey ex Coulter (1885: 1885) and *Bromus catharticus*, surrounded by a forest of *Pinus* and *Quercus* in Maderas del Carmen, Coahuila, México (*Peterson et al. 20971*). Photo: J.M. Saarela.

**Specimens Examined:—COSTA RICA**. cultivado en el campo de experimentacion del Centro Nacional do Agricultura, 29 March 1933, *n.c.* (US-1610580); Térraba, 23 January 1943, *J. León 1118* (US-2183498). **Alajuela:** Cordillera Central, Volcán Poas, 12 km above Vara Blanca road, 10.2°N, 84.2°W, 29 September 1968, *R.W. Pohl & G. Davidse 11173* (CR-47168, F-1733299, US-3096737); region of Zarcero, Palmera 10.1833°N, 84.4°W, September 1937, *A. Smith A341* (F-922582). **Cartago:** within 1 km radius of Sanitorio Duran, Volcán Irazu, [9.97°N, 83.85°W], 2300–2450 m, 16–17 September 1966, *A.S. Weston, D.F. Weston & J. Weston 2349* (US-2921953); Cartago, road to Irasu, 9.9769°N, 83.8542°W, 2500 ft, 26 October 1950, *E. Anderson 1336* (MICH-1119238, US-2042172); near Hotel Robert, on upper slopes of Mt. Irazu, 9.9769°N, 83.8542°W, 8000 ft, 15 October 1960, *F.W. Gould 9446* (MICH-1119263). **San José:** Cerro de la Muerte from hotel La Georgina to Cerro Frío, 9.5594°N, 83.7794°W, 3100–3400m, 20 September 1983, *G. Davidse 25022* (CR-101679, MO, NY); near

Santa Rosa, S slope of Volcán de Irazu, [9.98°N, 83.85°W], 23 February 1924, *P.C. Standley 35444* (US-1215495). **EL SALVADOR**. Esesmiley, 14.43°N, 89.34°W, 9000 ft, April 1943, *Watkins 8* (US-2436988). **San Salvador:** El Picacho NE of El Boqueron, Volcán San Salvador, [13.74°N, 89.26°W], 1950 m, 1 March 1968, *A. Molina R. & E. Montalvo 21822* (GH, 2 sheets, F-1672238, NY). **Santa Ana:** Cordillera Miramundo, mountain of Montecristo, [14.47°N, 89.48°W], 2000–2220 m, 27–31 January 1966, *A. Molina R., W.C. Burger & B. Wallenta 16822* (F-1637212, NY, US-3055674); Montaña Montecristo, [14.41°N, 89.43°W], 2000 m, 22 May 1963, *A. Molina R. & A. R. Molina 12546* (F-1619638, US-2523603); summit of Cerro Monte Cristo, juncture of Salvador, Honduras and Guatemala, [14.41°N, 89.43°W], 2418 m, 10 July 1971, *R.W. Pohl 12573* (F-1841087, MO); Volcán Cerro Verde, [13.8271°N, 89.624°W], 1970 m, 8 June 1970, *R.W. Pohl & G. Davidse 11846* (CR-68233, F-1837393, MO). **GUATEMALA**. **Chimaltenango:** 3 km E of Chocoyos, 14.7°N, 91.05°W, 2100 m, 5 December 1963, *L.O. Williams, A. Molina R. & T.P. Williams 25142* (F-1652129); N of Patzicia, [14.7°N, 91.2°W], ca. 1800 m, 26 December 1938, *P.C. Standley 60921* (F-983606, GH, NY). **El Quiché:** Nebaj, on Arroyo La Prea, [15.41°N, 91.14°W], 17 June 1964, *E. Contreras 5033* (GH, US-2486049). **Guatemala:** along old road to San Lucas, vicinity of San Rafael, 14.99°N, 91.89°W], 1800 m, 27 September 1972, *A. Molina R. & A. R. Molina 27600* (F-1724806); Guatemala City, hills between Antigua, 14.6229°N, 90.5314°W, 1500 m, 1–3 December 1911, *A.S. Hitchcock 9145* (MICH-1119265, US-1009550). **Huehuetenango:** between kms 100 and 107, vicinity of Campo de Bolas on way to El Mirador, Sierra Cuchumatanes, [15.42°N, 91.34°W], 2000 m, 12 September 1971, *A. Molina R. & A.R. Molina 26378* (F-1740209); between Puente Negro and Los Alisos on way to Aguacatab, [15.31°N, 92.27°W], 1600 m, 16 September 1971, *A. Molina R. & A.R. Molina 26543* (F-1740208); Cerro Cananá, between Nucapuxlac and Cananá, Sierra de los Cuchumatanes, [15.86°N, 91.46°W], 2500–2800 m, 18 July 1942, *J.A. Steyermark 49015* (F-1201544, US-1935039); El Mirador, at the summit of the road leading from Huehuetenango to Sierra de los Cuchumatanes, [15.42°N, 91.34°W], ca. 3300 m, 31 December 1940, *P.C. Standley 81857* (F-1203102); mountains W of Aguacatán, on the road to Huehuetenango, [15.59°N, 91.68°W], ca. 1950 m, 27 December 1940, *P.C. Standley 81305* (F-1200751, US-2436985); Sierra de los Cuchumatanes just below Calaveras, 15.5194°N, 91.5447°W, 3000 m, 29 November 1962, *L.O. Williams, A. Molina R., T.P. Williams 21939* (F-1606490, US-2465087) & *22019* (F-1606553); Sierra de los Cuchumatanes, above Chiantla, [15.36°N, 91.46°W], 1950–2550 m, 19 February 1939, *P.C. Standley 65570* (F-977288); Sierra de los Cuchumatanes, between Paquix and San Juan Ixcoy, [15.62°N, 91.44°W], 3000–3350 m, 8 January 1971, *A. Molina R., A.R. Molina & J.A. Molina 30080* (F-1827339, MO); Sierra de los Cuchumatanes, between kms 136 to 150 of San Juan Ixcoy, [15.62°N, 91.44°W], 3000–3500 m, 12–23 January 1966, *A. Molina R., W.C. Burger & B. Wallenta 16532* (F-1638079); vicinity of Táchique, E of Huehuetenango, ca. 1900 m, [15.91°N, 91.34°W], 7 January 1941, *P.C. Standley 82609* (F-1202686, US-2436987). **Quezaltenango:** grown by Division of Genetics, Berkeley, 30 June 1944, *H. Harlan s.n.* (US-1939769); S of Quetazaltenango, [14.8333°N, 91.5167°W], 7 April 1932, *Westherwax 1888* (US-1610532); above Los Vahos, Cerro Quemado, [14.79°N, 91.52°W], 2900–3000 m, 5 February 1941, *P.C. Standley 56147* (F-1200792); above Los Vahos, Cerro Quemado, [14.79°N, 91.52°W], 2900–3000 m, 5 February 1941, *P.C. Standley 86138* (F-1200764); Barranco Buenavista, Cuesta El Caracol, Sierra Madre Mountains, ca. 5 km NW of San Juan Ostuncalco, [14.87°N, 91.62°W], 2800–2900 m, 11 December 1962, *L.O. Williams, A. Molina R. & T.P. Williams 22819* (F-1606518, US-2465027); Cerro La Pedrera, S of Quezaltenango, [14.82°N, 91.52°W], ca. 2400 m, 18 February 1939, *P.C. Standley 65525* (F-986381); lower N slope of Volcán de Santa María, above PaloJunoj, [14.76°N, 91.55°W], 2500–2700 m, 15 January 1941, *P.C. Standley 83464* (F-1202704, US-2436986); mountains above Ostuncalco, [14.87°N, 91.62°W], ca. 3700 m, 22 February 1939, *P.C. Standley 66402* (F-981534, US-2436905); mountains above Río Samalá, Sierra Madre Mountains, 2 km W of Zunil, [14.56°N, 91.62°W], 2300 m, 14 December 1962, *L.O. Williams, A. Molina R. & T.P. Williams 22992* (F-1606538, US-2465095); mountains above San Juan Ostuncalco, on road to Palestina, [14.87°N, 91.62°W], ca. 2700 m, 30 January 1941, *P.C. Standley 85279* (F-1202265); near Cantel, [14.81°N, 91.45°W], 2250–2365 m, 18 January 1941, *P.C. Standley 83851* (F-1202257); SE of Palestina, on old road to San Juan Ostuncalco, [14.84°N, 91.52°W], 2550–2850 m, 21 January 1941, *P.C. Standley 84334* (F-1202580); slope of Volcán de Santa María, above PaloJunoj, [14.76°N, 91.55°W], 2400–3768 m, 11 February 1939, *P.C. Standley 65059* (US-2436989); Volcán Zunil, [14.73°N, 91.45°W], 2500–3800 m, 22 January 1940, *J.A. Steyermark 34683* (F-1051025); ravine below Fuentes Georginas, just above Zunil, [14.78°N, 91.49°W], 2500 m, 20 January 1940, *J.A. Steyermark 24482* (F-1059346). **Sacatepéquez:** Volcán de Agua, above Santa María de Jesús, [14.45°N, 90.74°W], 2250–3000 m, 11 February 1939, *P.C. Standley 65059* (F-988651); Volcán de Agua, N of crater at km 17 on dirt road to summit from km 8 on Ruta Departamental No. 1

just N of Santa María de Jesús, 14.45°N, 90.7431°W, 2860 m, 7 October 1980, *R.E. Gereau 768* (MSC-261176, NY); Volcán de Agua, 14.465°N, 90.7431°W, 5 December 1911, 2000–3500 m, *A.S. Hitchcock 9124* (US-1009549). **San Marcos:** above Río Tacaná, near San Antonio, [14.42°N, 90.49°W], ca. 2700 m, 22 February 1939, *P.C. Standley 66072* (F-984447); Aldea Ixcamal, Serchil, San Marcos, [15.03°N, 91.79°W], 3000 m, 27 August 1977, *D.N. Smith, B. Olson & A. Squires 766* (F-2070833, F-1858164); Barranco Eminencia, road between San Marcos and San Rafael Pie de la Cuesta, in upper part of the barranco between Finca La Lucha and Buenavista, 2500–2700 m, 6 February 1941, *P.C. Standley 86268* (F-1200770); near Aldea Fraternidad, between San Rafael Pie de la Cuesta and Palo Gordo, W facing slope of the Sierra Madre Mountains, [14.93°N, 91.82°W], 1800–2400 m, 10–18 December 1963, *L.O. Williams, A. Molina R. & T.P. Williams 25996* (F-1608958, NY, US-2461804); outer slopes of Tajumulco Volcáno, Sierra Madre Mountains ca. 8–10 km W of San Marcos, 14.9653°N, 91.7958°W, ca. 2300 m, 31 December 1964–1 January 1965, *L.O. Williams, A. Molina R., T.P. Williams, D.N. Gibson & C. Laskowski 26934* (F-1657998, US-2537608); Sierra Madre Mountains ca. 6 km (airline) N of San Marcos, 14.9653°N, 91.7958°W, 2700 m, 13 December 1963, *L.O Williams, A Molina R. & T.P. Williams 25885* (F-1656825, NY, mixed sheet with *B. dolichocarpus*, US-2537628); Volcán Tajumulco, along road between San Sebastián at km 21 and km 8, 8–18 mi NW of San Marcos, 15.0833°N, 91.8833°W, 2700–3800 m, 15 February 1940, *J.A. Steyermark 35770* (F-1053535, US-2240535). **Solola:** 8000 ft, 20 [?] 1907, Mt. Etitlan [?], *W.A. Kellerman 6261* (US-1009551); Volcán San Pedro, N-facing slopes towards Lago de Atitlan, above village of San Pedro, [14.65°N, 91.27°W], 1800–3200 m, 7 June 1942, *J.A. Steyermark 47205* (F-1201398, US-1935017); Mt. Atitlan, 14.5833°N, 91.1861°W, 8000 ft, 23 January 1907, *A.S. Hitchcock 6261* (F-220758). **Totonicapán:** near Villa Las Cruces, ca. 8 km SW of Totonicapán, [14.91°N, 91.36°W], 2800 m, 13 December 1963, *L.O. Williams, A. Molina R. & T.P. Williams 22957* (F-1606480). **HONDURAS**. **Ocotepeque:** El Portillo on Cordillera Merendon, 20 km from Nueva Ocotepeque, [14.49°N, 89.04°W], 1800 m, 28 August 1968*, A. Molina R. 22311* (F-1676793, NY). **MÉXICO**. **Aguascalientes:** Mpio. Jesús María, Gracias a Dios, 21.93°N, 102.5°W, September 1991, *J.A. de Santiago 114* (MEXU). **Baja California:** 5 mi south of Campo Costa Rica, 2 mi N of Arroyo Hondo, [31.89°N, 116.58°W], 23 April 1984, *P.M. Peterson & C.R. Annable 2206* (US); Arroyo Agua Caliente, [32.11°N, 116.39°W], 1 May 1981, *O. Paulin & V. Morales 218* (MEXU-1098059); Sierra San Pedro Mártir, bank of La Sanca Creek, ca. 5 mi NW of La Grulla, 31.69°N, 116.48°W, 2042 m, 17 September 1930, *I.L. Wiggins & D. Demaree 4872* (MO, US-2012336); Coronado Islands, N Island, E slope, near N end, 32.4467°N, 117.2983°W, 50 m, 25 April 1977, *R. Moran 23976* (SD-97207); Ensenada, 31.8606°N, 116.6178°W, 7 April 1882, *Fish s.n.* (RSA-POM-114934); Guadaloupe Ranch, 32.5°N, 116.6°W, 6 April 1886, *C.R. Orcutt s.n.* (US-1009471); in canyon draining Santa Catarina Spring, Santa Catarina, 64 mi SE of Ensenada, 31.6167°N, 115.8°W, 1128 m, 20 May 1961, *R.E. Broder 416* (US-2523592); just below upper end of road from San José (Melling) Ranch and oak pasture below Prado del Corona in central Sierra San Pedro Mártir, [30.75°N, 115.5167°W], 7200 ft, 6 October 1962, *J.D. Olmsted 4750* (RSA-POM-170825); San Martín Island, lava rock W of Hassler Cove, 30.4833°N, 116.1083°W, 25 m, 11 April 1963, *R. Moran 10547* (US-2545383); Nachoguero Valley, 32.55°N, 116.35°W, 4 June 1894, *L. Schoenfeldt 3444* (US-236112); Nachoguero Valley, 32.55°N, 116.35°W, 5 June 1894, *E.A. Mearns 3481* (US-238577); Parque Nacional Sierra San Pedro Matir, 62 mi SE of Hwy. 1 on road towards Villecentos, 31.0332°N, 115.34°W, 2490 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15204* (CAN, US); San Julio Cañon, 29.65°N, 114.7667°W, 20 April 1889, *T.S. Brandegee 17* (US-1009476); San Quintín, 30.4833°N, 115.95°W, 5 April 1936, *C. Epling & W. Stewart 551* (US-1721904); Sierra Juárez, just N of Valle Redondo, 32.1167°N, 115.9583°W, 1675 m, 24 May 1992, *R. Moran 31084* (RSA-POM-609295, SD-133872); Sierra San Pedro Mártir, "Corral Meadow", 7.5 km NW of the observatory, [31.1125°N, 115.44°W], 2520 m, 16 June 1988, *A.C. Sanders, R. Minnich, E. Franco & M. Salazar 7915* (RSA-POM-494922); Sierra San Pedro Mártir, 30.95°N, 115.6°W, 1675 m, 29 July 1970, *R. Moran 1970* (SD-127298); Sierra San Pedro Mártir, above Observatory living quarters, 31.0333°N, 115.4542°W, 2600 m, 7 May 1986, *R.F. Thorne, T.S. Elias & P. Rojas 61969* (RSA-POM-353945); Sierra San Pedro Mártir, La Encantada, 30.9167°N, 115.4°W, 2200 m, 19 August 1967, *R. Moran & R.F. Thorne 14327* (RSA-POM-222139, SD-76640); Sierra San Pedro Mártir, La Víbora, Arroyo la Grulla 4 km SW of La Grulla, 30.8667°N, 115.5083°W, 1900 m, 9 August 1977, *R. Moran 2442* (SD-97751); Todos Santos Bay, 31.7667°N, 116.6167°W, 1882, *F.E. Fish s.n.* (US-1009474). **Chiapas:** 3 km NW of Pueblo Nuevo Solistahuacan, 17.07°N, 92.86°W, 5800 ft, 10 October 1971, *R.F. Thorne & E. Lathrop 46500* (RSA-POM-284903); 7 km N of Teopisca, 16.59°N, 92.4833°W, 7 October 1968, *F.W. Gould 12740* (MO, US-3010562); along road between


**FIGURE 19.** *Bromus carinatus* var. *marginatus*. *McVaugh 17563* (MICH-1119169).

Palenque and San Cristóbal de las Casas, 30 mi W of Ococingo, 20.4 m E of Hwy. 190 junction, 2130 m, 7 June 1987, *T.B.Croat 66144* (ANSM, MO); Amatenango del Valle, 16.52°N, 92.42°W, 12 June 1945, 1835 m, *E. Matuda 15888* (F-1273278, F-13330880); ca. 15 mi SE of Teopisca, 16.44°N, 92.27°W, 2330 m, 21 August 1953, *J.R. Reeder & C.G. Reeder 2044* (US-2473565); in Piedracitas, 16.75°N, 92.7°W, 2347 m, 30 July 1964, *D.E. Breedlove 6737* (DS, US-3039282); Mpio. Amatenango del Valle, Amatenango del Valle, 16.5167°N, 92.45°W, 1768 m, 7 July 1966, *D.E. Breedlove 14462* (DS, F-1823667, US-3116100); Mpio. Amatenango del Valle, Amatenango del Valle, 16.52°N, 92.42°W, 7 July 1966, *D.E. Breedlove 14452* (MICH-1119245); Mpio. Chamula, near school house of Yal Ichin, 16.8°N, 92.64°W, 6000 ft, 24 June 1965, *D.E. Breedlove 10472* (DS, MICH-1119254, US-3007633); Mpio. San Andrés Larrainzar, near the summit of Chuchil Ton, NE of Bochil, 16.99°N, 92.89°W, 2700 m, 3 August 1972, *D.E. Breedlove 26792* (DS, MICH-1119275, MO, RSA-POM-276448); Mpio. San Cristóbal las Casas, N edge of city of San Cristóbal las Casas, 16.75°N, 92.6333°W, 2164 m, 18 June 1965, *D.E. Breedlove 10417* (DS, US-3007649); Mpio. San Cristóbal las Casas, sitio in San Cristóbal las Casas, 16.75°N, 92.6333°W, 2164 m, 20 September 1965, *D.E. Breedlove 12312* (DS, US-2999872); Mpio. Tenejapa, at Moel Ch'en above Tenejapa Center along trail to Kulak-tik, [16.81°N, 92.51°W], 7500 ft, 13 July 1965, *D.E. Breedlove 10942* (DS, MICH-1119256); Mpio. Tenejapa, on the NE side of the hill called Matsab, paraje of Matsab, 16.85°N, 92.45°W, 2804 m, 25 August 1966, *D.E. Breedlove 15291* (DS, US-3005129); Mpio. Tenejapa, Paraje Shohleh, 16.86°N, 92.49°W, 2560 m, 12 January 1966, *A.S. Ton 546* (F-1670291, MICH-1119252, US-3005103); Mpio. Tenejapa, Tenejapa Center, [16.81°N, 92.51°W], 11 July 1965, *D.E. Breedlove 10770* (MICH-1119257, DS); Mt. Pasitar, 6 January 1937, 15.4333°N, 92.4333°W, *E. Matuda 317* (MICH-1119181, US-1722005); Siltepec, 15.55°N, 92.3333°W, 8 August 1937, *E. Matuda 1711* (GH, MICH-1119183, MO, NY, US-1721980). **Chihuahua:** 24.7 mi N of San Juanito on road towards Cuauhtémoc, 28.2636°N, 107.4931°W, 2233 m, 5 September 2008, *P.M. Peterson & J.M. Saarela 22033* (CAN, US); 6 km WNW of Ocampo on road to baseball field, 6000 ft, 25 June 1987, *T.R & R.K. Van Devender & P.S. Martín 87-212* (ANSM); Cerro Mohinora, 10 mi S of Guadalupe y Calvo, 26.1°N, 107.06°W, 2300–2500 m, 13 August 1960, *R.M. Straw & M. Forman 2034* (MICH-1119134, RSA-POM-178217, mixed sheet with *B. carinatus* var. *carinatus*); Chuchiuchupa, [29.62°N, 108.4°W], Aug–September 1936, *H. LeSueur Mex-110* (GH, MEXU-5580, MO); Cusárare (Tarahumara village), 27.6167°N, 107.5333°W, 1 November 1995, *A.M. Rea 2000* (SD-174916); Cusárare, 27.6167°N, 107.5333°W, *s.d.*, *A.M. Rea s.n.* (SD-174915); E slope of Sierra Mohinora, 26.1°N, 107.0667°W, 8500–9000 ft, 17 October 1959, *D.S. Correll & H.S.* Gentry *23203* (GH, US-2378623); Jiménez, 27.12°N, 104.91°W, 1340 m, 31 July 1939, *L.H. Harvey 1359* (MICH-1119266); km 60 carretera Balleza-Guachochic, [27.07°N, 106.65°W], 2100 m, 23 September 1981, *R. Fierros 1607* (MEXU); Largo Canyon, 29.68°N, 108.28°W, 7000 ft, 16 September 1903, *M.E. Jones s.n.* (RSA-POM-115041); Menelichic, Río Mayo, 7500 ft, 18 September 1936, *H.S. Gentry 2789* (GH, F-864591, MEXU, MO); Mpio. Batopilas, Quirare on N rim of Barranca de Batopilas, 27.03°N, 107.74°W, 1981 m, 2 October 1972, *R.A. Bye 2816* (MICH-1119191); Mpio. Bocoyna, Ejido San Ignacio Arareco, E of Creel, [27.73°N, 107.62°W], 7300 ft, 19 October 1973, *R.A. Bye 5478* (MEXU-696581); Mpio. Bocoyna, S of San Ignacio Arareco, [27.73°N, 107.61°W], 2225 m, 19 July 1972, *R.A. Bye 2388-n* (GH); Mpio. Bocoyna, Cusárare, S of Creel, 27.6167°N, 107.5333°W, 1 September 1973, *R.A. Bye 4856* (CAN-499790, GH, MEXU-839117); Mpio. Bocoyna, Cusárare, S of Creel-Guachochi road vado of Arroyo Cusarare, 27.6167°N, 107.5333°W, 2100 m, 11 August 1972, *R.A. Bye 2736* (GH, MICH-1119192); Mpio. Madera, Laguna de Babícora, alrededores de Nicolás Bravo, [29.0556°N, 106.8611°W], 2150 m, *Quintana, Lebgue & E. Estrada 3119* (NY); Mpio. Madera, Mesa del Huracán, [29.6728°N, 108.2531°W], 28 October 1977, *J.M. Peña Neira 811* (ANSM); near Cumbre Mohinora, Sierra Mohinora, 25.9594°N, 107.05°W, 3250 m, 13 September 2006, *P.M. Peterson, F. Sánchez Alvarado & E.P. Gómez Ruíz 20036* (CAN, US); near Mirador de Cascada de Basaseachic, 28.1647°N, 108.2°W, 2022 m, 7 September 2008, *P.M. Peterson & J.M. Saarela 22084* (CAN, US); Rancho La Ciénega, Ejido El Largo, [26.5167°N, 105.3667°W], 2500 m, 31 August 1990, *O. B. Bolanos 1399* (ANSM, MEXU-583609); Rosetilla, a 50 km carretera Chihuahua-Ojinaga, [29.36°N, 104.91°W], 1250 m, 24 July 1978, *Rodríguez, Molinar & Baray 23* (MEXU-1110823); Sánchez, 2438 m, 12 October 1910, 27.7333°N, 107.6833°W, *A.S. Hitchcock 7704* (US-1009547), *7718* (US-1009546) & *7719* (US-1009545); Sierra Madre Occidental, 12.1 mi W of San Juanito on road towards Baquiriachic, 27.9567°N, 107.76°W, 2530 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15357* (US); Sierra Madre Occidental, 2.3 mi W of San Juanito on road towards Baquiriachic, 27.9815°N, 107.63°W, 2590 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15359* (CAN, MO, US); Sierra Madre Occidental, 7 mi NE of San Rafael on road towards Creel, at Divisidero lookout, [27.81°N, 107.63°W], 5 September 2008, *P.M. Peterson & J.M. Saarela 22042* (CAN, US); Sierra Madre Occidental, at Cuesta Preta, along road from San Juanito to Creel,

3.1 mi S of San Juanito, [27.9267°N, 105.5908°W], 2286 m, 22 September 1992, *K.W. Allred 5791, T. Columbus & J. Valdés-Reyna* (ANSM); Sierra Madre Occidental, W of Casas Grandes, 5 mi S of Hernández, 29.97°N, 108.2667°W, 2134 m, 18 September 1960, *J.R. Reeder, C.G. Reeder & T.R. Soderstrom 3519* (US-2473564); Sierra Madre, 3 October 1887, *C.G. Pringle 1173* (MEXU-5880); Soldier Canyon [Arroyo Soldado], 16 September 1903, [30.0667°N, 108.2333°W], 6600 ft [2012 m], *M.E. Jones s.n.* (RSA-POM-112247); W slopes of Sierra Mohinora, 25.9703°N, 107.05°W, 3008 m, 13 September 2006, *P.M. Peterson, F. Sánchez Alvarado & E.P. Gómez Ruíz 20054* (CAN, US); Yamuco at 1 km E of highway towards Basihuare and Creel, N of Río Urique crossing, 27.4004°N, 107.49°W, 1891 m, 26 August 2003, *P.M. Peterson, P. Catalán 17543* (US); Yamuco, 1 mi E of highway N of Río Urique, crossing towards Basihuare and Creel, 27.3998°N, 107.489°W, 1890 m, 6 September 2008, *P.M. Peterson & J.M. Saarela 22066* (CAN, US); Sierra de los Órganos, 28.25°N, 104.75°W, 9 August 1937, *H. LeSueur 211* (GH, mixed sheet with *B. frondosus*); 1.1 km N of San Juanito near large lumber mill, 2200 m, 24 September 1988, *P.M. Peterson & C.R. Annable 5869* (US); . Bocoyna, Entronque carretera Creel, entrada Bocoyna, ladera S Rancho Cima, Rancho de Lucía, 10 September 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 31882* (US-3589154); de la Cienega, camino Norogachi, 27.2117°N, 107.052°W, 2245 m, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 29476* (US-3587693). **Coahuila:** 1 mi SE of San Antonio de las Alazanas (SE of Saltillo), [25.26°N, 100.55°W], 19 July 1963, *F.W. Gould & D. Watson 10514* (MICH-1119190); 10 mi E of San Antonio (SE of Saltillo), [25.53°N, 102.18°W], 4 September 1965, *F.W. Gould 11532* (MICH-119197); 21 km SE of Saltillo on Hwy. 57 towards Matehuala, 25.247°N, 100.9061°W, 2460 m, 19 September 2001, *P.M. Peterson & J. Valdés-Reyna 15807* (CAN, US); Buenos Aires, [25.3167°N, 100.55°W], 17 August 1948, *Kenoyer & Crum 2743* (GH, MICH-1119201); ca. 12 km SE of San Antonio de las Alazanas (SE of Saltillo), [25.26°N, 100.55°W], 20 July 1963, *F.W. Gould & D. Watson 10522* (MICH-1119198); campus of La Escuela Superior de Agricultura, Buenavista, ca. 5 mi SE of Saltillo, [26.55°N, 101.267°W], 18 June 1952, *F.W. Gould 6381* (ANSM, MICH-1119206, mixed sheet with *B. catharticus*, RSA-POM-108377); Cañón de San Lorenzo, 25.3167°N, 100.9167°W, 1980 m, 15 May 1978, *L. Arce G. s.n.* (ANSM); Diamante, 14 mi S of Saltillo, [25.39°N, 100.99°W], 2 July 1947, *F.A. Barkley, G.L. Webster & C.M. Rowell, Jr. 7234* (F-1500313); El Coahuilón, Sierra de la Maria (Arteaga), 25.2367°N, 101.4236°W, *J.A. Villarreal, M.A. Carranza & M. Vázquez 3859* (ANSM); in valley 15 km W of Concepcion del Oro just within Coahuila border, 24.9°N, 103.7°W, 2300 m, 22 July 1941, *L.R. Stanford, K.L. Retherford & R.D. Northcraft 556* (GH, MO, NY, US-1815822); Maderas del Carmen, 0.5 mi from Campo Uno, up the road towards the summit, 28.9962°N, 102.6113°W, 2355 m, 22 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 21019* (CAN, US); Maderas del Carmen, 12.0 mi NE of Los Pilares, 28.9378°N, 102.6025°W, 2271 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20956* (CAN, MO, US); Maderas del Carmen, 12.2 mi NW of Pilares near "old cabin", 28.9401°N, 102.5978°W, 2300 m, 7 September 2005, *P.M. Peterson & J. Valdés-Reyna 18885* (CAN, MO, US); Maderas del Carmen, 13.5 mi NE of Los Pilares, 28.9497°N, 102.5859°W, 2309 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20971* (CAN, US); Maderas del Carmen, 16.3 mi NE of Los Pilares on road towards Campo Dos, 28.9626°N, 102.5643°W, 2235 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20986* (CAN, US); Maderas del Carmen, canyon above Campo El Dos, 28.9899°N, 102.61°W, 2280 m, 8 September 2005, *P.M. Peterson & J. Valdés-Reyna 18909* (US); Mpio. Arteaga, Sierra de las Alazenas al Noroeste del Ejido Mesa de las Tablas, 25.2722°N, 100.1667°W, 2527 m, 15 September 2001, *J.A. Encina 825*, *S. Cruz J. & E. López V.* (ASNM); Sierra El Pino, 40.3 km W of Rancho El Cimarron, 2000 m, 14 September 1991, *P.M. Peterson & C.R. Annable 10666* (US); Sierra El Pino, 39.5 km W of Rancho El Cimarron, 15 September 1991, *P.M. Peterson & C.R. Annable 10675* (US); Madera del Carmen, 13.3 mi NW of Pilares, 28.9494°N, 102.5858°W, 2301 m, 15 September 2012, *P.M. Peterson & K. Romaschenko 24494* (US); Madera del Carmen, between Campo Cinco and Campo Dos, 28.9767°N, 102.6153°W, 2456 m, 15 September 2012, *P.M. Peterson & K. Romaschenko 24506* (US) & *24507* (US); Madera del Carmen, 28.9958°N, 102.6114°W, 2374 m, 16 September 2012, *P.M. Peterson & K. Romaschenko 24517* (US); Madera del Carmen, at Campo Dos, 29.0106°N, 102.6083°W, 2627 m, 16 September 2012, *P.M. Peterson & K. Romaschenko 24530* (US); Mpio. Arteaga, Sierra del Coahuilón, 25.2444°N, 100.3111°W, 3425 m, 22 September 2000, *J.A. Encina 878, B. Braham, S.E. López V. & A. Càrdenas* (ANSM); Mpio. Arteaga, Predio El Cristal, 25.5083°N, 100.7778°W, 2100 m, 21 June 1994, *E. Pérez 59* (MEXU-1098032); N Coahuila, Mesa Grande, high mesas 40 km NW of Hacienda de la Encantada, 28.9°N, 102.58°W, 14 September 1941, *R.M. Stewart 1633* (GH, US-2436908); road towards El Renacer de la Sierra and 36.5 mi E of Arteaga, 25.2206°N, 100.3896°W, 2821 m, 27 September 2001, *P.M. Peterson & J. Valdés-Reyna 15951* (ANSM, CAN, US); Saltillo, 25.4167°N, 101°W, 10–14 July 1910, *A.S.*

*Hitchcock 5584* (US-1009538) & *5594* (US-1009537); Saltillo, 25.4167°N, 101°W, 15–30 April 1898, *E. Palmer 5* (GH, MO, NY, US-1009536); Saltillo, 25.4167°N, 101°W, 1600 m, 1909, *Br. Nil & G. Arséne 3466* (MO, US-1002627); Saltillo, 25.4167°N, 101°W, 1650 m, March 1908, *Br. Nil & G. Arséne 12/3468* (US-1002625); Saltillo, 25.4167°N, 101°W, June 1898, *E. Palmer 266* (F-95905, GH, MO, NY, US-1009535); Saltillo, 25.4167°N, 101°W, March 1909, *G. Arséne & Br. Nicolás 88/3466* (US-1009539); Saltillo, 25.4167°N, 101°W, March 1909, *G. Arséne s.n.* (F-386772); Saltillo, 25.4167°N, 101°W, May–June 1908, 1650 m, *G. Arséne & Bro. Nil 3468* (GH, MO, NY); Santa Rosa Mts., [25.37°N, 100.94°W], 25 July 1938, *E.G. Marsh, Jr. 1439* (F-1254622, GH); SE of San Antonio de Las Alazanas and SE of Saltillo at end of road near summit of Coahuilón, [25.26°N, 100.54°W], 3120 m, 17 October 1989, *P.M. Peterson, J. Valdés-Reyna & J.A. Villarreal 08392, 08397* (CAN, US); Sierra del Carmen, Mesa Bonita, 2600 m, 7 December 1997, *S. Wood, D. Doan-Crider & G. Harper s.n.* (ANSM); Sierra El Jardín, 29.0832°N, 102.64°W, 2100 m, 3 September 2006, *P.M. Peterson & S. Lara-Contreras 19940* (US); Sierra la Viga, 6 km al de Jamé, Puerto Maravillas, 25.3667°N, 100.9553°W, 3000–3150 m, 16 September 1989, *J.A. Villarreal, P. Hooge, J. Valdés-Reyna & M. Barkworth 1978* (ANSM); Sierra Maderas del Carmen, at Campo El Tres, an abandoned logging camp in the high country, 29°N, 102.6°W, 2500 m, 6 August 1974, *T. Wendt & A. Adamcewicz 511* (ANSM); Sierra Maderas del Carmen, streamside habitat in oak-conifer forest about 0.2 mi SE of central cabin of Campo Dos, 28.9939°N, 102.6197°W, 2270 m, 9 August 2004, *D. Riskind, J. Henrickson & J. Valdés 2978* (ANSM); Sierra Zapalinamé, E of Saltillo, 25.3468°N, 100.9016°W, 2700 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18785* (CAN, US); Sierra Zapalinamé, E of Saltillo, grassy ridgetop "El Penitente", 25.3468°N, 100.9016°W, 3070 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18792* (CAN, MO, US) & *18794* (CAN, MO, US); de Saltillo a Los Lirios, San Francisco, 25.3939°N, 100.5539°W, 2270 m, 16 October 2007, *F.O. Zuloaga, N.B. Deginani & J. Valdés-Reyna 9739* (ANSM); Las Vigas, Cañón de Jamé, Sierra de Arteaga, 25.3333°N, 100.65°W, 2600–3300 m, 15 September 1980, *J.A. Villarreal & M.A. Carranza 4624* (ANSM) & *4629* (ANSM); Sierra Hermosa, hacia el W rumbo al Cañón del Carbón, 25.3167°N, 100.9689°W, 2270 m, 8 August 1979, *R. López A. s.n.* (ANSM). **Distrito Federal:** San Angel, Valley of México, [19.42°N, 99.13°W], 12 August 1910, *C.R. Orcutt 6342* (MEXU, MICH-1119233, NY, RSA-POM-531585, US-1266998); 2 km al E de Xochimilco, [19.26°N, 99.11°W], 25 April 1965, 2250 m, *J. Rzedowski 19730* (F-1692573, RSA-POM-209184); 9000 ft, 2 August 1947, *F.A. Barkley, C.M. Rowell, Jr. & G.L. Webster 2433* (F-1405553); Ajusco, [19.2075°N, 99.2581°W], 19 August 1910, *C.R. Orcutt 3722* (GH, MICH-1119240, MO, NY, US-1009503); ca. 20 mi E of México City, 19.4342°N, 98.8306°W, 9 September 1965, *F.W. Gould 11612* (MICH-1119196, US-2551510); camino de San Francisco Tlanepantla hacia el volcán Cuautzin, Delegación Xochimilco, [19.26°N, 99.11°W], 2860 m, 11 October 1985, *A. Miranda & P. Guerrero 89* (MEXU-1110786) & *73* (MEXU-1110785); Chales region, 19.2667°N, 98.9°W, 4 October 1921, *G.N. Collins s.n.* (US-1125328); Chapultepec Park, 19.4167°N, 99.1833°W, 11 July 1960, *W.T. Gillis 3729* (US-2382411); Coyohuacan, 19.3289°N, 99.1603°W, 1947, *B.P. Reko s.n.* (US-1911679); Estacionamiento Museo Universum, [19.42°N, 99.13°W], 2300 m, 23 December 1998, *J. Anicua 403* (MEXU); Guadalupe, [19.37°N, 99.11°W], 29 June 1926, *M. St. Pierre 271* (MICH-1119248, US-1537817); México, [19.37°N, 99.11°W], 7000 ft, 20 July 1891, *H.E. Seaton s.n.* (F-266401, GH); Mixcoac, [19.44°N, 99.12°W], 5 September 1929, *M. St. Pierre 841* (MICH-1119258); Mixcoac, El Olivar, [19.44°N, 99.12°W], 2300 m, 7 April 1913, *G. Arséne 8869* (F-485052, GH, MO, NY, US-1001917); Mixcoac, Narvarte, 19.3833°N, 99.1833°W, 2250 m, 5 August 1929, *M. St. Pierre 841* (US-1537815) & *844* (US-1537816); near San Angel, Valley of México, 19.3733°N, 99.225°W, 15 August 1905, *J.N. Rose, J.H. Painter & J.S. Rose 9481* (US-452971); outskirts of México City, [19.43°N, 99.02°W], 3 August 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1598* (RSA-POM-253261, US); Periférico Sur, cerca del Iman, [19.31°N, 99.17°W], July 1980, *L. Rico & C.H. Ramos s.n.* (RSA-POM-506083, RSA-POM-506084); San Estebán, Tacuba, 19.4°N, 99.15°W, September 1909, *L.G. Ruíz 6* (F-293480, US-1490098); San Gregorio, Valle de México, 19.7272°N, 99.4683°W, 2200 m, 1 April 1951, *E. Matuda 21017* (US-2043374); Santa Cruz, 19.19°N, 99.14°W, 5 September 1929, *M. St. Pierre 844* (MICH-1119260); SE slope of Cerro Pelado, 1–2 km N and NW of LaCima R.R. station, [19.15°N, 99.22°W], 3050–3300 m, 14 August 1960, *H.H. Iltis, R. Koeppen & F. Iltis 918b* (MICH-1119251); Tacubaya, Dolores, 19.4°N, 99.2°W, 2400 m, 9 July 1930, *M. St. Pierre 873* (MICH-1119250, US-1537818); Temascaltepec Dist., Tequesquipan, 19.0578°N, 99.9506°W, 2480 m, 18 August 1932, *G.B. Hinton 1337* (US-1867828); Tlalpan, 19.1883°N, 99.2219°W, 16 August 1910, *C.R. Orcutt 6615* (US-1267067); Valle de México, Cerro de Progreso, 19.5167°N, 99.15°W, 2700 m, 30 September 1950, *E. Matuda 19732* (US-2040949); Valle de México, Cuajimalpa a Río Hondo, 19.3558°N, 99.3011°W, 2400 m, 9 September 1951, *E. Matuda 21816* (US-2041609); Valle de México, 19.4°N, 99.15°W, 2225 m, 9 May 1901, *C.G. Pringle 9601* (F-120602, GH, MO, US-1009509); Venda de Carpin,

Colline, 19.6167°N, 99°W, 2350 m, 16 July 1930, *M. St. Pierre 880* (MICH-1119249, US-1537814); vicinity of México, Azcapotzalco, 19.4889°N, 99.1836°W, 27–30 July 1910, *A.S. Hitchcock 5921* (US-1009505); vicinity of México, Pedregal, 19.3°N, 99.18°W, 27–30 July 1910, *A.S. Hitchcock 5949* (US-1009502); vicinity of México, Xochimilco, 19.2622°N, 99.1075°W, 27–30 July 1910, *A.S. Hitchcock 5872* (US-1009504); W de Tlahuac, en zona de chinampas, [19.27°N, 99.01°W], 2250 m, 21 August 1966, *M. Villegas D. 563* (MSC-223081); Xochimilcho, [19.26°N, 99.11°W], 11 July 1947, *W.D. Barkley, C.M. Rowell & F.A. Barkely 17M343* (F-1499759); Xochimilcho, [19.26°N, 99.11°W], 25 April 1965, 2240 m, *C. Vázquez s.n.* (MICH-1119194). **Durango:** 0.8 mi S of Fancisco I. Madero and 2.3 mi N of Canoas, 22.6482°N, 104.2895°W, 2720 m, 2 October 2001, *P.M. Peterson & M.S. González-Elizondo 16031* (CAN, MO, US); 18.4 mi S of Mezquital on road towards Cuesta Blanca, 23.3475°N, 104.3331°W, 2382 m, 7 September 2006, *P.M. Peterson & F. Sánchez Alvarado 19977* (CAN, US); 2 km al N de Súchil (ojo de agua, entre los potreros La Reserva y Grande), [23.6414°N, 103.9328°W], 25 July 1984, *S. González-Elizondo 2866* (ANSM); 2 mi N of Tepehuana on road towards Mezquita, 23.3089°N, 104.3457°W, 2522 m, 11 September 2003, *P.M. Peterson & F. Sánchez-Alvarado 17738* (MO, NY, RSA-POM-725677, US); 2 mi S of Fancisco I. Madero and 1.2 mi N of Canoas, 22.6322°N, 104.2926°W, 2700 m, 1 October 2001, *P.M. Peterson & M.S. González-Elizondo 16013* (CAN, MO, US); 23 mi N of Hwy. 40 turnoff on road towards San Luis de Villa Corona, 24.0727°N, 105.4898°W, 2194 m, 29 September 2008, *P.M. Peterson & J.M. Saarela 22431* (CAN, US); 3 mi S of Guachichiles, upper slopes of Cerro Huehento, 24.0786°N, 105.7433°W, 3078 m, 30 September 2008, *P.M. Peterson & J.M. Saarela 22449* (CAN, US); 3.2 mi south of La Peña on road towards La Puerta, 23.5561°N, 105.3666°W, 2760 m, 15 September 2003, *P.M. Peterson, S. González-Elizondo & G.A. Teña-González 17788* (US); 40.3 mi W of Huejuquilla towards Canoas, 22.6324°N, 104.2204°W, 2430 m, 30 September 2001, *P.M. Peterson & M.S. González-Elizondo 16006* (CAN, MO, US); 52 km W of Durango on Hwy. 40 towards El Salto, 23.9149°N, 104.982°W, 2531 m, 28 September 2008, *P.M. Peterson & J.M. Saarela 22400* (CAN, US); 56 km W of Durango on Hwy. 40 towards El Salto, 23.9127°N, 105.0194°W, 2450 m, 6 October 2002, *P.M. Peterson & L.E. Brothers 16961* (CAN, MO, P-03216915, US); Arroyo La Sidia Crosing, 1 mi above El Madroño, 24.4796°N, 105.7889°W, 2250 m, 8 October 2002, *P.M. Peterson & L.E. Brothers 17007* (CAN, MO, US); ca. 6 mi N of Navios, 23.9°N, 105.1667°W, 8400 ft [2560 m], 12 October 1966, *J.R. Reeder & C.G. Reeder 4682* (MSC-231765, US-2982195); Cerro Chupadero, 45 mi S of El Salto, and just W of Pueblo Nuevo, [23.17°N, 105.41°W], 2000–2500 m, 28 July 1955, *J.H. Maysilles 8245* (MICH-1119268); Durango and vicinity 24.0333°N, 104.6667°W, April–November 1896, *E. Palmer 734* (GH, MO); Durango, 24.0333°N, 104.6667°W, 1890 m, 6–8 October 1910, *A.S. Hitchcock 7569* (US-1009541); Durango, 24.0333°N, 104.6667°W, 6200 ft, 23 July 1944, *G.L. Fisher 44201* (GH, NY); Durango, 24.0333°N, 104.6667°W, April–November 1896, *E. Palmer 171* (F-51284, F-176473, GH, MICH-1119174, MO, NY); Ejido las Mercedes, Cuencamé, camp experimental de Zonas Aridas, 24.8667°N, 100.2167°W, 19 km al N de Cuencamé, carretera 40 Durango-Torreón, 1435 m, 8 May 1992, *A. Rdz. G. 1519, J.A. Villarreal & M.A. Carranza P.* (ANSM); El Soldado, [23.93°N, 104.94°W], August 1987, *J.G. Andrade C. 143* (MEXU-1110856); km 7 Ciudad Durango-Mazatlán, 24.93°N, 104.76°W, 1900 m, 4 November 1954, *E. Hernández X. & C. Tapia J. N-615* (GH); Mpio. de Súchil, La Mesa del Burro, rancho de La Peña, [23.3969°N, 104.2389°W], 18 September 1985, *Y. Herrera A. 722* (ANSM, MEXU-447122, NY); Mpio. Durango, 13 km al E Cd. de Durango, Rancho El Duranguito, 24.0028°N, 104.5625°W, 1900 m, August 1995, *D.E. Aceval A. 585* (MEXU-1063458); Mpio. Durango, Ejido Llano Grande, frente al Cerro de la Carpa, 23.8431°N, 105.2055°W, 18 July 2001, *R. Carrillo 81* (ANSM, MEXU-1057493); Mpio. Durango, Predio "Presitas", 24.0875°N, 105.2981°W, 2500 m, July 1999, *D.E. Aceval 760* (MEXU); Mpio. Nombre de Dios, 1 km al N del puente del rio de Nombre de Dios, 23.85°N, 104.24°W, 203 m, 16 October 1984, *R. Jimenez 203* (RSA-POM-356388); Mpio. Pueblo Nuevo, Cruz de Piedra, [23.87°N, 105.25°W], September 1988, *E. Aceval 264* (MEXU-1110780); Mpio. Pueblo Nuevo, km 115, carretera Durango a Mazatlán, 23.7472°N, 105.45°W, 2700 m, October 1999, *D. Aceval 772* (MEXU-1063620); Mpio. Súchil, El Temascal, [24.5°N, 103.83°W], 31 July 1984, *S. González 2898* (ANSM, MEXU-955087); Mpio. Súchil, Laguna de la vaca, cerca del casco del Rancho El Temascal, [24.5°N, 103.83°W], 15 July 1985, *Y. Herrera A. 658* (MEXU-117268, NY); Mpio. Súchil, Mesa del Burro, 6 km al SW de Piedra Herrada, [23.62°N, 103.93°W], 2650 m, 16 September 1982, *Y. Herrera A. 236* (MEXU-819383, NY); N slopes of Cerro Huehuento S of Huachicheles ca. 75 mi W of central Durango, [24.06°N, 105.76°W], 2900–3150 m, 2 July 1950, *J.H. Maysilles 7301* (MICH-1119269); near Minas, 25.231°N, 105.13°W, 2580 m, 3 October 2002, *P.M. Peterson, M.S. González-Elizondo & L.E. Brothers 16933* (US); Nombre de Dios al N, [23.8444°N, 104.2425°W], 3 April 1981, *S. Acevedo 7* (ANSM); Otinapa, [24.05°N, 105°W], 25 July–5 August 1906, *E. Palmer 346* (F-213079, GH, MO, NY); Sierra Madre Occidental, 1.8 mi NW of Cienaga de Nuestra Senora on road towards Topia, 25.083°N,

106.34°W, 2570 m, 12 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15442* (US), Sierra Madre Occidental, 2.7 mi SW of Tableteros 23.6673°N, 104.7181°W, 2485 m, 2 October 2007, *P.M. Peterson, J.M. Saarela, M.S. González-Elizondo, D.J. Rosen & C.S. Reid 21218* (CAN, US); Sierra Madre Occidental, 2.7 mi SW of Tableteros, 23.6673°N, 104.7181°W, 2485 m, 2 October 2007, *P.M. Peterson, J.M. Saarela, M.S. González-Elizondo, D.J. Rosen & C.S. Reid 21216* (CAN, MO, US); Sierra Madre Occidental, 3.2 mi SW of Las Bayas on road towards Ceballos, 23.4983°N, 104.8607°W, 2780 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15421* (CAN, MO, US); Sierra Madre Occidental, 56 km W of Durango along Hwy. 40 towards El Salto and 0.4 mi E of entrance to Parque El Tecuan, 23.9109°N, 105.0252°W, 2536 m, 3 October 2007, *P.M. Peterson & J.M. Saarela 21256* (CAN, MO, US); Sierra Madre Occidental, 6.8 mi E of Los Canoas on road towards Huejuquilla El Alto, 22.6349°N, 104.2163°W, 2460 m, 21 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19063* (CAN, MO, US); Sierra Madre Occidental, at Río Mimbres 45 km W of Durango on Hwy. 40 towards El Salto, 24.19°N, 104.9527°W, 2430 m, 8 October 2000, *P.M. Peterson & J. Cayouette 1540*0 (CAN, US); Sierra Madre Occidental, SW slope of Cerro Gordo just below twin rock outcrops, 23.209°N, 104.9484°W, 3130 m, 26 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19148* (CAN, MO, US); Sierra Madre Occidental, SW slope of Cerro Gordo just below twin rock outcrops, 23.209°N, 104.95°W, 3130 m, 26 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19147* (US); Sierra Madre Occidental, Sierra Murata, 5.3 mi W of La Ventana, 22.9604°N, 104.5003°W, 2540 m, 20 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19042* (CAN, US); Tepehuanes, 25.35°N, 105.7333°W, 1771 m, 28 July 1944, *G.L. Fisher 44185* (MO, US-90885); transect from Paseo de Cerro Gordo to the top (cumbre), 23.2086°N, 104.9481°W, 3136–3348 m, 9 September 2006, *P.M. Peterson & F. Sánchez Alvarado 19994* (CAN, MO, US); Sierra Madre Occidental, 4.2 mi NE of El Salto on Hwy. 40 towards Durango, 2520 m, 26 October 1995, *P.M. Peterson, M.B. Knowles, C. Dietrich & S. Braxton 13452* (US). **Guanajuato:** Acambaro, 20.0333°N, 100.7333°W, 1920 m, 14 September 1910, *A.S. Hitchcock 6947* (US-1009529); Casa Sautto, San Miguel de Allende, [20.92°N, 100.75°W], 5 July 1963, *S.K. Harris 25794* (GH); Casa Sautto, Predio Montecdillo del Panteón Andocutín, [20°N, 100.71°W], 1839 m, 19 August 1983, *E. Guízar 1091* (MEXU-795738); Mpio. Cortázar, Cerro Culiacán, [20.33°N, 100.97°W], 1 September 1981, *A.A. Beetle M-7301* (MICH-1119189, RSA-POM-303026, SD-122030); Mpio. Guanajuato, Cañada de la Virgen Alrededor del Agua Sabrosa, 21.1675°N, 101.2017°W, 2400 m, 23 August 1998, *Martínez, Cruz & Juan 1038* (MEXU-851286); Obregon, 21.3167°N, 101.0833°W, 23 July 1910, *A.S. Hitchcock 5800* (US-1009530); ca. 2 km NE of San Miguel, [20.9418°N, 100.7397°W], 31 October 1952, *E.R. Sohns 498* (MICH-1119135); Puerto de Neito, [20.8833°N, 100.5333°W], 13 August 1947, *L.A. Kenoyer 2047* (GH). **Guerrero:** Tres Palitos, Chilpancingo, [17.55°N, 99.5°W], 2400 m, 26 July 1994, *A. Carrillo Soberón 771* (MEXU-1097988). **Hidalgo:** 8 mi S of Ixmiquilpan, 20.4861°N, 99.2589°W, 5 August 1960, *F.W. Gould 9305* (MICH-1119261); between Pachuca and Real Del Monte, 20.1167°N, 98.7°W, 19 July 1905, *J.N. Rose, J.H. Painter & J.S. Rose 8683* (US-452175); between Somoriel and Las Lajas, 20.0133°N, 98.5102°W, 5 August 1905, *J.N. Rose, J.H. Painter & J.S. Rose 9203* (US-452686); ca. 13 mi E of Pachuca, [20.09°N, 98.71°W], 2560 m, 30 September 1974, *J.R. Reeder & C.G. Reeder 6405* (RSA-POM-305966); Dist. Zacualtipán, beside Río Teponapa, vicinity of Zacualtipán, 20.65°N, 98.6°W, 2000 m, 2 July 1947, *H.E. Moore, Jr. 3236* (GH, US-2012715); Ejido Emiliano Zapata, 2700 m, 22 September 1992, *Ma. de los Angeles Garcia & L. Caballero S. 11* (ANSM); in Barranca de San Vicente near km 238 on highway between Zimapán and Jacala, 20.83°N, 99.25°W, 549-610 m, 24 September 1949, *H.E. Moore, Jr. 5066* (US-1983649); Mpio. Real del Monte, ca. a 4 km sobre el camino de terracería Real del Monte-Santa Rosalía, 20.1167°N, 98.6333°W, 13 July 1994, *A. Olmos García 18* (MEXU); near Ixmiquilpan, 20.4833°N, 99.2333°W, 28 July 1905, *J.N. Rose, J.H. Painter & J.S. Rose 8998* (US-452478) & *9061* (US-452540); near Tula, 20.05°N, 99.35°W, 3–4 July 1905, *J.N. Rose, J.H. Painter & J.S. Rose 8358* (NY, US-451851); Pachuca, 20.1167°N, 98.7333°W, 2438 m, 6–7 September 1910, *A.S. Hitchcock 6745* (NY, US-1009527); Real del Monte, 20.1333°N, 98.6667°W, 10 November 1919, *I.W. Clokey 1904* (US-726923) & *1908* (US-726921); Real del Monte, 20.1333°N, 98.6667°W, 15 September 1910, *I.W. Clokey 1910* (US-726922); Sierra de Pachuca, 20.14°N, 98.73°W, 1 September 1903, *J.N. Rose & J.H. Painter 6750* (GH, US-450307); near Real del Monte above Pachuca, [20.17°N, 98.73°W], 9300 ft [2835m], 1 October 1944, *A.J. Sharp 441086* (MEXU-136475). **Jalisco:** 3 mi W of Capilla de Guadalupe, 20.8333°N, 102.6333°W, 2000 m, 30 August 1958, *R. McVaugh 17563* (MICH-1119169, US-2381230); Cerro de Santa Fé, Puente Grande, Zapotlanejo, [19.92°N, 104.33°W], 1900 m, 21 October 1972, *C.L. Diaz Luna 3574* (MICH-1119167, RSA-POM-301496); cumbre de Volcán Tequila, 11.2 mi S of Tequila, 20.7878°N, 103.847°W, 2920 m, 5 October 2001, *P.M. Peterson & O. Rosales 16075* (CAN, MO, US). **Estado de México:** "La Puerta", a 2 km por la carretera al Nevado de Toluca (Sur), [19.1083°N, 99.7583°W], 3020 m, 1

August 1981, *R. Guzmán 3981, 3978* (MEXU); 2 km al W de San José El Vidrio, [19.65°N, 99.39°W], 2500 m, 30 July 1981, *R. Guzmán 3957* (MEXU-1110855); 20 mi S of México City, [19.33°N, 98.62°W], 1 September 1946, *A.I. Ortonburger, J.B. Paxon & F.A. Barkley 16M711* (F-1408979) & *16M760* (F-1408978); 27 km SW of Toluca on road to Temaxcaltepic, 19.11°N, 100°W, 2800 m, 9 July 1964, *G. Mick & K. Roe 235* (MICH-1119239, US); 27 mi S of San Juan del Río, [20.12°N, 99.69°W], 28 July 1960, *F.W. Gould 9209* (MICH-1119262); 3.6 mi S of Aculco on Hwy. 55, 20.0439°N, 99.87°W, 2602 m, 8 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21333* (CAN, MO, US); 5 mi E of Michoácan-México state line on road from Morelia to Toluca, 19.4°N, 100.07°W, 24 July 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1479* (US-2473571); 5 mi E of Toluca, [19.29°N, 99.42°W], 10 August 1947, *F.A. Barkley, J. Salgado II & J.B. Paxson 698* (F-1405687); a 7 km de Buenavista, rumbo a Temascaltepec, 3250 m, 29 August 1983, *Manrique, Jaramillo & Guerrero 289-a* (MEXU) & *290* (MEXU); a 7.2 km de la desviación al Nevado de Toluca (cerca de Raíces) carretera Toluca-Temascaltepec, [19.1083°N, 99.7583°W], 3460 m, 28 July 1983, *Manrique, Guerrero & Miranda 262* (MEXU-1110800); al oeste de Amecameca, por la carretera Amecameca-Cuautla, [19.12°N, 98.79°W], 2520 m, 8 February 1984, *Manrique & Beetle et al. 713* (MEXU-1110830) & *714* (MEXU-11108329); Amecameca, 19.1167°N, 98.7667°W, 2600 m, 20 August 1950, *E. Matuda 19306* (US-2040924, MEXU); between Nicols Romero and Progreso Industrial, 19.6286°N, 99.33°W, 2134–2743 m, 20 September 1953, *E.R. Sohns 522* (US-2118504) & *527* (P-02629879, US-2118509); Brecha San Marín de las Pirámides-Tizayuca, a 7 km al W de San Martín de las Pirámides, [19.7°N, 98.84°W], 29 July 1981, *R. Guzmán 3873* (MEXU-1110769); ca. 5 mi S of Tizayuca on road between México City and Pachuca, 19.53°N, 98.9°W, 3 August 1950, *J.R. Reeder & C.G. Reeder 1608* (US-2473585); carretera al Ajusco, en frente al Ejido San Andres Tlalpan, D.F., [19.26°N, 99.17°W], 2650 m, 29 June 1980, *L. Pacheco 45* (F-2055659); carretera Villa Victoria-El Oro, [19.81°N, 100.13°W], 2570 m, 9 August 1981, *R. Guzmán & P. Guerrero 4245* (MEXU-1110833); cerca de la Presa Ñadÿó, por la carretera Acambay-Querétero, [20.05°N, 99.83°W], 2490 m, 10 August 1981, *R. Guzmán 4289* (MEXU-1110832); Cerro de Sacromonte, cerca de Amecameca, [19.12°N, 98.76°W], 2500 m, 5 August 1967, *L. López 104* (RSA-POM-209191); Chapingo, 2240 m, June 1966, *R. Moreno F. 39* (ANSM); Chapingo-Chimalhuacan, orillando lago Texcoco, 19.5°N, 99°W, 5 July 1953, *E. Matuda et al. 28667* (US-2119994); Chapultepec, 19.4167°N, 99.1833°W, 2600 m, 10 October 1953, *E. Matuda et al. 29472* (US-2119849); *Coulter 1651* (GH); E de Tlalnepantla, cerca de la población, 19.55°N, 99.1833°W, 2250 m, 27 October 1963, *M. Villegas-D. 242* (US-2589256); El Horno Chapingo, 19.4667°N, 98.8667°W, 8 August 1946, *E. Hernández-Xolocotzi X-1965* (US-1962006); Griaderos, 3000 m, 3 September 1950, *E. Matuda 19390* (MEXU-109284, US-2040929); Juchitepec, Pedregal de Huihuilango, [19.09°N, 98.88°W], 2800 m, 10 March 1976, *A. Ventura A. 1127* (SD-120462); junction of Hwy. 10 and road to Parque Nacional Nevado de Toluca, NW of the volcán, 19.1506°N, 99.8°W, 3572 m, 11 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16156* (CAN, MO, US) & *16157* (CAN, US); km 3 por terracería Coatepec-Agua Amarga a orilla del arroyo El Molino, [19.42°N, 98.95°W], 30 September 1987, *R. Méndez Ibarra 138* (MEXU); Lecheria, 19.6114°N, 99.1856°W, 10 July 1904, 7300 ft, *C.G. Pringle 13243* (F-179486, GH, MICH-1119173, US, MEXU-537475); México City, 19.4342°N, 99.1386°W, 5 June 1944, *J. Harlan 441-13 & -16* (US-1939768); Mpio. Amecameca, Cueva del Negro, carretera al Paso de Cortés, 15 km al W de la carretera Amecameca-Cuautla, 19.23°N, 98.84°W, 3260 m, 20 December 1981, *S.D. Koch & M.F. Denton 8118* (US-2989673); Mpio. Texcoco, Santa Rosa, km 35 del camino México-Texcoco, 19.5294°N, 98.88°W, 2250 m, 20 September 1967, *A. Rebolledo Vélez s.n.* (MICH-1119203, MSC-223206); Mt. Popocatepetl, 19.0333°N, 98.6333°W, 3353 m, 5–6 August 1910, *A.S. Hitchcock 5994* (US-1009499); Nanchititla, Temascaltepec, [18.81°N, 100.42°W], 10 November 1933, *G.B. Hinton 4984* (NY, RSA-POM-364162); near city of México, 19.4342°N, 99.1386°W, 9 October 1898, *E.W.D. Holway 3034* (US-1009506); on old Hwy. 190 between turnoff to Chalco (Hwy. 115) and Santa Bárbara ca. 30 m above Azotla, 19.32°N, 98.89°W, 21 July 1964, *G. Mick & K. Roe 293* (US-2630280); por la carretera a Texcaltitlán, al S del Nevado de Toluca, [19.1083°N, 99.7583°W], 2360 m, 1 August 1981, *R. Guzmán 4027* (MEXU); Rancho Buena Vista y Libertad, por la carretera a Morelia, [19.68°N, 101.12°W], 2520 m, 8 August 1981, *R. Guzmán & P. Guerrero 4227* (MEXU-1110861); Tehuacán area, along Tehuacán-Orizaba highway just above Azumbilla, 18.7°N, 97.41°W, 1500–1800 m, 18 July 1961, *C.E. Smith Jr., F.A. Peterson & N. Tejeda 3962* (US-2382355); Tequesquipan, 19.0578°N, 99.9506°W, 2480 m, 30 June 1933, *G.B. Hinton 4185* (RSA-POM-364163); Tequesquipan, Temascaltepec, 19.0578°N, 99.9506°W, 30 June 1932, *G.B. Hinton 4186* (NY, US-1840859); Toluca, 19.3°N, 99.65°W, 2682 m, 13 September 1910, *A.S. Hitchcock 6907* (US-1009501); valle de Ixtapan de la Sal, [18.8333°N, 99.6833°W], 1950 m, 28 July 1968, *A. Pindea R. 420* (MSC-234832); Valle de México, Cerros Tenayo, Sonayo, 19.0833°N, 99.1333°W, 2600 m, 27 July 1952, *E. Matuda 26250* (US-2119845);

Volcán de Zinantecatl near Toluca, [19.12°N, 99.76°W], 12000 ft, 23 August 1947, *F.A. Barkley, G.L. Webster & B.L. Westlund 36* (F-1405746); 11 mi E of Amecameca, fir forest en route up Popocatypetl, 10,950 ft, 31 July 1975, *D. LeDeoux, Wallace & Ellis 68* (NY). **Michoácan:** S-facing slopes of mountains between the Río del Salto and La Polvilla, ca. 18 mi E of Morelia, 19.65°N, 100.95°W, 2195–2438 m, 9–18 November 1961, *R.M. King & T.R. Soderstrom 5014* (MICH-1119186, NY, US-2378940); ca. 12 mi E of Zacapu on road from Guadalajara to Morelia, 19.72°N, 101.63°W, 22 July 1950, *J.R. Reeder, C.G. Reeder & L.N. Goodding 1449* (US-2473570); ca. 20 mi W of Morelia, 19.63°N, 101.47°W, 1524–2134 m, 3 October 1953, *E.R. Sohns 763* (US-2118692); Morelia, Rinson, 19.7°N, 101.183°W, 1950 m, 28 July 1909, *G. Arséne 7273* (US-1002629); Mpio. Huiramba, parte alta del Cerro del Burron, 23 November 1986, 19.53°N, 101.47°W, 3300 m, *J. Rzedowski 41895* (MICH-1119188); vicinity of Morelia, Jardín, 19.7°N, 101.2°W, 1850 m, 2 May 1909, *G. Arséne 3304* (US-1002652); Cerro Tancítaro, 27 km al W de Uruapan en linea recta Barranca del Agua al N de Zirimondiro, Mpio. de Tancítaro, [19.41°N, 102.3°W], 2400 m, 26 September 1996, I. *Garcia Ruíz, J.A. Machuca & M. Cházaro 4238* (MICH-1119230). **Morelos:** Cuernavaca, 18.9167°N, 99.25°W, 1372 m, 10–11 September 1910, *A.S. Hitchcock 6885* (US-1009525); Mpio. Totolapan, Nicolás Villa Zapata, Cerro del Algibe, [18.99°N, 98.92°W], 2440 m, 28 April 1981, *G. Ayala A. 82* (MEXU); near Valle de México, Oastepec, 18.9°N, 98.9667°W, 1600 m, 16 March 1952, *E. Matuda 26010* (US-2079220). **Nayarit:** Sierra Madre, near Santa Teresa, Territorio de Tepic, 22.4667°N, 104.7333°W, 9 August 1897, *J.N. Rose 2138* (US-301044). **Nuevo León:** 1.4 mi NW of Dulces Nombres, 24.0115°N, 99.5731°W, 1926 m, 23 September 2001, *P.M. Peterson & J. Valdés-Reyna 15936* (CAN, US); 11.7 mi NE of Dulces Nombres, 23.9755°N, 99.4882°W, 1808 m, 23 September 2001, *P.M. Peterson & J. Valdés-Reyna 15938* (CAN, US); 32 mi S of San Roberto, along Hwy. 57, 24.3°N, 100.3833°W, 11 July 1963, *R.L. McGregor, L.J. Harms, A.J. Robinson et al. 497* (US-2454844); 4 km W of Tepehuanes on road towards Zaragoza, 23.9349°N, 99.7312°W, 1980 m, 21 September 2001, *P.M. Peterson & J. Valdés-Reyna 15865* (ANSM, CAN, MO, NY, US); along road up to Cerro Potosí, 24.8875°N, 100.2126°W, 2884 m, 21 October 2007, *P.M. Peterson, J.M. Saarela & D. Stancik 21454* (CAN, MO, US); Cerro Potosí, 24.8667°N, 100.2167°W, 2743 m, 8 July 1963, *R.L. McGregor, L.J. Harms, A.J. Robinson et al. 301* (US-2454958); Cerro Potosí, E side of mtn. at km 18 (from Dieciocho de Marzo) on road to Teléfonos de México installation, 24.8667°N, 100.2167°W, 3 August 1962, *E.K. Longpre 506* (MSC-281858); Ejido Tepehuanes, 23.905°N, 99.7118°W, 2317 m, 21 September 2001, *P.M. Peterson & J. Valdés-Reyna 15873* (ANSM, CAN, US); El Tejocote, Santiago, [25.3317°N, 100.2525°W], 2100 m, 8 July 2004, *E. Estrada et al. 16469* (ANSM); Mpio. Galeana, 24.8333°N, 100.0667°W, 1646 m, 30 July 1939, *V.H. Chase 7681* (US-1763086); Mpio. Zaragoza, Sierra El Soldado, camino a Puerto Pinos, 2840 m, 24 August 1989, *J.A. Villarreal, M.A. Carranza, G. Nesom & J. Norris 4953* (ANSM, MEXU-508589, NY); Renacer de la Sierra, Serranía La Marta, 25.25°N, 100.1667°W, 2800 m, 26 July 1987, I. *Cabral C. 1023* (ANSM, MEXU-472758); Sierra La Lagunita, 13.5 mi SE of Aramberri on road towards Agua Fría, 24.0417°N, 99.7333°W, 2250 m, 20 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16720* (ANSM, CAN, US); Sierra La Lagunita, 13.5 mi SE of Aramberri on road towards Agua Fría, 24.0423°N, 99.7345°W, 2170 m, 20 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16716* (ANSM, CAN, US); Sierra La Lagunita, 13.5 mi SE of Aramberri on road towards Agua Fría, 24.0533°N, 99.74°W, 2153 m, 20 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16711* (ANSM, US); Sierra Las Cautivas, 4.1 mi SW of Dulces Nombres and 22.7 mi E of Zaragoza, 23.9798°N, 99.5955°W, 2017 m, 26 September 2007, *P.M. Peterson & J.M. Saarela 21096* (CAN, MO, US); Sierra Madre Oriental, Alamar ca. 15 mi SW of Galeana, 24.61°N, 100.01°W, ca. 5000 ft, 1 June 1934, *C.H. Mueller & M.T. Mueller 667* (MICH-1119264, GH); Sierra Madre Oriental, ascent to Sierra Infernillo, ca. 15 mi SW of Galeana, 24.61°N, 100.01°W, 9000–10000 ft, 16 June 1934, *C.H. Mueller & M.T. Mueller 812* (F-938712, GH, MICH-1119178); Sierra El Pinal Alto, 3.7 mi N of San Pablo, 25.0992°N, 100.42°W, 2640 m, 10 September 2005, *P.M. Peterson & J. Valdés-Reyna 18945* (ANSM, CAN, US). **Oaxaca:** vicinity of El Rancho de Buenavista, La Cumbre del Cuartel, district of Ixtlán, 17.26°N, 96.4°W, 11000–12000 ft, 2 November 1944, J. *Vera Santos 3617* (MICH-1119241); 1.6 mi N of San Miguel Suchixtepec along Hwy. 175, 16.1157°N, 96.4745°W, 2722 m, 23 September 2008, *P.M. Peterson & J.M. Saarela 22379* (CAN, US); 14.1 mi N of San Cualimojoyas on road towards Santa María Yavesia, 17.2267°N, 96.4308°W, 2150 m, 19 September 2008, *P.M. Peterson & J.M. Saarela 22304* (CAN, US); 16 mi S of Villa Talea de Castro and 17.5 mi W of San Bartolome Zoogocho, 17.2668°N, 96.37°W, 2696 m, 25 September 2006, *P.M. Peterson & R. Garcia 20164* (US); 7.6 mi N of Espiritú Santo Tanazulapan, 17.1074°N, 96.0367°W, 1722 m, 26 September 2006, *P.M. Peterson & R. Garcia 20193* (CAN, MO, US); 8.3 mi N of San Cualimojoyas on road towards Santa María Yavesia, 17.1819°N, 96.4445°W, 2794 m, 20 September 2008, *P.M. Peterson & J.M. Saarela 22313* (CAN, US); along Route 175, 12 km N of Ixtlán de Juárez on the road to Valle

Nacional, [17.39°N, 96.51°W], ca. 2500 m, 26 July 1959, *R.M. King 2098A* (MICH-1119259); Mpio. Ixtlán de Juárez, 4 km E of Ixtlán de Juárez on road to Capulalpan, Rancho Teja, [17.35°N, 96.52°W], 2200 m, 1 September 1980, *G.J. Martín 137* (MO, MSC-282217); Mpio. Ixtlán de Juárez, Rancho Vivero Teja, 2.5 mi from church in Ixtlán de Juárez on road to Yavesia, 17.32°N, 96.48°W, 2200 m, 10 September 1980, *R.E. Gereau 650* (MSC-276340, NY); Santa María Yavesia, 17.2347°N, 96.43°W, 2006 m, 19 September 2008, *P.M. Peterson & J.M. Saarela 22290* (CAN, US); Tepautlali, 14 May 1980, *Ledezma 2* (MEXU). **Puebla:** 1 km al oeste de San Isidro Vaquerías, [18.9667°N, 98.2667°W], 3000 m, 27 June 1989, *P. Dávila 359, P. Tenorio & J. Sánchez-Ken* (ANSM); 16 August 1908, *Nicolás s.n.* (US-1009569); 24 February 1909, *Nicolás s.n.* (US-1009520); 25 July 1908, *G. Arséne s.n.* (US-566850); 39 mi NW of Puebla, 19.25°N, 97.61°W, 9 September 1962, *F.W. Gould 10173* (MICH-1119138); 5 mi NE of Zacatepec, on Hwy. 40 from Jalapa to Zacatepec, 19.32°N, 97.48°W, 2438 m, 29 August 1959, *T.R. Soderstrom 494* (US-2378257); 8 km después de Zaragoza rumbo a Zacapoaxtla, [19.84°N, 97.57°W], 2140 m, 21 November 1985, *I. Núñez et al. 379* (MEXU); Arzohispado, vicinity of Puebla, 19.05°N, 98.2°W, 2165 m, 14 July 1907, *G. Arséne 7139* (US-1000497); base du Cerro San Juan, vicinity of Puebla, 19.0833°N, 98.2667°W, 2180 m, 5 August 1906, *G. Arséne 178* (US-1000498); ca. 16 mi W of Texmelucan near the continental divide, [19.34°N, 98.71°W], 2980 m, 31 August 1953, *J.R. Reeder & C.G. Reeder 2205* (RSA-POM-287294, US-2473587); Chalchicomula, 18.9833°N, 97.45°W, 2743 m, 19 August 1910, *A.S. Hitchcock 6269* (US-1009511) & *6287* (US-1009512) & *6290* (US-1009513); Chinantla, 18.2°N, 98.25°W, July 1841, *Liebmann 483* (US-207525); Chinantla, 18.2°N, 98.25°W, May 1841, *Liebmann 12892* (US-1389852); El Carmen Zacatepec entre San José Chapa y Lara Grajales, 3380 m, 5 September 1988, *F. Domínguez F-32* (MEXU-110790); Esperanza, 2591 m, 18.8667°N, 97.4°W, 23 August 1910, *A.S. Hitchcock 6495* (US-1009517) *& 6497* (US-1009518); Huauchinango, 20.1833°N, 98.05°W, 13 June 1950, *J.T. Baldwin, Jr. 14389* (US-2436907); just over the Veracruz–Puebla boundary on Hwy. 150, [18.85°N, 97.27°W], 2 October 1976, *F.W. Gould 14894* (ANSM, SD-126967); margenes del río "El Calvario", en la Cd. de Teziutlán, [19.82°N, 97.35°W], 2000 m, 4 May 1996, *M.G. Cano 133* (MEXU); Mayorazgo, sur l'Atoyac, vicinity of Puebla, 19.033°N, 98.2°W, 2120 m, 7 July 1907, *G. Arséne 1325* (MO, US-1002641) & *1336* (US-1002643); Mayorazgo, 19.033°N, 98.2°W, 2120 m, 4 July 1907, *G. Arsène 10105* (US-1003995); Mpio. Atempan, [19.83°N, 97.46°W], 11 November 1992, *S. Aguirre 84* (MEXU-1099512); Mpio. Chapulco, 6–8 km al E de la interseccion Tehuacán-Orizaba-Esperanza, 18.63°N, 97.41°W, 18 July 1990, *A. Salinas T. 5461* (RSA-POM-544232); Mpio. Chignahuapan, 12 km de Zacatlán rumbo al municipio Chignahuapan, 19.84°N, 98.03°W, 2000 m, 30 July 1981, *L. Román M. 4* (MEXU); Mpio. Cholula, Santa María Zacatepec, [19.12°N, 98.37°W], 2150 m, 13 November 1992, *R. López 70* (MEXU-1099514); Mpio. Nicolás Bravo, 5 km al. E de la desviación a Nicolás Bravo, 2200 m, 21–22 September 1990, *A. Salinas T., J. Sánchez-Ken & P. Tenorio 5760* (RSA-POM-544235); Mt. Orizaba, 19.0167°N, 97.2667°W, 3962 m, 17–18 August 1910, *A.S. Hitchcock 6250* (US-1009516); near Hacienda Santa Bárbara, barranca de la Alseseca, vicinity of Puebla, 18.8333°N, 97.7333°W, 2150 m, 18 July 1907, *G. Arséne s.n.* (US-1002640); Puenta del Emperador, near La Venta, 19.2833°N, 98.4333°W, 2530 m, 18 August 1944, *A.J. Sharp 44418* (GH, MO, NY, US-1939422); Rancho Posadas, vicinity of Puebla, 19.0333°N, 98.1833°W, 2180 m, 6 August 1908, *G. Arséne 1603a* (US-1002638) & *1605* (MO, US-1002636); Rancho Posadas, vicinity of Puebla, 19.0333°N, 98.1833°W, 2194 m, 15 August 1909, *G. Arséne 270, 270a* (US-1002628); Rancho Posadas, vicinity of Puebla, 19.0333°N, 98.1833°W, 67 m, 10 April 1909, *Br. Nicolás & G. Arséne* 270 (GH, NY, mixed sheet with *B. anomalus*, US-1002656); Rancho Posadas, 19.0333°N, 98.1833°W, 2194 m, 10 August 1909, *G. Nicolás s.n.* (F-387670, MEXU, US-1009519); Route de México, sous Cerro San Juan, vicinity of Puebla, 19.0833°N, 98.2667°W, 2190 m, 30 August 1906, *G. Arséne 336* (MO, US-1002649); San Marcos, 18.4°N, 97.35°W, 2591 m, 29 August 1910, *A.S. Hitchcock 6517* (US-1009514) & *6537* (US-1009515); San Miguel, Cholula, [19.06°N, 98.31°W], 2162 m, 27 September 1988, *E. Coyote E-23* (MEXU-1110789); San Miguel, Distrito de Tepeaca, vicinity of Puebla, 18.8833°N, 97.8333°W, 2110 m, July 1907, *Br. Amable & G. Arséne 2243* (US-1002634); Santa Isabel de la Visitación, Cholula, [19.08°N, 98.3°W], 2100 m, 25 September 1985, *I. Núñez et al. 178* (MEXU-1110799); Tehuacán, 18.45°N, 97.3833°W, 1676 m, 9 August 1910, *A.S. Hitchcock 6043* (US-1009521); Teziutlan, 19.8167°N, 97.35°W, 7 September 1910, *C.R. Orcutt 4037* (US-1009510); vicinity of Puebla, 19.05°N, 98.2°W, 14 July 1910, *Br. Nicolás & G. Arséne 5244* (US-1002655); vicinity of Puebla, 19.05°N, 98.2°W, 2160 m, 20 December 1906, *G. Arséne 445* (US-1002648); vicinity of Puebla, 19.05°N, 98.2°W, 2170 m, 23 June 1907, *G. Arséne 2227* (GH, MO, US-1002630) & *2228* (MO, US-1002631). **Queretaro:** carretera Pinal de Amoles-Jalpan, [21.19°N, 99.57°W], 24 August 1982, *R. Guzmán 5966* (MEXU-1110824); vicinity of Queratro, [20.58°N, 100.39°W], 1912, *Basile 23* (US-1009526); Mpio. Pinal de Amoles, Cuesta de Huazmazontla, [21.14°N, 99.62°W], 1620 m, 11 December 1996, *L.G. Rincón 441* (MEXU-1089795);

just below Cerro El Zamorano, 20.9328°N, 100.1839°W, 3191–3250 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24682* (US); Pinal de Amoles, Ridge near Cerro Pinuical, 21.1692°N, 99.6911°W, 3076 m, 28 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24784* (US); Pinal de Amoles, Ridge near Cerro Pinuical, 21.1344°N, 99.6803°W, 2979 m, 28 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24786* (US); just below Cerro El Zamorano, 20.9328°N, 100.1839°W, 3191–3250 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 246780-A* (US). **San Luis Potosí:** 21 mi ESE of San Luis Potosí on MEX 40, [22.09°N, 100.64°W], 7200 ft, 28 September 1972, *L.H. Harvey & J.T. Witherspoon 9246* (MICH-1119243); 22 mi E of San Luis Potosí on the road to Rioverde, 22.11°N, 100.66°W, 2316 m, 8 November 1964, *J.R. Reeder & C.G. Reeder 4080* (US-2473586); 26 mi E of San Luis Potosí, along Hwy. 86 to Rioverde, 22.07°N, 100.61°W, 2438 m, 14 July 1963, *R.L. McGregor, L.J. Harms, A.J. Robinson et al. 713* (US-2454908); 30 mi E of San Luis Potosí, along Hwy. 86 to Rioverde, 22.06°N, 100.56°W, 2103 m, 13 July 1963, *R.L. McGregor, L.J. Harms, A.J. Robinson et al. 576* (US-2454948); Álvarez, Sierra de Álvarez, Sierra Madre Oriental, 22.0333°N, 100.6167°W, 2200–2400 m, 30–31 July 1934, *F.W. Pennell 17847* (MEXU-612, US-1841168); between Puerta Huerta and Rioverde in the Sierra de Álvarez, 21.91°N, 100.1°W, 1150–2200 m, 11 September 1954, *E.R. Sohns 1167* (US-2154429); Cárdenas, 22°N, 99.6667°W, 19–20 July 1910, *A.S. Hitchcock 5744* (US-1009533); carretera a ciudad Valles, en el Parador Cruz de Encinos de la Sierra de Álvarez, 22.07°N, 100.52°W, 1500 m, 27 July 1995, *M.A. Reyes 527* (MEXU-1097984); Charcas, 23.1°N, 101.0333°W, July 1934, *A.F.Whiting 488* (MICH-1119185, US-1646336); in the canyons in the Sierra de San Miguelito, ca. 2 km W of Terrero, 22.4°N, 100.92°W, 1850–2200 m, 8 September 1954, *E.R. Sohns 1133* (US-2154403); Mpio. Villa de Zaragoza, San Isidro, 23.1°N, 101.65°W, 2000 m, 13 September 1994, *H. Bravo M. 394* (MEXU-1097982); near Puerta Huerta in the Sierra de Álvarez, 21.91°N, 100.1°W, 2200–2400 m, 4 September 1954, *E.R. Sohns 1021* (US-2154301) & *1025* (US-2154305) & *1029* (US-2154308); San Luis Potosí, 22.15°N, 100.9833°W, 15–18 July 1910, *A.S. Hitchcock 5667* (US-1009532) & *5711* (US-1009531). **Sinaloa:** Mpio. Concordia, El Palmito en al parte aguas, a ca. 8 km al oeste del poblado, 2350 m, 18 November 1984, *R. Vega Aviña 1379* (MEXU-793013); Ocurahui, 16 mi N of Surutato, 25.9278°N, 107.65°W, 1700 m, 14 September 2008, *P.M. Peterson & J.M. Saarela 22220* (CAN, US); region of the Río de Bavispe, NE Sonora, El Bilito, NE of El Tigre, 30.61°N, 109.17°W, 1890 m, 12 October 1941, *J. Vera-Santos 2129* (F-1930120, MICH-119184, NY, US-1938697). **Sonora:** cemetary in Yécora, [28.3736°N, 108.93°W], 1540 m, 7 September 1995, *T.R. Van Devender, J.F. Wiens, A.L. Reina G., D.A. Yetman & M.E. Fishbein 95-861* (ARIZ-319640, RSA-POM-585391); El Llano, on Mesa del Campanero, W of Yécora, [31.09°N, 111.98°W], 2100 m, 14 July 1997, *T.R. Van Devender, A.L. Reina G., D. Larson, R.L. Bellsey, P. Merlin & M.J. Martínez C. 97-642* (RSA-POM-608784); just W of El Palmito Rancho el Liebre, 23.5596 N, 105.8446 W, ± 1000 m, 12 March 1980, *E. Lehto s.n.* (ASU-0010751). **Tamaulipas:** 3 mi N of Miquihuana, 23.61°N, 99.7833°W, 15 July 1949, *L.R. Stanford, S.M. Lauber & L.A. Taylor 2480* (NY, US-2013050); Mpio. Gómez Farías, La Gloria, 1400 m, 22 October 1981, *J.L. Ramos 31* (MEXU-1055912, MEXU-1098030); Mpio. Miquihuana, Ejido Valle Hermoso, [23.57°N, 99.76°W], 2350 m, 4 September 1981, *R. Carranco 67* (MEXU-1055915, MEXU-1052823. **Tlaxcala:** 5 km SW Tlaxcala, 19.29°N, 98.27°W, 2286 m, 22 July 1942, *J.N.Weaver 235* (US-2436984); between San Cristóbal and Calpulalpan, 19.5833°N, 98.61°W, 2134-2743 m, 22 September 1953, *E.R. Sohns 558* (MEXU-171736, US-2118539) & *574* (US-2118552); ca. 3 mi NE of Tlaxco, 19.65°N, 98.08°W, 2743–3048 m, 23 September 1953, *E.R. Sohns 587* (US-2118565) & *589* (MEXU-171766, P-02629882, US-2118566); ca. 5 mi E Apizaco, 19.41°N, 98.14°W, 7898 ft, 24 June 1979, *F.W. Gould 15647* (MICH-1119166, RSA-POM-486239); carretera Tlaxco-Chimiahuapan, limite entre Tlaxcala y Puebla, [19.73°N, 98.07°W], 2900 m, 10 August 1983, *Guerrero, Romero, Contreras, Rodríguez & de la Mora 686* (MEXU-1099501); Mpio. Terrenate, camino Zapata-Villarreal, [19.47°N, 97.92°W], 3000m, 18 January 1990, *L. Ordoñez 8* (MEXU-1099502); San Sebastián, near Santa Ana, 19.3167°N, 98.1833°W, 2400 m, 15 November 1906, *G. Arséne s.n.* (US-1000499). **Veracruz:** ca. 14 mi SW of Mendoza, 19.43°N, 96.68°W, 2042 m, 17 August 1953, *J.R. Reeder & C.G. Reeder 2007* (RSA-POM-287184, US-2473567); ca. 7 mi W of Las Vigas on road from Jalapa to Puebla, 19.6333°N, 97.1833°W, 1 August 1950, *J.R. Reeder & C.G. Reeder 1578* (RSA-POM-253280, US-2473572); Cumbre de Acultzingo, 4 km SW of Acultzingo on Hwy. 150 at km 283, 18.6667°N, 97.3333°W, 1700 m, 17 August 1965, *K. Roe, E. Roe & S. Mori 1280* (MICH-1119246, US-3115422); Mpio. Acajete, 1 km al E de Acajete, 19.5861°N, 97°W, 1950 m, 15 September 1991, *H.R. Sandoval 88* (MEXU); Mpio. Acultzingo, along old Hwy. MEX 150, 1.5 km above and WSW of Acultzingo, 18.7083°N, 97.3333°W, 1750 m, 8 February 1984, *M. Nee & K. Taylor 29487* (F-1988240); Mpio. Altotonga, 1.5 km W of Orilla del Monte, 14 km (by air) NW of town of Perote, 19.6667°N, 97.25°W, 2360 m, 30 November 1981, *M. Nee 23492* (F-1973840); Mpio. Jalacingo, km 2 de la

carretera estatal Jalacingo Altotonga, comunidad Ahuacatán, [19.81°N, 97.31°W], 1860 m, 14 July 1996, *M.G. Cano 139* (MEXU-1099498); Mpio. Perote, 1.5 km N of Tenextepec and 5.5 km SSE of Guadalupe Victoria, 19.5°N, 97.25°W, 2450 m, 7 November 1981, *M. Nee 22858* (F-1975232, MO, NY); Mpio. Perote, N slopes of Cofre de Perote, vicinity of village of Conejos, 14 km (by road) SE of town of Perote, along road to televisión towers on summit of Cofre de Perote, [19.52°N, 97.18°W], 3150 m, 8 July 1980, *B.F. Hansen & M. Nee 7709* (F-1912041); Mt. Orizaba, 19.03°N, 97.27°W, 10000 ft, 8 August 1891, *H.E. Seaton 189* (F-266582, GH); Orizaba, 19.0167°N, 97.22°W, *Botteri 726* (GH, US-1009522) & *727* (GH) *Schaffner 734* (US-865503); Orizaba, Río Blanco, 18.8333°N, 97.15°W, 1219 m, 23–25 August 1910, *A.S. Hitchcock 6332* (US-1009523); Mpio. Chiconquiaco, Arriba de Chocoyul, 19.1278°N, 94.8667°W, 100 m, 25 July 1989, *C. Gutierrez B. 3546* (NY); Mpio. Villa Aldama, 1 km SE of Villa Aldama, 19.1139°N, 97.0000°W, 2275 m, 19 August 1986, *M. Nee 32840* (NY). **Zacatecas:** 15 (air) mi NE of Estación Camacho on NW slopes near granitic summit of Pico de Teyra, [23.55°N, 102.1667°W], 8000 ft, 23 September 1973, *J. Henrickson 13461* (NY, RSA-POM-664573); 15 (air) mi NE of Estación Camacho, NW and just below summit of Pico de Teyra, [24.55°N, 102.1667°W], 8700 ft, 23 September 1973, *J. Henrickson 13484* (RSA-POM-664418); 4 mi N of Zacatecas, 22.84°N, 102.58°W, 2469 m, 24 September 1959, *T.R. Soderstrom 715* (US-2378359); Mpio. Guadalupe, km 19.7 de la carretera Guadalupe - Genaro Codina, 2350 m, 9 October 1989, *J.J. Balleza C. 2509* (ANSM); Mpio. Valparaíso, 27 km al N de San Juan Capistrano, por recha a Sta. Lucía de la Sierra Límite entre los estados de Zacatecas y Durango, 2100 m, 28 September 1988, *J.J. Balleza C. 2042* (ANSM); Mpio. Valparaíso, Ejido de Santa Lucía de la Sierra, [22.4692°N, 104.2203°W], 27 September 1989, *J.J. Balleza C. 2351* (ANSM); Mpio. Zacatecas, Cerro de la Virgen, 2490 m, 10 August 1988, *J. Balleza C. 1579* (ANSM); Mpio. Zacatecas, km 15.5 carretera Zacatecas-Guadalajara, terrenos de la Escule de Agronomía de la U.A.Z., 2350 m, *J. Balleza C. 1593* (ANSM); Sierra Los Cardos, 10.7 mi NW of Jerez, W of El Cargadero on road to Monte de los Garcia, 22.7084°N, 103.13°W, 2535 m, 19 October 2007, *P.M. Peterson, J.M. Saarela & D. Stancik 21424* (CAN, MO, US); Zacatecas, 22.7833°N, 102.5833°W, 2286 m, 3–4 October 1910, *A.S. Hitchcock 7505* (US-1009534); N of Fresnillo, rumbo a Durango, 23.61°N, 103.11°W, 5 Sepember 1981, *A.A. Beetle M-7454* (MICH-1119161, RSA-POM-303027, SD-122029);

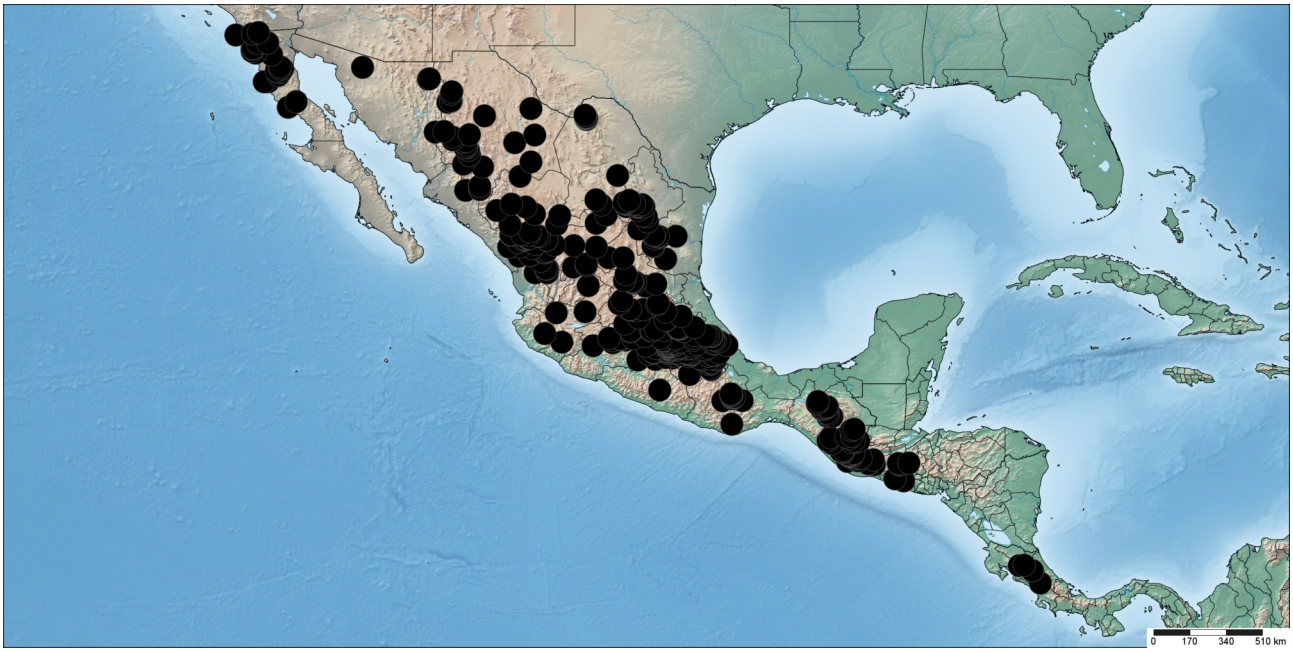


**FIGURE 20.** Geographical distribution of *Bromus carinatus* var. *marginatus* in México and Central America.

6. ***Bromus catharticus*** Vahl (1791: 22). Figs. 21–23.

*Ceratochloa cathartica* (Vahl) Herter (1940: 144). Type:—PERU. In siccis cultis prope Lima, *J. Dombey s.n.* (lectotype P-JU, designated by Pinto-Escobar 1976: 12, isolectotype P-00624390!).

*Festuca unioloides* Willdenow (1803a: 3, pl. 2). *Ceratochloa unioloides* (Willd.) Palisot de Beauvois (1812: 75, t. 15, f. 7). *Bromus unioloides* (Willd.) Raspail (1825: 439), *nom. hom. illeg. Bromus willdenowii* Kunth (1829: 134). *Tragus*

*unioloides* (Willd.) Panzer ex Jackson (1895: 1099), *nom. illeg*. Type:—UNITED STATES OF AMERICA. Cultivated: grown at Berlin from seed from Carolinas, USA (holotype B-Willd.-02103!).

*Bromus unioloides* Kunth in Humboldt *et al.* (1816: 151). *Schedonorus unioloides* (Kunth) Roemer & Schultes (1817: 709). *Zerna unioloides* (Kunth) Lindman (1918: 101). Type:—ECUADOR. Pichincha, *Humboldt & Bonpland 2286* (holotype P-00669420!, isotypes P-00152246!, US-01009587! fragm. ex P, BAA-00001639!).

*Bromus brongniartii* Kunth (1833: 421), replacement name. Replaced name: *Bromus strictus* Brongniart in Duperrey (1829[1831]: 45) *nom. hom. illeg*. Blocking name: *Bromus strictus* Scopoli (1772: 79). Type:—BRAZIL. Santa Catarina: 1825, *D'Urville s.n.* (holotype P-00624387!, isotypes US-00601098! fragm. ex P, BAA fragm.).

*Ceratochloa haenkeana* Presl (1830: 285). *Bromus haenkeanus* (J.S. Presl) Kunth (1833: 416). *Bromus unioloides* var. *haenkeanus* (J.S. Presl) Shear (1900: 52). Type:—CHILE. *T. Haenke s.n.* (holotype PR, isotypes MO-128816!, US-A0865713! fragm. ex PR).

*Ceratochloa secunda* Presl (1830: 285). *Bromus preslii* Kunth (1833: 416, 545), replacement name. Blocking name: *Bromus secundus* Presl (1830: 263). Type:—PERU. *T. Haenke s.n.* (holotype PR, isotype US-A0865714! fragm. ex PR).

*Ceratochloa breviaristata* Hooker (1840: 253). *Forasaccus breviaristatus* (Hook.) Lunell (1915: 225). Type:—UNITED STATES OF AMERICA. Lewis and Clark's River and near sources of the Columbia, 1826, *Douglas s.n.* (holotype K, isotype US-A0865710! fragm. ex K).

*Bromus unioloides* var. *sanjuaninus* Hieronymus (1881: 69). Type:—ARGENTINA. San Juan: December 1875, *S. Echegary s.n.* (holotype CORD-00001541!, isotypes BAA-00001645! fragm. ex CORD).

*Bromus angustatus* Pilger (1898: 719). Type:—BOLIVIA. La Paz, Lake Titicaca *Stübel 60C* (holotype B, isotype US-A0865509! fragm. ex B).

*Bromus unioloides* var. *montanus* Hackel in Stuckert (1904: 144). Type:—ARGENTINA. Córdoba: Cueva del arroyo de los tabaquillos, Sierra de Achala, 2200 m, 24 December 1901, *T. Stuckert 10855* (holotype W-19160013939!, isotype US-A0865477 fragm. ex W, CORD-00001540!).

*Bromus unioloides* f. *chasmogama* subf. *achalensis* Hackel in Stuckert (1911: 172). Type:—ARGENTINA. Córdoba: Estancia Pampa de San Luis, Achala, 2000 m, *T. Stuckert 20651* (holotype W-19160032887!, isotype CORD).

Plants annual, biennial or short-lived perennial, not rhizomatous. Culms 20–120 cm tall, 2–4(–5) mm wide at base, erect or decumbent, glabrous below inflorescences; nodes 3–4, glabrous. Leaf sheaths pubescent or pilose, hairs up to 1.2 mm long; auricles absent; ligules 2–5(–6) mm long, lacerate, glabrous or pubescent; blades up to 32 cm × 2–10 mm, usually flat, sometimes conduplicate, adaxial surfaces scabrous or pubescent on the nerves, hairs up to 0.5 mm long, glabrous between the nerves, abaxial surfaces glabrous to weakly pubescent, margins serrulate. Panicles 8–30(–36) cm long, ± open, nodding, branches erect to ascending, scabrous, up to 5 spikelets per branch. Spikelets 1.5–3(–3.5) cm long, elliptic to lanceolate, 4–11-flowered, strongly laterally compressed; glumes glabrous, scabrous, or pubescent, margins hyaline, midnerves glabrous to scabrous distally, apices acute to obtuse; lower glumes 6–12 mm long, lanceolate, 3–7-nerved, green to purplish-green along and between the nerves; upper glumes 8–14 mm long, ovate-lanceolate, 9(–11)-nerved, green to purplish-green along and between the nerves; lemmas 10–20 mm long, obovate-lanceolate, strongly keeled, apices acute to obtuse, 7–11-nerved, green, greenish-yellow or purplish-green along and between the nerves, glabrous or scabrous, margins hyaline, nerves glabrous to scabrous distally; awns 0.5–3.5(−4) mm long, inserted up to 0.5 mm below lemma apex, straight; paleas shorter and narrower than the lemmas, backs glabrous, strongly keeled, keels ciliate, cilia up to 0.2 mm long; anthers 0.5–1.3 mm long; caryopses 8−10 mm long, light brown. $2n = 42$ (Klos *et al.* 2009).

**Distribution**:—Introduced. In México *B. catharticus* is known from Aguascalientes, Baja California, Chihuahua, Coahuila, Distrito Federal, Durango, Hidalgo, Jalisco, Estado de México, Nuevo León, Puebla, Querétaro, San Luis Potosí, Sonora, Tlaxcala, Veracruz, Zacatecas. Also known from Costa Rica (San José), Guatemala (Quezaltenango) and Panama (Chiriqui) (Fig. 24). The species is native to South America, introduced in Central America, México and across the southern United States (Pavlick & Anderton 2007) and in Europe, Australia and New Zealand (Forde & Edgar 1995).

**Ecology:**—This species is widely distributed primarily in disturbed habitats along roadsides, washes and rocky slopes in pine-oak woodlands; associated with *Pinus* Linnaeus (1753: 1000) spp., *Quercus* spp., *Kochia scoparia* (Linnaeus 1753: 221) Schrader (1809: 85), *Bidens* Linnaeus (1753: 831), *Salsola* Linnaeus (1753: 222), *Chenopodium album* Linnaeus (1753: 219) and *Parthenium incanum* Kunth in Humboldt (1818: 204). Elevation: 2200–2400 m (Guatemala), 1200–2700 m (Costa Rica), 5–100 m (México, Baja California), 1370–3130 m (México, except Baja California).

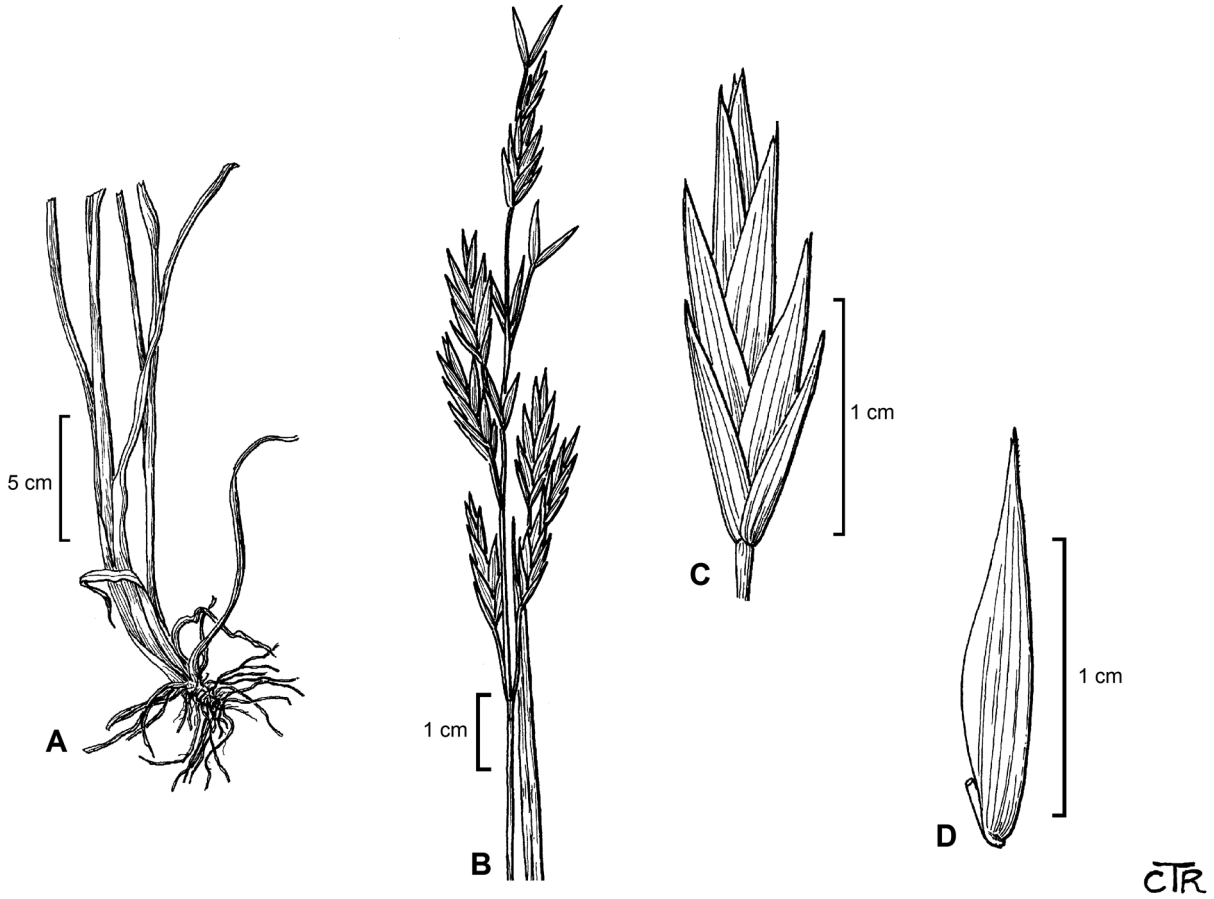


**FIGURE 21.** *Bromus catharticus.* A. Habit. B. Inflorescence. C. Spikelet. D. Lemma. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Common Name:—**Rescue grass, rescue brome, prairie grass (English); bromo cebadilla, cebadilla, zacate de rescate (Spanish).

**Comments:—***Bromus catharticus* was not reported from Guatemala by Swallen & McClure (1955) or from Panama by D'Arcy (1987). Plants in México are referable to *B. catharticus* var. *catharticus*, one of three varieties currently recognized in the species. *Bromus catharticus* var. *rupestris* (Spegazzini 1896: 76) Planchuelo & P.M. Peterson in Peterson & Planchuelo (1998: 54) is known from central and southwest Argentina, and *B. catharticus* var. *elatus* (E. Desv. in Gay 1854: 438) Planchuelo (2006: 556) is native to South America and introduced in California and New Zealand (Planchuelo 2006). In México the species is used as fodder (Saulés & Dávila Aranda 1992).

**Specimens Examined:—COSTA RICA. San José:** Cartago, San Blas, Faldas del Irazú, 9.76°N, 83.68°W, 1500m, 23 June 1982, *J. Gómez-Laurito 8609* (CR-88908); Cantón de Montes de Oca, 100m W of Calle La Cruz, Ciudad Universitaria, 9.93°N, 84.05°W, 1200 m, 15 August 1990, *M. Grayum 9931* (INB-60062); Dota, Copey, 9.5472°N, 83.8161°W, 2179 m, 22 February 2001, *A. Estrada 2790, J. Sánchez & J. Solano* (CR-227492); Pérez Zeledón, R.F. Los Santos, Cuenca de Savegre, San Gerardo de Dota, 9.72°N, 83.85°W, 2300–2700 m, 20 June 2004 (INB); San José, Jardín del Museo, 9.9333°N, 84.0833°W, 17 July 1942, *I. Valio R. 1400* (US-2183494). **GUATEMALA. Quezaltenango:** near Quezaltenango, [14.83°N, 91.52°W], 2280–2400 m, 18 February–3 March 1939, *P.C. Standley 66424* (F-987700); Quezaltenango Experimental Station, [14.83°N, 91.52°W], 2200 m, 7 November 1971, *A. Molina R. & A R. Molina 26947* (F-1736399, MICH-1119168); Común, floración precoz, casi todo el año, 14.88°N, 89.53°W, 10 June 1954, *M. de Koninck 48* (US-2151630). **MÉXICO. Aguascalientes:** Mpio. Aguascalientes, Arellano, 21.6167°N, 102.28°W, 1 February 1978, *L.R. Chávez s.n.* (MEXU-300782); Pabellón de Arteaga, 22.125°N, 102.275°W, July 1985, *E. Esparza Lugo 2* (MEXU-1110851). **Baja California:** 3 km N of Maneadero, 32.7667°N, 116.55°W, 5 m, 12 August 1977, *R. Moran 24510* (SD-97752); Cantamar,


**FIGURE 22.** *Bromus catharticus*. *Rzedowski 22433* (MICH-1119200).

**FIGURE 23.** *Bromus catharticus* inflorescence, Coahuila, México (*Peterson et al. 23124*). Photo: J.M. Saarela.

32.2292°N, 116.9208°W, 5 m, 4 August 1979, *R. Moran 27944* (SD-104328); Cantamar, 32.2333°N, 116.9°W, 20 m, 29 April 1972, *R. Moran 19106* (SD-83043, MSC-276879); City of Ensenada, 31.8694°N, 116.6156°W, 31 March 2007, *F. Casillas 74* (SD-182570); La Mesa, 32.5°N, 116.9667°W, 30 m, 21 May 1977, *R. Moran 24142* (SD-97259); Puesta del Sol, Tijuana, 32.5333°N, 117.0708°W, 100 m, 2 November 1980, *R. Moran 29446* (SD-107261); Tecate, just S of the border, [32.57°N, 116.63°W], 14 March 1987, *R.F. Thorne, A. Liston & O. Mistretta 62109* (RSA-POM-431038); Tijuana River bottom, 32.5333°N, 117.0167°W, 20 m, 18 April 1981, *R. Moran 29551* (SD-108522). **Chihuahua:** camino al Willis, rancho Mesa de la Avena Casas Grandes, 2570 m, 29 May 1981, *R. Fierros 1270* (MEXU-1110835); km 58 carr. Bachiniva-Alvaro Obregón, [28.1278°N, 106.9139°W], 1920 m, 18 May 1994, *G. Quintana & E. Estrada 2503* (NY); Ciudad Juárez, [31.739444° N, 106.486944°W], 1911, *E. Stearns s.n.* (NY). **Coahuila:** 12 mi S of Saltillo, 25.25°N, 101°W, 1830 m, 10 August 1958, *J.R. Reeder & C.G. Reeder 2911* (US-2473582); 12.9 km E of Los Lirios on road to Laguna de Sánchez, [25.24°N, 100.42°W], 60 km SE of Saltillo, 2500 m, 9 October 1988, *P.M. Peterson & C.R. Annable 6265* (CAN, US); 13 km NNE of Saltillo along Hwy. 40, 25.45°N, 101.17°W, 21 June 1964, *G. Mick & K. Roe 26* (US-2630292); 2 mi W of Saltillo, road to Torreón, [25.43°N, 100.99°W], 1525 m, 2 July 1939, *L.H. Harvey 1102* (MICH-1119205); 21 km SE of Saltillo on Hwy. 57 towards Matehuala, 25.247°N, 100.91°W, 2460 m, 19 September 2001, *P.M. Peterson & J. Valdés-Reyna 15808* (CAN, US); 26 mi E of Saltillo, 25.4167°N, 101.4°W, 2316 m, 3 September 1960, *J.R. Reeder, C.G. Reeder & T.R. Soderstrom 3293* (US-2473584); 5 mi SE of Saltillo on W side MEX Hwy. 57, [25.43°N, 100.99°W], 15 December 1973, *A.A. Reznicek & R.S.W. Bobbette et al. 8* (MICH-1119172); Buenavista, [26.55°N, 101.267°W], 1770 m, November 1974, *J. Marroquín et al. 2323* (ANSM) & *2315* (ANSM); Buenavista, jardínes y terrenos de la U.A.A.A.N., [25.4333°N, 101.0167°W], 1850 m, 4 March 1981, *J.A. Villarreal s.n.* (ANSM); Buenavista, Saltillo, [25.4333°N, 101.0167°W], 1770 m, 9 September 1975, *R. Pelomo Garza s.n.* (ANSM); ca. 2 mi W of Cuatro Ciénegas, 26.95°N, 102.1°W, 22 April 1965, *F.W. Gould 11176* (US-2474067); campus of La Escuela Superior de Agricultura, Buenavista, ca. 5 mi SE of *Saltillo*, 27.53°N, 103°W, 18 June 1952, *F.W. Gould 6382* (MICH-1119206, mixed sheet with *B. carinatus* var. *marginatus*); grounds of Escuela Superior de Agricultura, Buenavista, Saltillo, [25.43°N, 100.99°W], 19 July 1963, *F.W. Gould & D. Watson 10497* (MICH-1119204); Hotel Americana, Nueva Rosita, 27.95°N, 101.2167°W, 22 April 1965, *F.W. Gould 11167* (US-2474069); Maderas del Carmen, 13.5 mi NE of Los Pilares, 28.9497°N, 102.59°W, 2309 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20967* (CAN, MO, US); Maderas del Carmen,

wooded canyon above Campo El Dos, 28.9899°N, 102.61°W, 2280 m, 8 September 2005, *P.M. Peterson & J. Valdés-Reyna 18907* (CAN, MO, US); Mpio. Arteaga, Ejido La Efigenia, [25.49°N, 100.84°W], 2460 m, 22 July 1993, *J. Garza 6* (MEXU-298114); Mpio. Hidalgo, Orilla del Río Bravo, [27.7033°N, 99.7594°W], 15 April 1999, *A. Mora-Olivo & J. Mora-López 7507* (MEXU); Mpio. Saltillo, Jardín Botánico UAAAN, exhacienda Buenavista, 25.3558°N, 100.97°W, 1770 m,1 December 2009, *R. Hernández A. & E. Carmona P.* (ANSM); roadside on outskirts of Villa Unión, 12 mi SE of Allende, 28.2167°N, 100.7167°W, 20 April 1965, *F.W. Gould 11128* (US-2474040); Saltillo, 25.4167°N, 101°W, June 1931, *J.R. Swallen s.n.* (US-1504935); Sierra de Parras, ca. 2 km antes del ojo de agua, 25.4333°N, 100.45°W, 1500 m, 20 March 1981, *A. Roríguez & M.A. Carranza s.n.* (ANSM); Sierra Hermosa, hacia el W rumbo al Cañón del Carbón, 25.3333°N, 100.65°W, 2320 m, 8 August 1979, *R. López A. s.n.* (ANSM); Canyon Hundido on N side of Pico Centinela, Sierra del Jardín, 8 km E of Rancho El Jardín by winding road, 29.0167°N, 102.6167°W, 1500–2250 m, 27 July 1973, *M.C. Johnston, F. Chiang, T.L. Wendt & D. Riskind 11797* (NY); 4.6 mi W of Rancho Ganadero "Los Angeles", 25.1486°N, 101.0731°W, 2064 m, 5 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko & J. Valdés-Reyna 23124* (US); Mpio. Saltillo, 38 km S of Saltillo on Hwy. 54 towards Zacatecas, at Carneros Pass, Sierra La Concordia, 25.1194°N, 101.1103°W, 2192 m, 5 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko & J. Valdés-Reyna 23089* (US); Arteaga, 1 km E of San Antonio, 25.2672°N, 100.5686°W, 2146 m, 19 September 2012, *P.M. Peterson, K. Romaschenko & J. Valdés-Reyna 24565* (US). **Distrito Federal:** alrededores de la Escuela Nacional de Ciencias Biológias, [19.42°N, 99.13°W], 2240 m, 17 January 1981, *E. Carrillo M. 191* (RSA-POM-356513); alrededores de la Escuela Nacional de Ciencias Biológias, [19.42°N, 99.13°W], 2450 m, 4 December 1975, *S. Hernández V. 1075* (RSA-POM-356194, US); camino al Desierto de los Leones km 16, [19.34°N, 99.24°W], 17 October 1985, *A. Miranda & P. Guerrero 165-A* (MEXU-1110838); Chapultepec, Ciudad de México, [19.42°N, 99.13°W], 2250 m, 17 January 1976, *M.D. Montesinos 177* (RSA-POM-356522); cultivo en la parcela experimental del Instituto Nacional de Ortop, [19.42°N, 99.13°W], 21 June 1981, *R. Torres 13* (RSA-POM-361174); El Rosario, 19.24°N, 99.01°W, 23 August 1936, *L.H. MacDaniels 679* (F-867748); Jardínes de la Escuela Nacional de Ciencias Biológicas, Ciudad de México, [19.42°N, 99.13°W], 2250 m, 7 November 1963, *R. Cruz Cisneros 14* (MICH-1119207); Santa Rosa Xochiac, Delegacíon Alvaro Obregón, [19.32°N, 99.29°W], 2700 m, 16 October 1985, *A. Miranda & P. Guerrero 128* (MEXU-1110775). **Durango:** Mpio. Durango, Cristóbal, 24.06°N, 104.58°W, 1860 m, August 1996, *R. Rangel R. 232* (MEXU-1009255); 2 km al S de Nombre de Dios, po la terraceria aledana al riod de Nombre de Dios, [23.85°N, 104.233333°W], 25 April 1985, *Y. Herrera 601* (NY). **Guanajuato:** 0.5 km E of Jofre, 21.5181°N, 100.5°W, 2301 m, 16 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni* 23409 (US); 0.5 km E of Jofre, 21.5239°N, 100.4803°W, 2146 m, 16 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni 23431* (US); 0.5 km E of Jofre, 21.5253°N, 100.4739°W, 1901 m, 16 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni 23439* (US); 3 km N of Marsa de Jesús, 21.5139°N, 100.4367°W, 2300–2688 m, 16 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni 23473* (US). **Hidalgo:** 4 km al S de Pachuca, [20.17°N, 98.73°W], 2300 m, 19 June 1966, *J.J. Rzedowski 22433* (MICH-1119200, MSC-216922); Tailings dam from Loreto Mill, Santa Julia near Venta Prieta, [20.08°N, 98.78°W], 17 June 1947, *H.E. Moore, Jr. 3084* (GH). **Jalisco:** Fraccionamiento Las Fuentes, Guadalajara, [20.71°N, 103.35°W], 1 June 1977, *L. Belden 6* (MEXU-203828). **Estado de México:** carretera Zumpango-Zitlaltepec, [19.75°N, 99.12°W], 30 July 1981, *R. Guzmán 3891* (MEXU-1110859); Chalco de Díaz Covarrubias, Rancho Atoyac, 19.8333°N, 98.8833°W, February 1983, *Espinosa & Molina 12* (MEXU); por la carretera Los Reyes a Zumpango, km 8, 30 July 1981, *R. Guzmán 3888* (MEXU-110837); Rancho La Plar, Ixtapaluca, [19.31°N, 98.89°W], 3 February 1983, *Espinosa & Molina 10* (MEXU-678287); Santa María Ajoloapan, [19.98°N, 99.05°W], 23 September 1982, *Espinosa & Molina 6* (MEXU-678291); Mpio. Chalco, San Pablo Atlazalpan, [19.22°N, 98.91°W], 2200 m, 24 November 1984, *A. Ventura A. 4348* (MICH-1116165, mixed sheet with *B. carinatus* var. *marginatus*, NY); Mpio. Chiautla, Papalotla, [19.56°N, 98.86°W], 23 February 1983, 2200 m, *E. Ventura V. 569* (RSA-POM-356813); Mpio. Texcoco, Lomas de Cristo, [19.47°N, 98.89°W], 2250 m, 18 June 1984, *E. Ventura V. 2168* (F-2148435, NY); Mpio. Zumpango, San Juan Zitlaltepec, [19.79°N, 99.1°W], 2250 m, 9 December 1979, *E. Ortega H. 329* (RSA-POM-356527); Rancho La Asunción, NW de Tlapizahuac, 19.28°N, 98.91°W, 2250 m, 5 June 1966, *M. Villegas D. 527* (MICH-1119208, MSC-234188). **Nuevo León:** along road up to Cerro Potosí, 24.8875°N, 100.21°W, 2884 m, 21 October 2007, *P.M. Peterson, J.M. Saarela & D. Stancik 21452* (CAN, MO, US); El Cedral, Sierra de Arteaga 30 km al E de San Antonio de las Alazanas, 25.1833°N, 100.1167°W, 2800 m, 6

September 1994, *J.A. Villarreal, M.A. Carranza & J.A. Encina 7914* (ANSM); El Tokio, Galeana, [24.6808°N, 100.2397°W], 1650 m, 19 July 1999, *E. Estrada C. 10267* (ANSM); Sierra La Lagunita, 13.5 mi SE of Aramberri on road towards Agua Fría, 24.0533°N, 99.74°W, 2153 m, 20 September 2002, *P.M. Peterson, J. Valdés-Reyna & M. Sosa Morales 16711a* (US); El Manzano, Santiago, [25.3678°N, 100.2°W], 1495 m, 4 August 2004, *E. Estrada et al. 15976* (ANSM); Sierra El Pinal Alto, 3.7 mi N of San Pablo, 25.0992°N, 100.42°W, 2640 m, 10 September 2005, *P.M. Peterson & J. Valdés-Reyna 18944* (CAN, MO, US); Terraceria Villa de García-Icamole km 8, [25.84°N, 100.66°W], 5 July 1993, *N. Bazaldúa et al. 94* (MEXU-1099423). **Puebla:** 3 km ESE of Puebla-Tlaxcala state border, on MEX Hwy. 136 just E of El Carmen, between Apizaco and Zacatepec, 19.3°N, 97.62°W, 2400 m, 4 July 1978, *G.J. Breckon et al. 2327A* (MEXU-713492). **Querétaro:** Mpio. San Juan del Río, Ribera del Río San Juan, 1978 m, 30 June 2003, *P. Cervantes Adriana s.n.* (ANSM); Mpio. Tequisquiapan, Rancho Alegre, al Oriente de San Juan del Río, 20.3833°N, 99.92°W, 28 February 1988, *M.L. Arreguín 832* (F-2162873, US-3320109); El Batan, [20.5°N, 100.4167°W], 2000 m, 5 April 1981, *E. Arguelles 1567* (MEXU). **San Luis Potosí:** 25 km al N de San Luis Potosí, por la carretera que va hacia Zacatecas, [22.3°N, 101.1456°W], 2060 m, 10 March 1984, *J.A. Andrade A. 134* (ANSM); Mpio. San Nicolás Tolentino, San Martín de Abajo, 22.25°N, 100.57°W, 1370 m, 15 July 1981, *H. Bravo Monreal 71* (MEXU-1014227); Canyon NW of Real de Catorce at abandoned silver mine, 23.6942°N, 100.8944°W, 1965 m, 10 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23256* (US); Sierra del Jórdan, Sierra de Catorce, 23.5358°N, 100.8467°W, 2013 m, 11 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23316* (US); 5 mi SE of Sierra del Jórdan, Sierra de Catorce, 23.5206°N, 100.7961°W, 2033 m, 11 September 2010, *P.M. Peterson, J.M. Saarela & K. Romaschenko 23335* (US); 9.4 mi SE of Villa Zaragoza on road towards La Salitrera, 2270 m, 14 September 2010, *P.M. Peterson, J.M. Saarela, K. Romaschenko, J. Herrera-Simoni & M. Herrera-Simoni 23390* (US). **Sonora:** Puerto Penasco, N edge of town at junction of MEX Hwy. 8 and road to Bahia de la Cholla, [31.32°N, 113.54°W], 25 June 1985, *R.S. Felger 85-771* (ARIZ-262110, ARIZ-277121, MSC-292067); Sonoyta, at junction of MEX Hwy. 2 and 8, [31.43°N, 113.34°W], 26 February 1987, *R.S. Felger, F. Lizarraga & C. Baker 87-14* (ARIZ-269900, MSC-365390, SD-127105); Yécora, [28.3736°N, 108.93°W], 1540 m, 27 May 1996, *T.R. Van Devender, A.L. Reina, A. Burquez M., V.W. Steinmann & W. Trauba 96-231* (ARIZ-328741, RSA-POM-593661); Mpio. de Imuris, Rancho Aribabi, Río Cocospera, 31.8 km NE of junction with MEX 15 in Imuris on road to Cananea (MEX 2), 30.8889°N, 110.78°W, 1000 m, 22 April 2004, *T.R. Van Devender, A.L. Reina, S.C. Doan, G.M. Ferguson & Z. Liu 2004-259* (ASU-0010726); Mpio. de Nacozari de Garcia, Rancho Agua Caliente (Río Bavispe drainage), 23.2 km (by road) SE of Esqueda, 30.7389°N, 109.492°W, 903 m, 11 April 2003, *T.R. Van Devender, A.L. Reina & G. Anderston 2003-471* (ASU-0010735); Yécora, 28.0681°N, 107.8389°W, 1540 m, 29 May 1998, *T.R. Van Devender, A.L. Reina G, J.A. Emmett & A.M. Salywon 98-753* (ARIZ-347795, NY); NW part of town at crossing of river ca. 1 km W of bridge, Río Sonoyta, Sonoyta, [31.1542°N, 111.8456°W], 9 April 1986, *R.S. Felger & R. Valenzuela López 86-94* (ARIZ-263956); Playa Los Vidrios, Pinacate Región, [32.0333°N, 113.4167°W], 230 m, 7 October 1981, *E. Ezcurra, M. Equihua & J. López-Portillo s.n.* (ARIZ-270771); 1 km S of Río Sonoyta, Sonoyta, 31.85°N, 112.8336°W,450 m, 28 April 1991, *R. Felger & A. Quijada-Mascarenas 91-2* (ARIZ-327503); Mpio. Cucurpe, Saracachi Ciénega, on Río Saracachi just W of Rancho Agua Frfa, 12.4 mi NNE of Cucurpe by road, 30.3597°N, 110.5889°W, 940 m, *T.R. Van Devender & P.D. Jenkins 91-652* (ARIZ-342010); Mpio. de Agua, Arroyo Guadalupe, 4.7 km S of MEX 2 on road to Colonia Morelos (E of Agua Prieta), 31.2944°N, 109.1764°W, 1175 m, 3 May 2007, *T.R. Van Devender & A.L. Reina G. 2007-535* (ARIZ-384457); near Observatorio Astrofisico "Guillermo Haro", Sierra la Mariquita, 9.4 km (by air) NNW of Cananea, 31.0544°N, 110.3825°W, 2440 m, 19 September 2010, *A.L. Reina-G., T.R. Van Devender, J.J. Sánchez-E., C. Roll & J. Sartain 2010-963* (ARIZ-406779); Rancho Bábaco headquarters, 28.3 km (by air) NNE of Sahuaripa, 29.2975°N, 109.1386°W, 775 m, 1 April 2011, *T.R. Van Devender, A.L. Reina-G., H. Duarte-Robles, M.A. Gómez-R., C.A. Guitérrez-G & J.P. Gómez-M. 2011-114* (ARIZ-409973); Hwy. 89 at La Volanta Ranch Rd., 1.7 mi S of Mututucachi, Sierra de los Ajos, 30.7167°N, 110.0000°W, 1130 m, 24 April 1995, *M. Fishbein, S. McMahon & K. Hooper 2355* (ARIZ-319047); Agua Caliente, 19 km N of Imuris, 5 km N of Mesa del Romero on MEX 15, 30.9531°N, 110.8525°W, 980 m, *T.R. Van Devender, A.L. Reina G., J.J. Sánchez E., O. Guiterrez & E. Gomez L. 2001-756* (ARIZ-360326). **Tlaxcala:** Apizaco, 8 November 1980, *H. Vibrans s.n.* (F-2174966). **Veracruz:** Mpio. Perote, Comunidad El Conejo camino al Cofre de Perote, 19.5322°N, 97.1553°W, 3300 m, 28 March 1995, *P.J. Parroquín 87* (MEXU-1097980); San Antonio, 27 April 1974, 1400 m, *F. Ventura A. 9960* (MICH-1119211); Mpio. Acajete, La Joya, 19.1117°N, 96.9819°W, 2100 m, *M.T. Mejía Saulés 210* (ARIZ-233858). **Zacatecas:** Mpio. Zacatecas, Camp Agrícolla de la

Escuela de Agronomía de la U.A.Z., ca. 2350 m, 5 April 1990, *J.J. Balleza C. 2739* (ANSM). **PANAMA. Chiriqui:** Distrito de Bugaba, Alrededores de Las Nubes, [8.49°N, 82.62°W], ca. 2000 m, 17 May 1996, *C. Galdames, M. Correa, L. Guillén, B. Araún, J. Deago & C. Guerra 2943* (F-2235273, MO, NY).


**FIGURE 24.** Geographical distribution of *Bromus catharticus* in México and Central America

7. ***Bromus densus*** Swallen (1950: 396). Figs. 25–27.

Type:—MÉXICO. Nuevo León: Mpio. Zaragoza, Cerro del Viejo, 15 mi W Dulces Nombres, in open pine forest, alt. 3330 m, densely tufted perennial to 3.5 ft tall, 18 August 1948, *F.G. Meyer & D.J. Rogers 2976* (holotype US-1962994!, isotypes G-00099281!, MO-1599222!, P-00689802!).

Plants perennial, densely caespitose, not rhizomatous. Culms 40–110 cm tall, with a thick, robust base 3–4 mm wide, glabrous or scabrous below inflorescences; nodes 3–4, glabrous. Leaf sheaths glabrous, margins sparsely to densely pilose distally and at collar, hairs up to 4 mm long; auricles usually absent, occassionally present; ligules 0.5–1 mm long, glabrous; blades up to 74 cm × 2–3 mm, flat, pilose proximally, hairs up to 4 mm long, adaxial and abaxial surfaces glabrous, margins serrulate. Panicles 7–22.5 cm × 3.5–4.5 cm, open, nodding, branches ascending, 0.4–10 cm long, shorter or longer than spikelets, scabrous, 1–4 spikelets per branch. Spikelets (1.5–)2–3.5 cm long, 5–7-flowered, elliptic to lanceolate, terete to moderately laterally compressed, rachillas sometimes visible at maturity; glumes glabrous, margins hyaline, midnerves glabrous or scabrous; lower glumes 6.5–12 mm × 0.5–1 mm, lanceolate, 1-nerved, purplish-green along the nerve, apices acute; upper glumes 8–13 mm × (0.8–)1–1.3 mm, lanceolate, 3-nerved, purplish-green along the nerves, usually lighter in color between nerves and ± translucent, apices acute to obtuse. Lemmas 10–14 mm × 1–2 mm, elliptic to lanceolate, rounded over the back, apices acute to obtuse, usually minutely bifid, 3-nerved, purplish-green along nerves, usually lighter in color between nerves and ± translucent, glabrous to scabrous, sometimes minutely pubescent along margins proximally, awns (1–)2–3.5 mm long, arising 0–0.5 mm below lemma apex, straight; paleas 9–11 mm long, backs glabrous to scabridulous, keels ciliate, cilia up to 0.2 mm long; anthers 6–6.5 mm long; caryopses 6–9 mm long, light brown. 2*n* = unknown.

**Distribution**:—Native. *Bromus densus* is endemic to Mexico in the central Sierra Madre Oriental in Coahuila (Sierra de Zapalinamé), Nuevo León (Cerro Potosí), San Luis Potosí (Cerro de la Luz) and Tamaulipas (Peña Nevada) (Fig. 28).

**Ecology:—**This species is found on gentle to steep rocky slopes and cliffs, primarily in calcareous soils; associated with *Quercus greggii* Candolle (1864: 34) Trel. in Standley (1922: 185), *Q. emoryi*, *Pinus greggii* Engelm. ex Parlatore (1868: 3), *Pseudotsuga menziesii*, *Cupressus arizonica*, *Abies vejarii*, *Symphoricarpos* Duhamel du Monceau (1755: 295), *Pachistima myrsinites* Rafinesque (1838: 42), *Ceanothus*, *Thalictrum* Linnaeus

(1753: 545), *Lupinus* Linnaeus (1753: 721), *Penstemon barbatus* (Cavanilles 1795: 22) Roth (1806: 49), *Cercocarpus montanus*, *Campanula rotundifolia* Linnaeus (1753: 163), *Trisetum viride* (Kunth in Humboldt 1816: 147) Kunth (1829) and *Buddleja* Linnaeus (1753: 112). Elevation: 2700–3380 m.

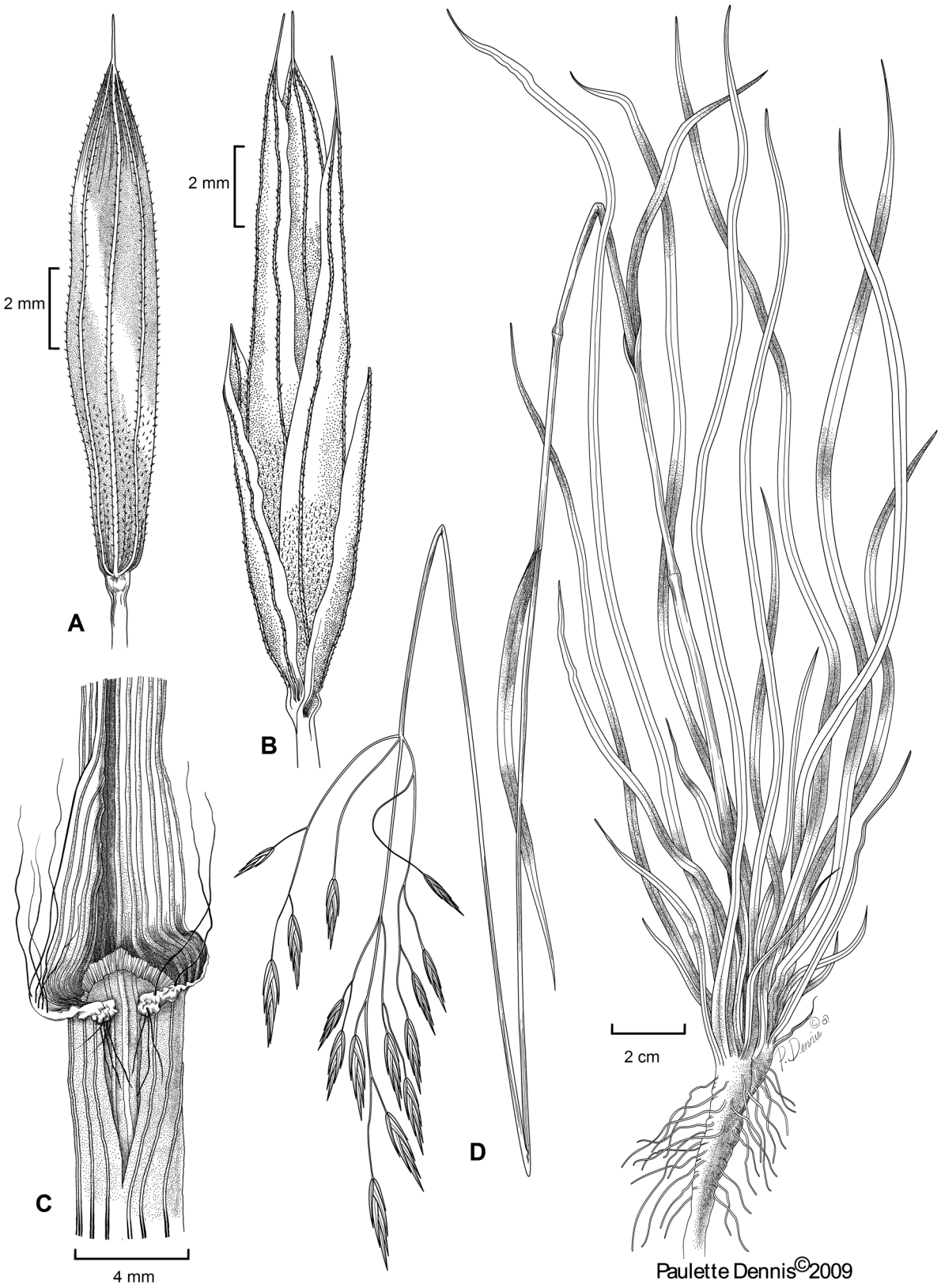


**FIGURE 25.** *Bromus densus*. A. Lemma. B. Spikelet. C. Ligule. D. Habit. Based on *Peterson et al. 17870* (CAN). Illustration by Paulette Dennis © Paulette Dennis.


**FIGURE 26.** *Bromus densus*. *Mueller & Mueller 811* (MICH-1119215).

**FIGURE 27.** A large population of *Bromus densus* growing on grassy slopes in Sierra Zapaliname, Coahuila, México (*Peterson et al. 21128*). Photo: J.M. Saarela.

**Common Name:—**Bromo del infiernio (Saulés & Dávila Aranda 1992) (Spanish).

**Comments:—***Bromus densus* is one of three Mexican species characterized by 3-nerved lemmas. It is here newly recognized in sect. *Mexibromus*, along with *B. attenuatus* and *B. dolichocarpus*. This is the first report of the species from San Luis Potosí, where we collected it in 2010 on Cerro de la Luz. This is a 255 km range extension to the south. The species is used as fodder (Saulés & Dávila Aranda 1992).

**Specimens Examined:—MÉXICO. Coahuila:** Sierra de Zapalinamé, área protegida, El Penitente, 25.3454°N, 100.9008°W, 3123 m, 29 September 2007, *S.G. Gómez P.*, *P.M.Peterson & J.M. Saarela 593* (ANSM); Sierra de Zapalinamé, brecha cortafuegos Chapultepec, al sureste de Saltillo, 25.2633°N, 100.6389°W, 28 August 2008, *E.F. Álvarez G. 313* (ANSM); Sierra de Zapalinamé, El Penitente, 25.3454°N, 100.9008°W, 3123 m, 29 September 2007, *S.G. Gómez 590, P.M. Peterson & J.M. Saarela* (ANSM); Sierra de Zapalinamé, along trail from El Cuatro to El Penitente, 25.3494°N, 100.90511°W, 2925 m, 28 September 2007, *P.M. Peterson, J.M. Saarela & S.G. Gómez Pérez 21128* (CAN, MO, US); Sierra de Zapalinamé, [25.3468°N, 100.9016°W], 2940 m, 19 May 1990, *G.B. Hinton 20284* (GH); Sierra de Zapalinamé, 25.3468°N, 100.908°W, 2800 m, 20 September 2003, *P.M. Peterson, J. Valdés-Reyna & R.H. Cárdenas 17870* (CAN, US); Sierra de Zapalinamé, E of Saltillo, 25.3468°N, 100.9016°W, 2700 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18786* (US) & *18789* (US); 40 mi S of Saltillo, July 1880, *E. Palmer 1372* (GH, mixed sheet with *B. anomalus*, NY); Sierra la Viga, 6 km al de Jamé, Puerto Maravillas, 25.3667°N, 100.9553°W, 3000–3150 m, 16 September 1989, *J.A. Villarreal, P. Hooge, J. Valdés-Reyna & M. Barkworth VR-1984* (NY); La Siberia, Sierra de la Marta, cerca del Ejido Sta. Rita ca. 18 km al SE de San Antonio de las Alazanas, 25.2333°N, 100.4167°W, 22 July 1983, *J. Valdés-Reyna & L.E. Rodriguez G. s.n.* (ARIZ-284698). **Nuevo León:** along road up to Cerro Potosí, 24.8875°N, 100.21°W, 2884 m, 21 October 2007, *P.M. Peterson, J.M. Saarela & D. Stancik 21453* (CAN, US); Cerro El Potosí, localizado en Galeana, 24.82°N, 100.07°W, 2950 m, 15 August 1998, *J. Garza C. & M. Castillo B. 210* (MEXU-1089779); Cerro Potosí, near microwave tower, 24.8667°N, 100.2167°W, 2743 m, 8 July 1963, *R.L. McGregor, L.J. Harms, A.J. Robinson, R. del Rosario & R. Segal 299* (NY, US-2454944); Sierra Madre Oriental, ascent to Sierra Infernillo, ca. 15 mi SW of Galeana, 24.61°N, 100.01°W, 9000–10000 ft, 16 June 1934, *C.H. Mueller & M.T. Mueller 811* (GH, F-938711, MICH-1119215); Sierra Madre Oriental, 11.4 mi W of Dieciocho de Marzo up road towards Cerro Potosi, 3130 m, 18 October 1995, *P.M. Peterson & M.B. Knowles 13334* (US). **San Luis Potosí:** Cerro de la Luz, W of La Trinidad,

21.40792°N, 99.1023°W, 2300–2688 m, 23 September 2010, *P.M. Peterson, J.M. Saarela & K. Romanschenko 23580* (US). **Tamaulipas:** Mpio. Miquihuana, Col. Agr. La Peña, 23.63°N, 99.73°W, 2900 m, 9 June 1982, *G. Villegas 489b* (MEXU); on E and S slopes and summit of Peña Nevada, 23.7°N, 99.8°W, 19 July 1949, *L.R. Stanford, S.M. Lauber & L.A. Taylor 2574* (NY, RSA-POM-72563, US-2013060).


**FIGURE 28.** Geographical distribution of *Bromus densus* in México.

8. ***Bromus diandrus*** Roth (1787: 44). Figs. 29, 30.

*Anisantha diandra* (Roth) Tutin in Clapham *et al.* (1962: 1149). *Anisantha diandra* (Roth) Tutin ex Tzvelev (1963: 4). Type:—*Gr. Bromoides, locustis maximus, lanuginosum, Italicum Hist. Nat.*: 261. no. 444 (neotype OXF-Scheuchzer, designated by Sales 1993: 8). The holotype at B, collected by Roth, was destroyed during the war in 1943 (Sales 1993).

*Bromus rigidus* Roth (1790: 21). *Genea rigida* (Roth) Dumortier (1868: 67). *Bromus madritensis* var. *rigidus* (Roth) Babington in Sowerby ex Syme (1873: 161). *Bromus villosus* var. *rigidus* (Roth) Ascherson & Graebner (1901: 595). *Anisantha rigida* (Roth) Hylander (1945: 32). *Bromus diandrus* subsp. *rigidus* (Roth) Laínz (1967: 49). *Anisantha diandra* subsp. *rigida* (Roth) (Tzvelev 1976: 223). *Bromus diandrus* var. *rigidus* (Roth) Sales (1993: 9). Type:—"*Triandria Digynia. Bromus rigidus spiculis multifloris lato-lanceolatis rigidus, floribus diandris, panicula contracta.* Roth, Catal. Bot. 1. P. 17. Habitat in Europa australi." ([first-step] neotype B-Willd., designated by Sales 1993: 9, [second-step] neotype B-Willd. barcode no. B -W 02162 -02 0!, **designated here**, isoneotypes B-Willd. barcode nos. B -W 02162 -01 0!, B -W 02162 -03 0!, B -W 02162 -04 0!). A folder in the Willdenow herbarium at B includes four sheets of the Roth collection that Sales (1993) designated as the neotype; there is a barcode on the folder cover (barcode no. B -W 02162 -00 0). Sales (1993) did not designate a particular specimen as neotype, thus a second-step neotype is selected here. The second-step neotype is a sheet with three flowering culms.

Plants annual. Culms 15–120 cm tall, 0.8–3 mm wide at base, erect or ascending, glabrous or weakly to moderately pubescent below inflorescences; nodes 2–3, blackish brown, glabrous. Leaf sheaths pubescent, hairs stiff and up to 0.6 mm long, or soft and up to 2.5 mm long; auricles absent; ligules 2.2–5 mm long, glabrous, erose-lacerate; blades 3–18 cm × 2–7 mm, flat, adaxial and abaxial surfaces pilose, hairs up to 1.5 mm long, margins smooth or pubescent. Panicles 6–30 cm × 2–25 cm, erect when young, sometimes spreading or nodding at maturity, branches erect to ascending, 0.3–5 cm long, usually shorter than spikelets, sometimes longer, scabrous to densely pubescent, 1–2 spikelets per branch. Spikelets 3.2–5.5 cm long (6.5–8 cm including awns), 5–8-flowered, linear-elliptic, moderately laterally compressed, widening at maturity with visible rachillas; glumes glabrous, margins hyaline, midnerves glabrous or scabrous, particularly distally, apices acute; lower glumes 12–26 mm, narrowly lanceolate to lanceolate, 1(–3)-nerved, green to purple along the nerves; upper glumes 18–35 mm long, lanceolate, 3(–5)-nerved, green to purple along nerves, lighter in colour and ± translucent between the nerves; lemmas 18–35 mm × 1–2 mm, linear-lanceolate, rounded over the backs, apices bifid, the cleft 2.2–5.2 mm deep, 7-nerved, green or sometimes

purplish-green along and between nerves, backs sparsely to densely scabrous, sometimes with hairs up to 1 mm long at apex or along margins, occasionally with a dense tuft of hairs 0.1–0.2 mm long at base, margins hyaline (except at base), smooth or minutely serrulate, keels scabrous; awns 30–50 mm long, arising 3.5–6 mm below lemma apex, straight; paleas 13–16 mm long, shorter than lemmas, backs glabrous, keels ciliate, cilia up to 0.5 mm long; anthers 0.5–1.2 mm long; caryopses 10−12 mm long, terete in cross section to somewhat flattened dorsally. 2*n* = 42, 56 (Oja & Laarmann 2002).

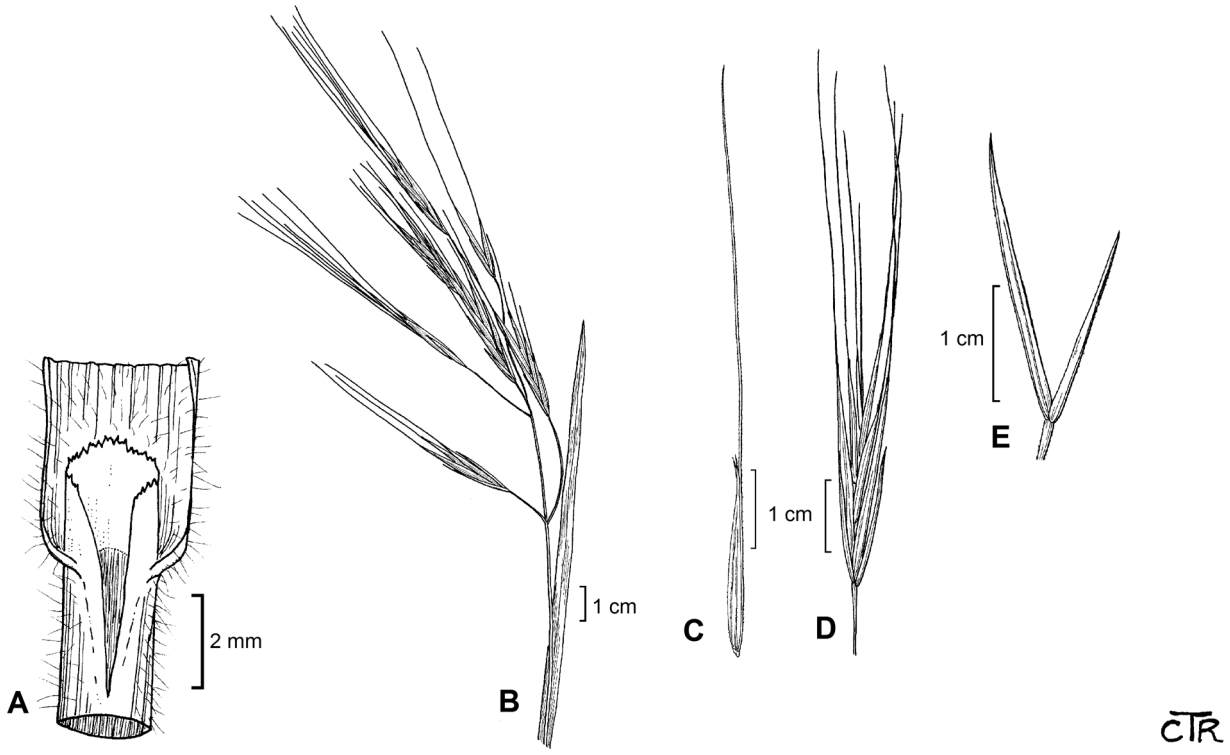


**FIGURE 29.** *Bromus diandrus*. A. Ligule. B. Inflorescence. C. Lemma. D. Spikelet. E. Glumes. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution**:—Introduced. In México *B. diandrus* is known from Baja California, where it has been present for over a century, and the Revillagigedo Islands (Colima), south of the Baja California peninsula (Fig. 31). Gould & Moran (1981: 30) reported *B. diandrus* to be "occasional to frequent" in Baja California. *Bromus diandrus* also occurs in central México in the states of México, Morelos, Puebla, Tlaxcala and Veracruz. It was not reported in central México by Soderstrom & Beaman (1968), but subsequent authors have reported it from Puebla (Beetle 1977, 1987, Dávila Aranda *et al.* 1990, Espejo-Serna *et al.* 2000), Estado de México (Beetle 1987, Espejo-Serna *et al.* 2000) and Distrito Federal (Espejo-Serna *et al.* 2000). *Bromus diandrus* was introduced to central México as early as the 1970s; a few collections were made in the 1970s and 1980s, and most collections were made more recently in the 1990s and 2000s. The species is likely spreading in this area. Also known from Guatemala (Cerro El Baul).

*Bromus diandrus* is native to Europe. It is widely introduced in western North America north of México, where it occurs from British Columbia south to California and Texas, with some scattered localities in the southeastern United States (Pavlick & Anderton 2007). In South America it occurs in Chile and Argentina (Planchuelo & Peterson 2000).

**Ecology:**—This species is widely distributed primarily in disturbed habitats along roadsides, rocky slopes, moist seeps and meadows; associated with *Quercus* spp., *Pinus* spp., *Abies* Miller (1754b: [unpaged]), *Juniperus* Linnaeus (1753: 1038), *Arbutus* Linnaeus (1753: 395), *Rubus* Linnaeus (1753: 492), *Polygala* Linnaeus (1753: 701), *Solanum* Linnaeus (1753: 184), *Alnus* Miller (1754b: [unpaged]), *Baccharis*, *Sambucus* Linnaeus (1753: 269), *Prunus* Linnaeus (1753: 473) and *Penstemon* Schmidel (1763). Elevation: 2400 m (Guatemala), 5–2200 m (México, Baja California), 1850–4267 m (México, except Baja California).


**FIGURE 30.** *Bromus diandrus*. *Beetle & Alcaraz M-6511* (MICH-1119217).

**Common Names:—**Ripgut brome, great brome (English); bromo frágil (Spanish).

**Comments:—**Plants referred to *B. diandrus* in México and elsewhere in North America have previously been treated as *B. rigidus* Roth (e.g., Wiggins 1980). Both *B. diandrus* and *B. rigidus* have been reported from México (Espejo-Serna *et al.* 2000). Sales (1993) conducted a comprehensive survey of morphological, geographical and ecological variation in the *B. diandrus*/*B. rigidus* complex, and recognized these taxa as varieties: *B. diandrus* var. *diandrus* and *B. diandrus* var. *rigidus*. Sales (1993) noted the differences between the varieties are subtle and that it is often difficult to place specimens into one variety or the other. We recognize the taxon as *B. diandrus*, with no recognition of intraspecific taxa, as in other recent treatments in North America (Stubbendieck *et al.* 2003, Jessop *et al.* 2006, Pavlick & Anderton 2007, Saarela 2008, Saarela & Peterson 2012).

*Bromus diandrus* was not reported for Guatemala by Swallen & McClure (1955), but was reported for Guatemala by Soderstrom & Beaman (1968) and Pohl & Davidse (1994), based on the same collection (*de Koninck 208*) seen here for the country.

**Specimens Examined:—GUATEMALA**. Cerro El Baul, [14.83°N, 91.5°W], 2400 m, August 1954, *M. de Koninck 208* (US-215372). **MÉXICO. Baja California:** 3.0 mi E of Los Héroes de la Independencia, on road from Ensenada to San Felipe, 1040 m, 17 May 1979, *J.R. Reeder & C.G. Reeder 7205* (SD-116088); Aguaje Vargas, Isla de Cedros, [28.19°N, 115.21°W], 600 m, 24 June 1977, *L.M. Villareal de Puga 10641* (MEXU-254480); Arroyo El Barbón, [32.05°N, 116.02°W], 6 May 1981, *A. Preciado & M. Montoya 239* (MEXU-1089759); arroyo mouth at El Descanso, 32.2042°N, 116.9125°W, 5 m, 27 March 1982, *R. Moran 30105* (SD-110757); Barranca de Salsipuedes, por la carreterra Tijuana-Ensenada, 32°N, 116.854°W, 28 April 1981, *R. Guzmán M. 1258* (MEXU-1089755); ca. 1 mi N of Camalú, 30.88°N, 116.0667°W, 120 m, 26 March 1979, *J.R. Reeder & C.G. Reeder 7115* (SD-116041, US-2861043); camino entre el Sausal y San Antonio de las Minas, al N de Ensenada, 31.99°N, 116.58°W, 28 April 1981 *R. Guzmán M. 1214* (MEXU); Cañon la Puerta, 6.0 km SW of Tecate, 32.5375°N, 116.6833°W, 500 m, 10 May 1980, *R. Moran 28462* (MSC-276929, SD-105868); Cedros Island, Cerro de Cedros, 28.15°N, 115.2167°W, 1050 m, 16 April 1983, *T. Oberbauer, H. Wier & E. Wier 46* (SD-127652); Guadalupe Island, [29.03°N, 118.3°W], 19 April 1925, *H.L. Mason 1543* (F-720871); Guadalupe Island, [29.03°N, 118.3°W], 24 April 1958, *I.L. Wiggins & W.R. Ernst 77* (SD-48313); Guadalupe Island, [29.03°N, 118.3°W], 350 m, 30 April 1967, in bed of Arroyo Melpomene 2 mi from mouth, *R. Moran 13773* (MSC-256754, RSA-POM-231537); Guadalupe Island, [29.03°N, 118.3°W], 3500 ft [1067 m], 15 June 1906, *W.W. Brown Jr. 31* (GH); Guadalupe Island, Arroyo Melpomene, 28.9°N, 118.2833°W, 50 m, 8 June 2000, *J.P. Rebman, T. Oberbauer & J.L. León de la Luz 6830* (SD-155061); Guadalupe Island, en route between NE Anchorage and springs, 29°N, 118.2667°W, 25 April 1958, *I.L. Wiggins & W.R. Ernst 103* (US-2241595); Guadalupe Island, in arroyo bed, near mouth of Long Canyon, 29.0083°N, 118.2333°W, 40 m, 16 April 1970, *R. Moran 17359* (SD-74870); Guadalupe Island, in bed of Arroyo Melpomene 2 mi from the mouth, 28.925°N, 118.2667°W, 350 m, 30 April 1967, *R. Moran 13773* (SD-78963); Guadalupe Island, N slope of island, slope below Hemizonia cliff, 29.1708°N, 118.3°W, 800 m, 24 May 1981, *R. Moran 29595* (SD-108579); Guadalupe Island, NE Anchorage, 29.1625°N, 118.2833°W, 10 m, 30 April 1958, *R. Moran 6758* (SD-47589); Guadalupe Island, near mouth of Long Canyon, [29.03°N, 118.3°W], 40 m, 16 April 1970, *R. Moran 17359* (RSA-POM-364160); just S of El Descanso, 32.1833°N, 116.8833°W, 10 m, 8 May 1977, *R. Moran 24006* (SD-97268); La Rumorosa, km 65 carretera Mexicali-Tijuana, [32.6°N, 116.08°W], 1120 m, 27 April 1994, *V. Jaramillo V., G. Villegas, A. Miranda 931* (MEXU-1089756); Los Coronados Islands, NE slope above Hotel Cove, S Island, 32.5792°N, 117.2458°W, 175 m, 7 May 1976, *R. Moran 23126* (SD-95619); Mpio. Ensenada, "Cuesta del Lechero" km 35 carretera Ensenada-Ojos Negros, 31.9533°N, 116.3928°W, 700 m, 15 May 1997, *L. Aragón M. 565* (MEXU-1089747); Mpio. Ensenada, a 22 km del Poblado de sitio Tomás 31.99°N, 116.58°W, 380 m, 8 April 1987, *L. Elena López 127* (MEXU-1110840); Mpio. Ensenada, Arroyo La Misión, Deleg. de Santa Rosa, [32.09°N, 116.85°W], 200 m, 12 March 1987, *L. Elena López 7* (MEXU) & *9* (MEXU-1110796); Mpio. Ensenada, Cuenca del arroyo San Carlos, [29.61°N, 115.5°W], 30 April 1981, *R.Guzmán 1315* (MEXU); Mpio. Ensenada, Delegación Francisco Zarco, Aguaje El Borreguero del rancho "El Dorado", 32.1369°N, 116.5331°W, 650 m, 14 May 1997, *L. Aragón M. 551* (MEXU); Mpio. Ensenada, Ensenada, [31.87°N, 116.59°W], 10 m, 23 April 1979, *M. Montoya 8* (MEXU-1089758, MEXU-1017329); Mpio. Ensenada, Las Ánimas, 14 km al SE de Maneadero, 31.6333°N, 116.4833°W, 140 m, 7 May 1987, *P. Tenorio L. & C. Romero de T. 1342*0 (MEXU-675500); Mpio. Ensenada, Coronel Esteban Cantu 14 km al SW de La Joya, 31.55°N, 116.6167°W, 100–570 m, 7 May 1987, *P. Tenorio L. & C. Romero de T. 13362* (MEXU-801663, MEXU-837673); Mpio. Tecate, Santa Verónica, [32.46°N, 116.36°W], 930 m, 26 May

1993, *Jaramillo V., Villegas G. & Domínguez O. 18* (MEXU-1089760); Rancho (solo) Sierra Blanca, Sierra Blanca, 32.075°N, 116.525°W, 675 m, 15 May 1976, *R. Moran 23180* (SD-94914); Santa María Plains, 10–20 mi S of Hamilton Ranch, 30.4°N, 115.8833°W, 8 April 1931, *I.L. Wiggins 5200* (GH, MICH-1119285, NY, RSA-POM-23502, US-1721755); Sierra Juárez, W shore of Laguna Hanson, 32.0542°N, 115.075°W, 1610 m, 21 June 1980, *R. Moran 28863* (SD-105481); Sierra San Pedro Mártir, Rancho Meling, [31.13°N, 115.19°W], 940 m, 27 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 60* (MEXU); Sierra San Pedro Mártir, La Encantada, 30.9167°N, 115.4°W, 2200 m, 19 August 1967, *R. Moran & R.F. Thorne 14326* (SD-76611); Sierra San Pedro Mártir, La Grulla, 30.8917°N, 115.4833°W, 2050 m, 9 June 1982, *R. Moran 30938* (SD-111212); Mpio. Tecate, Juntas de Negi, 32.4922°N, 116.4606°W, 820 m, 12 May 1997, *M.A. Vergara B. 85* (MEXU); between La Humarosa [Rumarosa] and Tecate, 32.53°N, 116.38°W, 27 April 1981, *A.A. Beetle & R. Alcaraz M-6511* (ANSM, MICH-1119217); Cañón de Agua Viva between Ensenada and Ojos Negros, [31.87°N, 116.62°W], 1 May 1981, *A.A. Beetle & R. Alcaraz M. 6639* (MICH-1119218). **Colima:** Revillagigedo Islands, Guadalupe Island, 29°N, 118.2667°W, 19 April 1925, *H.L. Mason 1543* (US-1319349). **Estado de México:** al oeste de Amecameca, por la carretera Amecameca-Cuautla, [19.13°N, 98.78°W], 2520 m, 8 February 1984, *Manrique & Beetle 705-M* (MEXU); Cuijingo (Delante de Juchitepec), [19.0839°N, 98.8517°W], 9 August 1994, *B. Rodriguez C. s.n.* (MEXU); Mpio. Amecameca, carretera Amecameca-Paso de Cortés, 19.0793°N, 98.719°W, 2785 m, 29 October 2000, *H. Vibrans 6872* (MEXU); Mpio. Amecameca, San Pedro Nexapa, [19.09°N, 98.74°W], 2 October 1992, *A. Miranda & G. Villegas 623* (MEXU); Mpio. Axapusco, Parque "Cerro Gordo" a 1.5 km al sur de la población de San Cristóbal Cuihuacan, 19.7606°N, 98.8256°W, 2740 m, 29 October 1999, *R. Mendoza Domínguez 400* (MEXU); Mpio. Juchitepec, Cuijingo (adelante de Juchitepec), [19.0839°N, 98.8517°W], 9 August 1994, *B. Rodriguez C. s.n.* (ANSM); Mpio. Ocoyoacac, vía férrea al lado norte del pueblo, sobre cerro, cerca de la carretera Panorámica, 19.2756°N, 99.4599°W, 2692 m, 7 August 2001, *H. Vibrans 7525* (MEXU-1029567); Mpio. Tenango de Arista, a 2.5 km al noroeste de San Fco. Tepexoxuca, [19.11°N, 99.6°W], 2865 m, 4 February 1993, *A. Ramírez Abarca 488* (MEXU); Tenango del Aire 2 km saliendo, [19.17°N, 98.88°W], 1980 m, 27 September 1985, *A. González & B. Rodríguez s.n.* (MEXU-793444); 2.8 mi E of Ocuilán Arteaga near cornfield, 18.9808°N, 99.3786°W, 2478 m, 11 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21371* (CAN, MO, US); 22.4 mi E of junction of Hwys. 10 and 12 on Hwy. 12 towards Ixtapan de la Sal, 18.9301°N, 99.862°W, 2789 m, 10 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21357* (CAN, MO, US); 6.7 mi E of Amecameca towards Paso de Cortés, 19.0706°N, 98.6923°W, 2488 m, 11 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21377* (CAN, MO, US); Mpio. Huitzilac, Rancho San Lorenzo km 53.5 de la carretera federal México-Acapulco (95), al SW del poblado Tres Marías, 19.65°N, 99.2333°W, 2660 m, 7 September 1988, *I. Díaz V. 1158* (MEXU-508075). **Morelos:** km 24 carret. Ded. Cuernavaca-México, 19.06°N, 99.25°W, 1850 m, 29 March 1996, *E. Oviedo 75* (MEXU); Mpio. Juchitepec, carretera Xochimilco-Oaxtepec 3 km desviación "Cicitec, [19.09°N, 99.02°W], 2000 m, 14 October 1993, *J.A. Montaño 4* (MEXU); Mpio. Juchitepec, carretera Xochimilco-Oaxtepec 3 km desviación "Cicitec", [19.09°N, 99.02°W], 2000 m, 14 October 1993, *J. Rosado 106* (MEXU). **Oaxaca:** 8.3 mi N of San Cualimojoyas on road towards Santa María Yavesia, 17.1819°N, 96.4445°W, 2794 m, 20 September 2008, *P.M. Peterson & J.M. Saarela 22318* (CAN, MO, US). **Puebla:** 1.2 mi W of Texmalaquila, just SE of Pico de Orizaba (Volcán Citlaltépetl), near E base of Sierra Negras, 18.9693°N, 97.3641°W, ± 1000 m, 3048–3353 m, 2 August 1977, *E. Lehto, D.J. Pinkava, B. Parfitt & T. Reeves L-21976* (ASU-0010750); alpine zone of Pico de Orizaba (Volcán Citlaltépetl), 19.0331°N, 97.2728°W, ± 15000 m, 4267 m, 1 August 1977, *T. Reeves, B. parfitt, E. Lehto & D.J. Pinkava R-5817* (ASU-0010749); 1 km al oeste de San Isidro Vaquerías, 3000 m, 27 June 1989, *P. Dávila, P. Tenorio & J. Sánchez-Ken 358* (MEXU); 5.6 km SE of Ciudad Serdán on MEX Hwy. 140 to Tehuacán, [18.98°N, 97.44°W], 2540 m, 18 September 1990, *P.M. Peterson & C.R. Annable 9956* (CAN, US); along the highway between Puebla and Córdoba near Orizaba near km 112 just N of Puebla-Veracruz border, [18.83°N, 97.48°W], 2480 m, 24 February 1983, *J.S. Miller & P. Tenorio L. 696* (MEXU-776909); Ciudad Serdán, Guadalupe Sabinal, [18.98°N, 97.44°W], 19 February 2001, *E. Gaspariano Martínez 115* (MEXU-1070140) & *116* (MEXU-1070141); Mpio. Atzizintla, El Mirador de las Cumbres de Maltrata, 29 km al O de Od. Mendoza, por la carretera a Puebla, [18.89°N, 97.32°W], 2500 m, 29 September 1984, *S.D. Koch, J. Garciá, M. González & I. Hernández 8420* (F-2035538, MO). **Morelos:** a 10 km de Morelos Cañada rumbo a Ciudad Serdán y 3 km al Este Amazoquillo, 19.7606°N, 98.8256°W, 2360 m, 17 October 1995, *A. Miranda, L. Aragón et al. 1084* (MEXU); Vertiente S del Pico de Orizaba, 1.0 km antes de Texmalaquilla por camino que viene de Atzitaintla, [18.98°N, 97.27°W], 14 September 1986, *M. González-Kledesma & P. Vera C. 190* (SD-141347);

Vertienta a Orizaba, supercarretera Puebla-Orizaba, 2300 m, 2 November 1972, *W. Boege 2600* (GH). **San Luis Potosí:** San Luis Potosí, *Virlet d'Aoust 1376* (P-02629888). **Tlaxacala:** Mpio. Terrenate, camino Zapata-Villarreal, [19.47°N, 97.921°W], 3000 m, 18 January 1990, *L. Ordóñez 9* (MEXU) & *18* (MEXU). **Veracruz:** 0.8 mi S on the Orizaba/Puebla cuota (MEX 150) from its junction with the Veracruz/Puebla state line, [18.84°N, 97.29°W], 7700 ft [2346 m], 9 July 1990, *S. & G. Jones 5323* (MICH-1119216); ca. 1 km E of Puebla/Veracruz line, rte 150D, [18.84°N, 97.29°W], ca. 7000 ft [ca. 2133 m], 23 March 1970, *R.W. Long & D. Burch 3081* (F-1952359); Mpio. Tehuipango, camino terracería Astacinga-Tehuipango, 18.525°N, 97.0556°W, 2400 m, 18 April 1997, *H.R. Sandoval 467* (MEXU); supercarretera Puebla-Orizaba pendiente sur, [18.84°N, 97.29°W], 2500 m, 20 November 1972, *L.W. Boege 2600* (MEXU) & *2609* (MEXU.


**FIGURE 31.** Geographical distribution of *Bromus diandrus* in México and Central America.

9. ***Bromus dolichocarpus*** Wagnon (1950: 65). Figs. 32, 33.

*Bromopsis dolichocarpa* (Wagnon) Holub (1973: 167). Type:—MÉXICO. Michoacán: in fir forest, ca. 10 mi NW of Ciudad Hidalgo, 18 March 1949, *R. McVaugh 9887* (holotype MICH-1108613!, isotype US-2012739!).

Plants perennial, not rhizomatous. Culms up to 192 cm tall, 2–4 mm wide at base, erect, the bases ± decumbent, pubescent below inflorescences; nodes 2–6, glabrous, puberulent or pubescent. Leaf sheaths sparsely to moderately pilose, hairs up to 1.5 mm long; auricles usually present; ligules 0.6–1.5(–3) mm long, glabrous; blades up to 39 cm × 3–16 mm, flat, adaxial surfaces pilose, hairs up to 1.5 mm long, abaxial surfaces glabrous, sometimes with scattered hairs adjacent to the midnerve, or sparsely pubescent, margins serrulate. Panicles up to 33 cm × 3–11 cm, open, nodding, branches ascending, 0.7–12 cm long, shorter or longer than spikelets, scabrous to densely pubescent, hairs up to 0.6 mm long, 1–2(–3) spikelets per branch. Spikelets 2.5–3.6(–4) cm long, 5–8-flowered, elliptic to lanceolate, terete to moderately laterally compressed, rachillas sometimes visible at maturity; glumes glabrous, sometimes a few hairs proximally and along the margins, or pubescent proximally, margins hyaline, midnerves scabrous, sometimes pubescent proximally, hairs up to 0.6 mm long; lower glumes 10–13(–14) mm × 0.3–0.7(–1) mm, narrowly lanceolate, 1(–3)-nerved, green along the nerve(s), apices acute, rarely acuminate; upper glumes 12–19 mm × 0.7–1.3 mm, lanceolate, 3-nerved, green along the nerves, green to light green–translucent between the nerves, apices acute, rarely acuminate; lemmas (13–)14–20 mm × 0.9–1.5 mm, linear-lanceolate, rounded over the backs, apices acute, 3(–5)-nerved, the nerves strong, backs puberulent proximally, glabrous distally, pubescent to pilose between the lateral nerves and the margins, hairs up to 0.5 mm long, light green-translucent between the nerves, margins hyaline, nerves scabrous or pilose, hairs up to 0.6 mm long; awns 7–13 mm long, attached up to 0.5 mm below lemma apex, straight; paleas shorter and narrower than the lemmas, backs

scabridulous to pubescent, keels ciliate, cilia up to 0.1 mm long; anthers 1.1–2.5 mm long; caryopses 10−15 mm long, light brown. 2*n* = 28 (Wagnon 1950).


**FIGURE 32.** Illustration of *Bromus dolichocarpus*. A. Spikelet. B. Lemma C. Inflorescence. D. Ligule. Based on *Breedlove 55564* (GH). Illustration by Paulette Dennis © Paulette Dennis.

**Distribution:—**Native. *Bromus dolichocarpus* is distributed from central México (Chiapas, Distrito Federal, Durango, Guerrero, Hidalgo, Jalisco, Estado de México, Michoácan, Morelos, Oaxaca, Puebla, Veracruz) to Guatemala (El Progreso, Quezaltenango, San Marcos) (Fig. 34). It was reported from Colima and Jalisco by Beetle (1977), but we have not seen specimens from these states. This is the first report of *B. dolichocarpus* from Durango, as the species was not reported for the state by Herrera Arrieta (2001, 2014).

**Ecology:**—*Bromus dolichocarpus* is found on gentle slopes and flats that are often steep and rocky and along small draws; associated with *Pinus* spp., *Pinus hartwegii* Lindley (1839: 62), *Abies religiosa*, *Quercus* spp., *Juniperus deppeana*, *Arbutus xalapensis*, *Gaultheria* Linnaeus (1753: 395), *Pteridium* Gled. ex Scopoli (1760: 169), *Tagetes* Linnaeus (1753: 887), *Symphoricarpos* Duhamel du Monceau (1755: 295), *Arctostaphylos pungens*, *Alnus*, *Ribes* Linnaeus (1753: 200), *Prunus serotina* Ehrhart (1783: 285), *Rhamnus* Linnaeus (1753: 193), *Crataegus* Linnaeus (1753: 475), *Toxicodendron* Miller (1754a), *Geranium* (Linnaeus 1753: 676) and *Baccharis*. Elevation: 2500–3800 m (Guatemala), (1900–)2200–3920 m (México).

**Common Names:—**Unknown.

**Comments:—***Bromus dolichocarpus* is one of three Mexican species with 3-nerved lemmas, which are newly recognized here in sect. *Mexibromus*. It is easily distinguished from *B. attenuatus* by its pubescent lemmas, longer awns and leaf blades that do not distinctly narrow towards their bases, and from *B. densus* by its longer awns, shorter anthers and wider leaf blades (see taxonomic key).

**Specimens Examined:—GUATEMALA. El Progreso:** Sierra de Las Minas, between Finca Piamonte and top of Montaña Piamonte, along Joya Pacayal, [15.13°N, 89.75°W], 2500–3000 m, 7 February 1942, *J.A. Steyermark 43619* (F-1202053, US-2436906). **Quezaltenango:** Cerro Quemado, [14.8°N, 91.52°W], 2600 m, September 1954, *M. de Koninck 210* (US-2153572); mountains SE of Palestina, on old road to San Juan Ostuncalco, [14.87°N, 91.62°W], 2550–2850 m, 21 January 1941, *P.C. Standley 84221* (F-1202285). **San Marcos:** along road between San Sebastián at km 21 and km 8, 8–18 mi NW of San Marcos, [15.06°N, 91.83°W], 2700–3800 m, 15 February 1940, *J.A. Steyermark 35769* (F-1052081) & *35771* (F-1052024); Sierra Madre Mountains, ca. 6 km (airline) N of San Marcos, [14.96°N, 91.79°W], 2700 m, 13 December 1963, *L.O Williams, A. Molina R. & T.P. Williams 25876* (F-1656824, US-2537602) & *25885* (NY, mixed sheet with *B. carinatus* var. *marginatus*). **MÉXICO. Chiapas**: Mpio. Zinacantán, near the summit of Muk'tavits, [16.3333°N, 92.75°W], 2745 m, 16 November 1981, *D.E. Breedlove & B. Bartholomew 55564* (CAS, GH, MO). **Distrito Federal:** cerca de Eslava, 19.42°N, 99.17°W, 19 October 1952, *J. Rzedowski 2005* (MEXU-100903, MICH-1119221); Cumbre de Estepa, 18.05°N, 97.7°W, April 1842, *Liebmann 487* (US-2473643); in imperio Mexicano, from Zuccarini, *Karwinsky s.n.* (US-1009477); San Rafael, 19.25°N, 98.79°W, 2600 m, 18 September 1932, *M. St. Pierre 938* (MICH-1119222, P-03629787, US); San Roman, *Liebmann 501* (MO, US-2473641); 10 mi E of Amecameca on road towards Paso de Cortés, in Parque Nacional Izta-Popo, 19.0764°N, 98.71°W, 2840 m, 12 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16160* (CAN, MO, US); 1er Dínamo, Delegacíon Magdalena Contreras, [19.42°N, 99.13°W], 2580 m, 17 October 1985, *A. Miranda & P. Guerrero 141* (MEXU-1110774); Desierto de Los Leones, 19.2531°N, 99.3286°W, 19 October 1960, *T. Tateoka 389* (MEXU-151424) & *1151* (US-2380596); Desierto de Los Leones, Delegación de Guajimalpa, [19.2533°N, 99.3308°W], 25 January 1976, *M. González E. 82* (ANSM); Mpio. Cuajimalpa, Desierto de Los Leones, [19.2533°N, 99.3308°W], 2 November 1979, 2700 m, *F. Santoyo 178* (ANSM); Río Grande, July 1928, *E. Lyonnet 266* (MEXU-258403); Valle de México, [19.42°N, 99.13°W], 3500 m, 9 December 1951, *E. Matuda 25754* (MEXU-499579, MEXU-499578); Valle de México, Lago Zempoala, Hdo. de Morelos, 19.0494°N, 99.3175°W, 3000 m, 7 October 1951, *E. Matuda 25587* (MEXU, US-2079183); Valle de México, San Rafael, 19.2333°N, 98.75°W, 2600 m, 19 November 1950, *E. Matuda 18722* (MEXU, US-2040890). **Durango:** Mpio. Súchil, Reserva de la Biosfera La Michilia, Mesa El Burro, 23.4108°N, 104.3108°W, 2650 m, 16 September 1982, *Y. Herrera 261* (ANSM). **Guerrero:** Mpio. Chilpancingo de los Bravos, Omiltemi, [17.55°N, 99.51°W], 1900 m, 15 November 1991, *V. Nandi 134* (MEXU-1089776); Mpio. Chilpancingo de los Bravos, al NW de Omiltemi en direccion a la toma de Agua de la Cañada de la Perra, [17.55°N, 99.5°W], 2120 m, 10 October 1985, *R. Antonio Ocampo 405* (MEXU-502476). **Hidalgo:** El Chico, 20.2167°N, 98.7333°W, July 1929, *P. Lyonnet 262* (US-1034151); Las Ventanas, Mineral del Chico, [20.17°N, 98.73°W], 2970 m, 19 May 1993, *J. Práxedes Pérez 23* (MEXU); Pachuca Dist., below Pueblo Nuevo on road from Real del Monte to El Chico, 20.1667°N, 98.7333°W, 2850 m, 17 October 1946, *H.E. Moore, Jr. 1531* (GH, US-1963095). **Jalisco:** on the divide above headwaters of Río Mascota (25–30 km, airline, SE of Talpa de Allende), steep mountainsides and barrancas 1–2 mi N of the sawmill "La Cumbre", and 11–12 road mi S of El Rincón, 20.0403°N, 103.8753°W, 2000–3000 m,

29 November 1960, *R. McVaugh 21533* (NY); steep mountainsides above Amacueca, near the summit of the plateau, road to Tapalpa, [19.1556°N, 102.9889°W], 2100–2250 m, 2 November 1960, *R. McVaugh 20654* (NY). **Estado de México:** 8 km de la desviación al Nevado de Toluca, [19.1083°N, 99.7583°W], 3260 m, 29 November 1983, *Manrique, Jaramilo & Núñez 558* (MEXU-1089780); a 6 km sobre la desviación a Tequesquiapan, carretera Toluca-Temascaltepec, 19.31°N, 98.97°W, 2580 m, 25 October 1983, *Manrique, Jaramillo & Nuñez 445* (MEXU-1098071, MEXU-1033954); al SE de Zinacantepec, [19.14°N, 99.71°W], 3920 m, 8 April 1992, *A. Vega, A. Ramírez & R. Mendoza 2* (MEXU-1089771); camino de terracería Malinalco-San José Tenería, [18.93°N, 99.49°W], 27 October 1988, *J.G. Aldape et al. 34* (MEXU); carretera Toluca-Temascaltepec, [19.12°N, 99.88°W], 2530 m, *Manrique, Guerrero, Guzmán & Jaramillo 140* (MEXU); Cieneguillas de Cabra, entre la carretera Sultepec-La Puerta, al S del Nevado de Toluca, [19.1083°N, 99.7583°W], 2600 m, 1 August 1981, *R. Guzmán 4021* (MEXU); entre Texcaltitlán y Las Juntas, al S del Nevado de Toluca, [18.93°N, 99.95°W], 2660 m, 1 August 1981, *R. Guzmán 4015* (MEXU-1110805); Estación experimental San Cayetano, 2500 m, 2 August 1978, *F.M. Fuchs 97* (MEXU-231170); Mpio. Amecameca, 1 km al noroeste de San Antonio, 2550 m, 11 December 1977, *N. Valentín M. 74* (ANSM); Mpio. Amecameca, km 15 carretera Amecameca-Tlamacas, [19.08°N, 98.67°W], 2 October 1992, *A. Miranda & G. Villegas 636* (MEXU); Mpio. Atlautla de Victoria, Volcán Popocatépetl, ladera W por Atlautla, [19.05°N, 98.64°W], 2725 m, 24 October 1987, *J. Hernández 230* (MEXU-565906); Mpio. México, 3 km al E de San Rafael, [19.21°N, 98.74°W], 2700 m, 19 September 1976, *C. Flores G. s.n.* (MEXU-292304); Mpio. Morelos, Valle del Tepeite, [19.27°N, 99.18°W], 16 October 1937, *E. Lyonnet 18112* (MEXU-278684); Mpio. Ocuilan de Arteaga, 2 km al NW de Sta. Mónica de Ocuilan, 18.9833°N, 99.4417°W, 2350 m, 4 February 1990, *González & O. Miranda J. 328* (MEXU-1031709); Mpio. Tepotzotlán, 2400 m, 26 October 1975, *J.R. Torres V.* (ANSM); Mpio. Texcoco, 2 km al SE de San Pablo Ixayoc, sobre el camino hacia el Aguaje, 12.5 km al SE de Texcoco, [19.41°N, 98.86°W], 2670 m, 21 October 1976, *S.D. Koch 76210* (MEXU-265511, MO); Mpio. Tlalmanalco, 3 km al E de San Rafael, [19.21°N, 98.76°W], 2700 m, 27 May 1965, *J. Rzedowski 19863* (MEXU-187911); Mpio. Tlalmanalco, a 3 km al E de San Rafael, [19.21°N, 98.76°W], 2700 m, *L.M. García R. 73* (ANSM, MEXU-220002); Mpio. Villa de Allende, San Cayetano (estación experimental) al N de Agua Escondida y a 26 km al NE de Valle de Bravo, [19.37°N, 100.15°W], 2490 m, August–December 1974, *Ma. E. Maury Hdez., V. Serrano Cardenas & S. Gallina Tessaro 5* (MEXU-200087); Mpio. Villa de Allende, San Cayetano (Estación experimental), al N de Agua Escondida y a 26 km NE de Valle de Bravo, [19.33°N, 100°W], 2490 m, August–December 1974, *S. Gallina Tessaro s.n.* (MEXU); Mpio. Villa Guerrero, carretera de cuota de Tenango de Arista a Ixtapan de la Sal, [18.84°N, 99.68°W], 2200 m, 30 September 1995, *H. Vibrans 5564* (MEXU-895630); Mpio. Zimatlán, Cañada El Frijolón, 8 km al NW de La Cofradía, comunidad de San Pedro El Alto, [19.61°N, 99.9°W], 2790 m, 8 October 1998, *A.G. Miranda M. & O.L. Hernández Martínez 248* (MEXU-907764); 1 km W of Amecameca along road to Ayapango, 19.15°N, 98.7833°W, ca. 2500 m, 29 September 1978, *H.H. Iltis, J. Doebley & A. Lasseigne 764* (F-1919412, MO, MSC-277227, RSA-POM-320576, US); 1.4 mi N of Tequexquipan, 2490 m, 19.071°N, 99.9388°W, 10 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16139* (CAN, MO, P-03216909, US); 1.9 mi W of Chiltepec on Hwy. 12, 18.9268°N, 99.8442°W, 2596 m, 10 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21364* (CAN, MO, P-03631106, US); 12.1 mi NE of San Miguel, SW of Volcán Toluca, 19.0317°N, 99.9102°W, 2826 m, 10 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16143* (CAN, MO, P-03216911, US); 5 km al NW de Amecameca, laderas vecinas al Cerro Tenayo, [19.12°N, 98.76°W], 2550 m, 17 November 1968, *A. Pineda R. 603* (MICH-1119227, MSC-223104); 6.7 mi E of Amecameca towards Paso de Cortés, 19.0706°N, 98.6923°W, 2488 m, 11 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21382* (CAN, MO, US); 8.7 mi NE of La Comumidad on Hwy. 134 toward Toluca, 19.1858°N, 99.86°W, 3190 m, 9 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16132* (US); at La Comunidad, along stream just below puebla (La Comunidad), 19.1518°N, 99.9118°W, 2607 m, 9 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16136* (CAN, MO, P-03216910, US); *Coulter 1651* (GH); Mpio. Amecameca, 1 km al NE de San Antonio, 19.12°N, 98.76°W, 2550 m, 21 October 1968, *J.J. Rzedowski 26431* (MICH-1119223, MSC-233266); Mpio. Amecameca, cerca de San Pedro Nexapa, 19.08°N, 98.74°W, 9 October 1966, 2550 m, *J.J. Rzedowski 23285* (MSC-217972); Mpio. Amecameca, Zumpango, carretera al Paso de Cortés, 16 km al E del entronque con la carretera Amecameca-Cuautla, Mor., 19.06°N, 98.7°W, 3300 m, 20 November 1976, *S.D. Koch 76275B* (US-2824581); Mpio. Huixquilucan, 5 km al E de México, carretera de la Marquesa a Naucalpan, 19.3833°N, 99.3333°W, 2600 m, 29 July 1976, *S.D. Koch 76107* (MEXU-270647, CHAPA, MO, US); Mpio. Texcoco, 2 km al SE de San Pablo Ixayoc, 12.5 km al SE de Texcoco, 19.42°N, 98.83°W, 2670 m, 21 October 1976, *S.D. Koch*


**FIGURE 33.** *Bromus dolichocarpus*. *Pineda R. 603* (MICH-1119227).

*76210* (US-2824630); S slopes of Nevado de Toluca, 35 km (road) SW of Toluca on Hwy. 130, 19.0833°N, 99.8333°W, ca. 3000 m, 29 August 1965, *K. Roe, E. Roe & S. Mori 149*1 (MSC-229117); Temascaltepec Dist., Comunidad, 19.1292°N, 99.9347°W, 2600 m, 25 November 1932, *G.B. Hinton 2459* (NY, US-1867841); Temascaltepec, Crucero, 19.04°N, 100.23°W, 28 October 1935, *G.B. Hinton 8395* (MO, NY, 2 sheets, RSA-POM-364158); Tlalmanalco, 3.0 km al E de San Rafael, [19.21°N, 98.74°W], 2700 m, 19 September 1976, *C. Flores G. s.n.* (MO, SD-110652); Volcán de Toluca, 3760 m, 19.1014°N, 99.7694°W, 18 October 1953, *E.R. Sohns & E. Matuda 1004* (US-2118910); W slopes of Nevado de Toluca, 35 km (road) SW of Toluca on Hwy. 130, 19.0833°N, 99.8333°W, 3000 m, 29 August 1965, *K. Roe, E. Roe & S. Mori 1491* (US-3115415); W slopes of Nevado de Toluca, 35 km (road) SW of Toluca on Hwy. 130, [19.11°N, 99.79°W], ca. 3000 m, 29 August 1965, *K. Roe, E. Roe & S. Mori* (GH). **Michoácan:** Cerro Tancítaro, 27 km al W de Uruapan en linea recta, 1 km al oeste de El Tepetate, [19.41°N, 102.3°W], 2850 m, 29 August 1996, *I. Garcia Ruíz, J.A. Machuca & M. Cházaro 4153* (MICH-1119229); 11 km al N de Indaparapeo, sobre el camino a Las Peras, [19.78°N, 100.97°W], 2200 m, 8 November 1987, *J. Rzedowski 45692* (MEXU-809934); 37 mi E of Morelia on MEX 15, 19.67°N, 100.73°W, 8000 ft [2438 m], 20 October 1972, *L.H. Harvey & J.T. Witherspoon 9419* (MICH-1119244); 5.7 mi NW of Huajumbaro on road towards Santa Clara, 19.7364°N, 100.78°W, 2430 m, 8 October 2001, *P.M. Peterson 16129* (CAN, MO, US); a 12 km al N de Uruapan, carretera a Carapan, [19.41°N, 102.06°W], 2075 m, 22 August 1980, *J.C. Soto Núñez 2393* (MEXU); above Villa Escalante on road to Ario de Rosales, 19.4°N, 101.65°W, 2340 m, 11 November 1949, *H.E. Moore, Jr., E. Hernández-X. & H. Porras-H. 5634* (US-1983697); ca. 10 mi NW of C. Hidalgo, 19.66°N, 100.71°W, 4 July 1950, *H.K. Wagnon 1615* (MEXU-772510, US-2154832); ca. 18 mi S of Pátzcuaro, 19.31°N, 101.66°W, 2713–2743 m, 20–25 November 1961, *R.M. King & T.R. Soderstrom 5178* (MICH-1119226, MEXU-55441, NY, mixed sheet with *B. carinatus* var. *carinatus*), US-2378973); canyon just NW of Congoon on Hwy. 120 towards Pátzcuaro, 19.3806°N, 101.65°W, 2350 m, 8 October 2001, *P.M. Peterson 16128* (CAN, MO, P-03216912, US); Cerro Azul, vicinity of Morelia, 19.7167°N, 101.1833°W, 2300 m, 4 November 1909, *G. Arséne 3273* (MO, US-1002650); grown at the Botanical Gardens, University of Michigan, Ann Arbor, from seed collected with the type in fir forests ca. 10 mi NW of Ciudad Hidalgo, 4 July 1950, *H.K. Wagnon 1615* (MICH-1119225 [chromosome number voucher specimen, Wagnon 1950], MO); Mesa Karitsho o del Padre, SE de San Francisco Pichataro, [19.57°N, 101.81°W], 2625 m, 9 November 1978, *J. Coballero & C. Mapes 644* (MEXU); Mpio. Charo, El Salto de Agua, 19.65°N, 100.9444°W, 1 February 1994, *J.A. Torres Estrada 35* (MEXU-1009115, MEXU-1089785); Mpio. Morelia, 3 km al W de San Miguel del Monte, [19.7°N, 101.18°W], 2300 m, 25 October 1986, *J. Rzedowski 41312* (MEXU-658295); Mpio. Pátzcuaro, vertiente W del Cerro del Burro, [19.415°N, 101.5006°W], 2900 m, 23 November 1986, *J. Rzedowski 41962* (ANSM); Mpio. Queréndaro, 2 km al N de Real de Otzumatlán, 2350 m, 20 November 1986, *J. Rzedowski 41855* (ANSM); Mpio. Senguio, Cerro Ross Azul, al E de Chincus, 19.73°N, 100.35°W, 2800 m, 23 November 1986, *J. Santos Martínez 1969* (MICH-1119219); Mpio. Zacapu, ± 5 km de Zacapu, por la carretera a Zamora, 2000 m, 9 September 1988, *A. Grimaldo Núñez 406* (ANSM); Mpio. Zinapécuaro, 5 km al SSE de Jeráhuaro, 2550 m, 7 December 1987, *J. Rzedowski 46150* (ANSM, MEXU-915763); slopes of lava flow E of San Juan Nuevo, ca. 8 km S of Uruapan, 19.41°N, 102.06°W, 11–15 October 1961, *R.M. King & T.R. Soderstrom 4760* (MEXU-55372); vicinity of Morelia, Cerro Agul, [19.69°N, 101.16°W], 4 November 1909, *G. Arséne 3293* [?] (GH); Campo Experimental INIF, Uruapán, 2100 m, 9 October 1976, *C.L. Días Luna 7504* (ANSM); carretera Pátzcuaro-Uruapan km 25, [19.44°N, 101.84°W], 4 December 1986, *J.J. Ortíz 1195* (MEXU-638476); Mpio. Ocampo, 2 km al E de Ocampo, camino al Rosario, [19.58°N, 100.34°W], 2400 m, 2 November 1989, *R. Torres & M. Ramírez 13553* (MEXU-904824); Mpio. Pátzcuaro, 6 km al S de Pátzcuaro, carretera a Opopeo, [19.5158°N, 101.6094°W], 2400 m, 10 November 1985, *J. Espinosa Garduño 1990* (MEXU-993903); Mpio. Pátzcuaro, lado SW del Cerro El Fríjol, [19.5158°N, 101.6094°W], 2700 m, 31 October 1985, *H. Díaz Barriga 1652* (MEXU-662626). **Morelos:** km 62 de la carretera Curenava-México, [19.27°N, 99.17°W], 2460 m, 8 February 1984, *Manrique, Beetle et al. 733* (MEXU-1110847); Valle del Tepeite, [19.27°N, 99.18°W], 15 October 1937, *E. Lyonnet 1812* (MEXU-278689); Valle del Tepeite, 19.27°N, 99.25°W, 16 October 1937, *E. Lyonnet & J. Elcoro 1811* (MEXU, US-1746382). **Oaxaca:** 1.6 mi N of San Miguel Suchixtepec along Hwy. 175, 16.1157°N, 96.4745°W, 2722 m, 23 September 2008, *P.M. Peterson & J.M. Saarela 22378* (CAN, US); 9.5 mi N of San Cualimojoyas on road towards Santa María Yavesia, 17.1966°N, 96.4512°W, 2727 m, 20 September 2008, *P.M. Peterson & J.M. Saarela 22307* (CAN, US); Campamento Río de Molino, 4 km al SW de San Miguel Suchistepec, 16.09°N, 96.47°W, 2250 m, 21 September 1965, *J. Rzedowski 20999* (MICH-1119224), *21039* (MICH-1119220) & *21082* (MSC-210582); Cerro de San Felipe, Distrito del Centro, 17.1°N, 96.85°W,

2300 m, 12 October 1920, *C. Conzatti 4069* (MEXU-6111, US-1014111); Mpio. Zimatlán, Comunidad El Tlacuache, San Pedro El Alto, 16.04°N, 96.47°W, 2420 m, 9 October 1998, *A.G. Miranda & O. Hernández M. 306* (MEXU-901092); 1.2 mi E of San José del Pacifico on road towards San Sebastián, 16.1698°N, 96.4898°W, 2641 m, 22 September 2008, *P.M. Peterson & J.M. Saarela 22353* (CAN, US). **Puebla:** 23.4 E of Amecameca on road towards Puebla in Parque Nacional Izta-Popo, 19.0897°N, 98.6064°W, 3330 m, 12 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16170* (US); 24.3 mi E of Amecameca on road towards Puebla, in Parque Nacional Izta-Popo, 19.085°N, 98.6°W, 3316 m, 13 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16175* (CAN, US). **Veracruz:** Orizaba, 19.0167°N, 97.22°W, *s.d., Liebmann 496* (US-2473642).


**FIGURE 34.** Geographical distribution of *Bromus dolichocarpus* in México and Central America.

10. ***Bromus exaltatus*** Bernhardi (1841: 90). Figs. 35, 36.

*Bromus subalpinus* Ruprecht in Galeotti (1842: 237), *nom. nud. Bromus subalpinus* Rupr. ex Fournier (1886: 128), *nom. inval.,*as synonym of *B. exaltatus*. *Bromopsis exaltata* (Bernh.) Holub (1973: 167). Type:—MÉXICO. *Anonymous s.n.* (lectotype MO-2957788!, designated by Davidse & Pohl 1992: 100, isotypes LE-00000754!, LE-00000755!). Soderstrom & Beaman (1968) neotypified *B. exaltatus* based on their understanding that original material in the Bernhardi Herbarium (MO) was missing, as reported by Wagnon (1950) and Shear (1901). Their neotype followed a species concept used by Fournier (1886) and later Hitchcock (1913). However, two sheets of original material were later found at MO, one of which Davidse & Pohl (1992) selected as the lectotype of *B. exaltatus*, superseding the neotypification. One of the isotypes at LE (LE-00000754) is a mixed sheet with *B. carinatus* var. *marginatus*.

Plants perennial, not rhizomatous. Culms 70–120 cm tall, (1–)2–3 mm wide at base, erect or ascending, glabrous or pubescent below inflorescences; nodes 2–4, weakly to densely pubescent. Leaf sheaths moderately to densely pilose, hairs up to 1.2 mm long; auricles absent or present; ligules 0.6–2.5 mm long, glabrous or pubescent, erose-lacerate; blades up to 39 cm × 2.5–7 mm, flat, adaxial surfaces weakly to moderately pilose, hairs up to 0.8 mm long, abaxial surfaces glabrous, margins serrulate. Panicles 15–27 cm × 3–9 cm, open, nodding, branches ascending, 0.8–6 cm long, shorter or longer than spikelets, scabrous, 1–4 spikelets per branch. Spikelets 2.1–3.1(–3.4) cm long, 6–9-flowered, linear-elliptic, moderately laterally compressed; glumes glabrous or pubescent, hairs up to 0.8 mm long, margins narrowly hyaline, midnerves glabrous to scabrous distally or pubescent throughout, hairs up to 0.4 mm long; lower glumes (7–)9–11 mm long, linear-lanceolate, 1- or 3-nerved, lateral nerves sometimes weak, green to purplish-green along and between nerves, apices attenuate to acute; upper glumes (9–)11–14 mm long, lanceolate, 3-nerved, green to purplish-green along and between nerves, apices acute to mucronate, mucros up to 1.5 mm long; lemmas 12–16 mm long, linear-lanceolate, gradually narrowed to apices, apices acute to obtuse, 5–7-nerved, green to purplish-green along and between nerves, backs glabrous or weakly to

moderately pubescent proximally, hairs appressed and up to 0.2(–0.3) mm long, usually glabrous distally, sometimes pubescent, hairs up to 0.2 mm long, margins pubescent with hairs up to 0.6 mm long, nerves scabrous; awns 2.5–6 mm long, straight, inserted up to 0.5 mm below lemma apex, straight; paleas shorter and narrower than the lemmas, backs puberulent, keels ciliate, cilia up to 0.2 mm long; anthers 1.7–2.5 mm long; caryopses 7.5−10 mm long, light brown. 2*n* = 14 (Pohl & Davidse 1971).

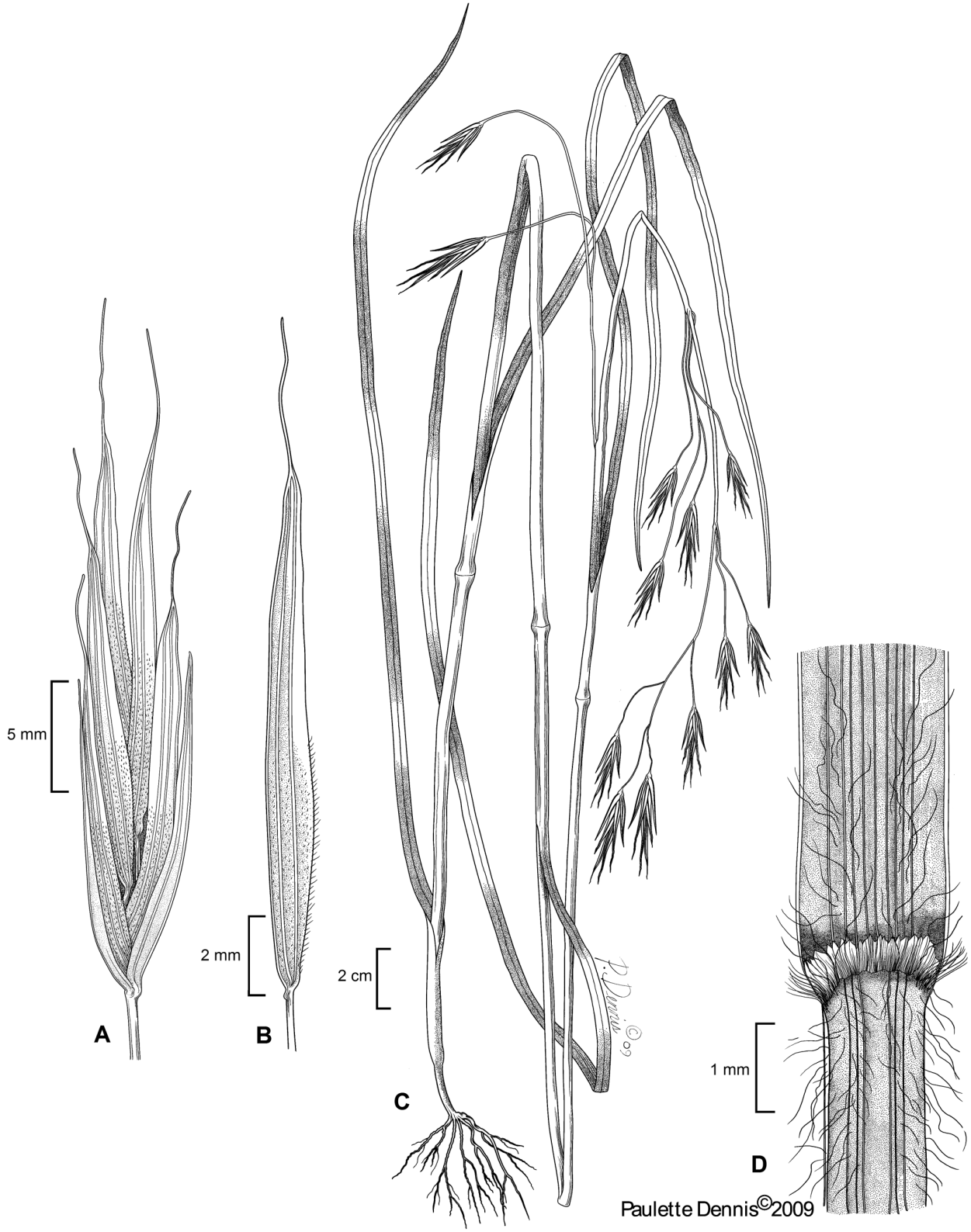


**FIGURE 35.** *Bromus exaltatus*. A. Spikelet. B. Lemma. C. Habit. D. Ligule. Based on *Hitchcock 883* (GH). Illustration by Paulette Dennis © Paulette Dennis.

**Distribution:—**Native. Central México (Distrito Federal, Guerrero, Hidalgo, Jalisco, Estado de México, Michoácan, Oaxaca, Puebla, Querétaro, San Luis Potosí, Tlaxcala, Veracruz), Costa Rica (San José), Guatemala (Chimaltenango, Huehuetenango, Quezaltenango, Sacatepéquez, San Marcos, Totonicapan) and Panama (Chiriqui) (Fig. 37). *Bromus exaltatus* is the only native *Bromus* species known from Panama.

**Ecology:—**This species occurs on steep rocky slopes, arroyos, wet meadows and roadsides; associated with *Pinus* spp., *P. hartwegii*, *P. rudis*, *Quercus* spp., *Abies religiosa*, *Juniperus*, *Pseudotsuga menziesii*, *Cupressus*, *Arctostaphylos pungens*, *Lupinus*, *Arbutus*, *Alnus*, *Senecio* Linnaeus (1753: 866), *Symphoricarpos*, *Coreopsis* Linnaeus (1753: 907) and *Buddleja*. Elevation: 3250–3739 m (Costa Rica), (2550–)3000–4200 m (Guatemala), 2400–3688 m (México), (1700–)2800–3170 m (Panama). McVaugh (1983) noted *B. exaltatus* to be local or rare throughout its range.

**Comments:—**Most specimens from Guatamela, Costa Rica and Panama have lemmas that are pubescent across the backs, while specimens from México have lemmas that are pubescent across the backs proximally and glabrous distally. Lemma margins are pubescent throughout the range of the species.

*Bromus exaltatus* is often confused with *Festuca breviglumis* Swallen (1950: 398) (McVaugh 1983, J.M. Saarela & P.M. Peterson pers. obsv.), which is similarly distributed from central México to Costa Rica. McVaugh (1983) noted that *F. breviglumis* is more common than *Bromus* species in western México. Although superficially similar, the two species are readily distinguished by a number of characters. *Bromus exaltatus* differs from *F. breviglumis* in its closed sheaths [vs. open], anthers < 3 mm long [vs. (3–)4–4.5(–5.3) mm long], lemmas that are pubescent marginally, proximally and sometimes distally [vs. glabrous or puberulent], lower glumes (5–)9–11 mm long [vs. (3–)4–5(–8) mm long], upper glumes 11–14 mm long [vs. 5.5–7(–9) mm long], awns 2.5–6 mm long [vs. (6–)8–12(–20) mm long], palea keels ciliate [vs. scabridulous] and lemmas inserted <0.5 mm below the lemma apex [vs. 0.5–1.2 mm below the lemma apex] (McVaugh 1983).

**Specimens Examined:—COSTA RICA.** Buenavista massif, road to Cerro Buvis, 3400m, 16 August 1969, *A.E. Weston 5885* (CR-81595). **San José:** Cantón de Pérez Zeledón, Chirripó-Cuericí, 9.4661°N, 83.4944°W, 3400–3739 m, 20 July 1966, *E. Alfaro 568* (INB-60022); Cordillera de Talamanca, Cerro de la Muerte, Asunción summit, [9.5°N, 83.67°W], 3250 m, 13 July 1966, *R.W. Pohl & G. Davidse 10692* (CR, F-1733108, US-3096597); Pérez Zeledón, P.N. Chirripó, Cuenca Térraba-Sierpe, 9.4512°N, 83.5046°W, 3350 m, 1 September 2000, *A. Rodríguez 6542, V. Ramírez, G. Soto, L. Acosta & G. Sancho* (INB, MO); Valle de los Leones and in the lower part of the Valle de los Conejos along upper Río Talari, 9.45°N, 83.5167°W, 3250–3450m, 21–23 August 1971, *W.C. Burger 8218 & L. Gómez P.* (CR-54405, F-1824924, NY); Cerro de la Muerte, C.R. [9.57°N, 83.75°W], 3400 m, 30 August 1952, *J.B. Carpenter 557* (US-2117586); Chirripó, camino Sabana Leones, [9.32°N, 83.61°W], 5–13 November 1976, *R.A. Ocampo 1494* (CR-63401); Chirripó, Valle de los Conejos, [9.32°N, 83.61°W], 5–13 November 1976, *R.A. Ocampo 1463 & 1465* (CR-63336); Asunción summit, Cerro de la Muerte, [9.57°N, 83.75°W], 3335m, 22 July 1966, *R.W. Pohl 10114 & C. Calderón* (CR-140884). **GUATEMALA.** Ixchiguan, San Marcos, [15.17°N, 91.93°W], 3200 m, 27 August 1977, *D.N. Smith & B. Olson 765* (F-2069462); Totonicapán, on road between Huehuetenango and Sija, [14.91°N, 91.36°W], 3000–3450 m, 20 February 1939, *P.C. Standley 65867* (F-987424)**. Huehuetenango:** Sierra Cuchumatanes, 15.42°N, 91.34°W], 11100 ft [3383 m], 15 September 1934, *A.F. Skutch 1242* (GH, US-1637903); Sierra de los Cuchumatanes, between Tojiah and Chemal at km 319.5 on Ruta Nacional 9 N, [15.42°N, 91.34°W], ca. 3380 m, 30 July 1960, *J.H. Beaman 3796* (GH, MSC-172050, US-2381693); Aldea San Nicolás, Chinautla, [14.71°N, 90.5°W], 3160 m, 16 August 1976, *D.N. Smith 317* (F-2069942, F-2069943, F-1788847); between Tojquia and Caxin bluff, summit of Sierra de los Cuchumatanes, [15.54°N, 91.54°W], 3700 m, 6 August 1942, *J.A. Steyermark 50151a* (US-1935058, F-1201444); ladera sur del valle del Llano de la Ventura, Yac, Todos Santos, [15.77°N, 91.57°W], 3580 m, 7 August 1977, *D.N. Smith 654* (F-2069461); near Tuinimá, Sierra de los Cuchumatanes, [15.63°N, 91.52°W], 3300–3500 m, 6 July 1942, *J.A. Steyermark 48273* (F-1201464). **Quezaltenango:** Volcán Santa Mariá, upper NE-facing slopes to summit of Volcáno, [14.76°N, 91.55°W], 3000–4200 m, 13 January 1949, *J.A. Steyermark 34159* (F-1045771). **Sacatepéquez:** Volcán Agua, 5 December 1911, 14.465°N, 90.7431°W, 2000–3500 m, *A.S. Hitchcock 9113* (MICH-1119235, S-1009548). **San Marcos:** Las Ventanas, San José Ojetenám, [14.77°N, 89.93°W], 3440 m, 11 October 1977, *D.N. Smith 929* (F-1858162); upper slope of Volcán Tajumulco, between Las Canojas and top of ridge, 7 mi from San Sebastián, [15.03°N, 91.9°W], 3300–3900 m, 16 February 1940, *J.A. Steyermark 35856* (F-1052008). **Totonicapan:** on the Tecum Uman ridge at km 154 on Ruta Nacional no. 1, ca. 20 km E of Totonicapan, [14.98°N, 91.41°W], ca. 3340 m, 13 August 1960, *J.H. Beaman 4146* (US-2381724); Tecum Uman Ridge at km

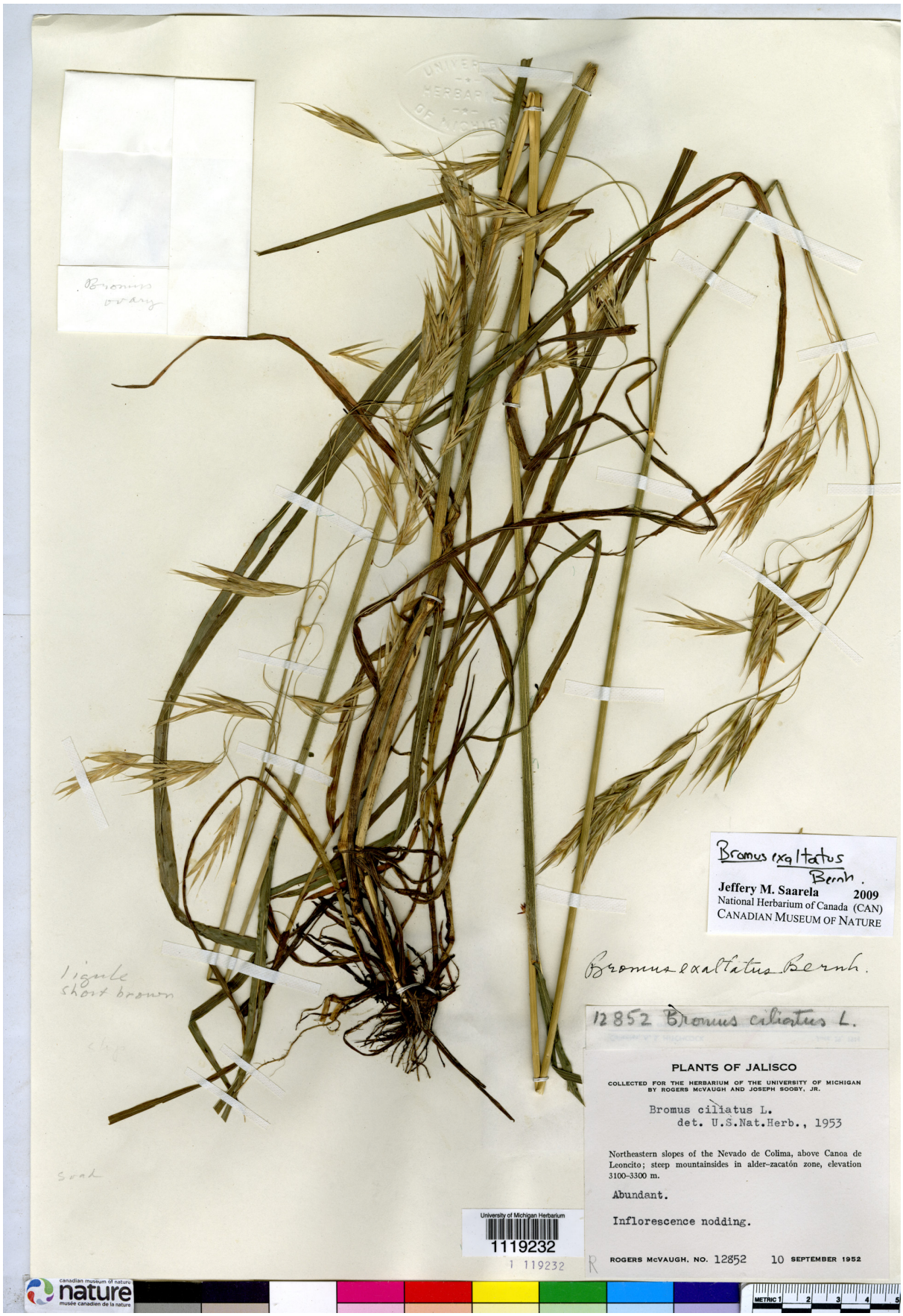


**FIGURE 36.** *Bromus exaltatus*. *McVaugh 12852* (MICH-1119232).

154 on Ruta Nacional No. 1 ca 20 km E of Totonicapan, [14.91°N, 91.36°W], ca. 3340 m, 13 August 1960, *J.H. Beaman 4146* (MSC-171998). **MÉXICO. Chiapas:** San Cristóbal Las Casas, 19 December 1972, 16.7100°N, 92.6200°W, 7200 ft., *J.R. Reeder & C.G. Reeder 6068* (MO); about 15 mi SE of Teopisca, 21 August 1953, 16.47°N, 92.29°W, *J.R. Reeder & C.G. Reeder 2031* (MO); Amatenango del Valle, 14 km SE of Teopisca along highway to Comitán, 16.5°N, 92.32°W, 2100 m, 15 November 1984, *G. Davidse, M. Sousa S., O. Tellez V., E. Martínez L. & J. Davidese 29801* (MO); NE edge of San Cristóbal Las Casas, 16.73°N, 92.63°W, 2250 m, *D.E. Breedlove & G. Davidse 54749* (MO); Zinacantán, near Paraje Nachij [Nachig], 16.72°N, 92.72°W, 28 October 1981, *D.E. Breedlove & G. Davidse 53890* (CAS, MO). **Distrito Federal:** 14 mi E of Amecameca on road towards Puebla, in Parque Nacional Izta-Popo, 19.087°N, 98.68°W, 3330 m, 13 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16166* (CAN, MO, US); Llano Grande, cerca del Desierto de los Leones, Delegación Cuajimalpa, [19.32°N, 99.29°W], 3300 m, 18 January 1970, *J. Rzedowski 26998* (MICH-1119236); Valle de México, Cerro de Sta. Rosa, Contreras, 19.3°N, 99.2833°W, 2900 m, 5 November 1950, *E. Matuda 18647* (MEXU-230673, US-2040887). **Guerrero:** Cima del Cerro Teotepec, [17.45°N, 100.16°W], 3200 m, 24 August 1999, *E. Domínguez 852* (MEXU); Mpio. Chilpancingo, al E de Omiltemi, rumbo a Cuevade la Viego, [17.56°N, 99.5°W], 7 October 1985, *G. Lozano Valdez 883* (MEXU-486848); Mpio. General Heliodoro Castillo, Puerto Unión, ladera Cerro Teotepec, [17.45°N, 100.16°W], 3030 m, *N. Diego, B. Ludlow & J.M. Davila 8205* (MEXU); Mpio. Tlacotepec, Cerro Teotepec, [17.45°N, 100.16°W], 3350 m, 5 December 1963, *J. Rzedowski 18153* (ARIZ-237656, MICH-1119237). **Hidalgo:** Valle de México, Real del Monte, 20.1333°N, 98.6667°W, 2600 m, 12 August 1951, *E. Matuda 21646* (MEXU-91094, US-2041604). **Jalisco:** 20.4 mi SW of Ciudad Guzmán, NE slopes of Nevado de Colima, 19.5971°N, 103.5869°W, 3245 m, 5 October 2001, *P.M. Peterson & O. Rosales 16087* (CAN, MO, US); 21.7 mi SW of Ciudad Guzmán, NE slopes of Nevado de Colima, 19.5962°N, 103.5896°W, 3282 m, 6 October 2001, *P.M. Peterson & O. Rosales 16110* (CAN, MO, US); 23.4 mi SW of Ciudad Guzmán, NE slopes of Nevado de Colima, 19.5935°N, 103.5923°W, 3415 m, 6 October 2001, *P.M. Peterson & O. Rosales 16108* (CAN, MO, P-03216907, US); Mpio. Tuxpan, 19 km al SO del Rancho de Las Milanes, brecha al Parque Nacional El Nevado, [19.56°N, 103.61°W], 3200 m, 20 Enero 1990, *J. Villa C., S.D. Koch & J. Chavez L. 557* (MICH-119231); NE slopes of the Nevado de Colima, above Canoa de Leoncito, 19.6167°N, 103.65°W, 3100–3300 m, 10 September 1952, *R. McVaugh 12852* (MEXU-772540, MICH-1119232, NY, US); road from Zapotlán to Mt. Nevada, 19.7°N, 103.5167°W, 1829–2743 m, 23–24 September 1910, *A.S. Hitchcock 7152* (US-1009479); Taludes de exposición N del Nevado de Colima, [19.56°N, 103.61°W], 19 September 1980, *A.A. Beetle & R. Guzmán M-5375* (MEXU). **Estado de México:** circa urben México secus margines agrorum ubi Mays consita, January, *W. Schaffner 42* (P-02630901); Mpio. Zinacantepec, a 4.93 km al SE de Ojo de Agua, 19.1786°N, 99.74°W, 3368 m, 11 October 1995, *A. Ramírez Abarca 678* (MEXU-1089789); 1.7 mi E of Hwy. 10 along road to Nevado de Toluca, 19.1347°N, 99.8°W, 3688 m, 9 October 2007, *P.M. Peterson, J.M. Saarela & M.J. Flores Villegas 21350* (CAN, MO, P-03216870, US); junction of Hwy. 10 and road to Parque Nacional Nevado de Toluca, NW of the volcán, 19.1506°N, 99.8°W, 3572 m, 11 October 2001, *P.M. Peterson & Y. Herrera-Arrieta 16155* (CAN, MO, US); Mount Popocatépetl, 19.0222°N, 98.6278°W, 2700 m, 7 August 1910, *A.S. Hitchcock 883* (F-715973, GH); Mpio. Amecameca, primera cañada al N de la carretera al Paso de Cortés, sobre una brecha maderera que entra en el km 15, 19.06°N, 98.7°W, 3310 m, 10 December 1976, *S.D. Koch 76323* (US-2832267); Mt. Popocatépetl, 19.0333°N, 98.6333°W, 3048 m, 5–6 August 1910, *A.S. Hitchcock 5985* (NY, US-1009480) & *993* (US-1009498). **Oaxaca:** Cañada El Derrumbadero, 7 km al NW de La Cofradía comunidad de San Pedro El Alto, [16.04°N, 96.47°W], 2800 m, 7 October 1998, *A.G. Miranda M. & O.L. Hernández Martínez 188* (MEXU-907865); Mpio. Zimatlán, Paraje Puesto Vigía, Comunidad de San Pedro El Alto, [16.04°N, 96.47°W], 3000 m, 30 November 1998, *A.G. Miranda Moreno 798* (MEXU); vicinity of Cerro Zempoaltepetl, 17.09°N, 95.88°W, 2900–3100 m, 10 August 1950, *B. Hallberg 913* (MEXU-58486, MICH-1119228, US). **Puebla:** 23.5 mi Ea of Amecaneca on road towards Puebla in Parque Nacional Izta-Popo, 19.089°N, 98.6°W, 3360 m, 13 October 2001*, P.M. Peterson & Y. Herrera-Arrieta 16174* (MO, US); Mpio. San Nicolás de los Ranchos, Declive E del Paso de Cortés, 3.5 km (5 km por la brecha) al NE del entronque de la..., 19.0667°N, 98.4833°W, 3600 m, 6 December 1976, *S.D. Koch 76315* (US-2832233). **Queratero:** just below Cerro El Zamorano, 20.9328°N, 100.1839°W, 3191–3250 m, 25 September 2012, *P.M. Peterson, K. Romaschenko & S. Zamudio Ruíz 24681* (US). **San Luis Potosí:** *Virlet d'Aoust 1410* (P-02630902); 30 mi E of San Luis Potosí, along Hwy. 86 to Rioverde, 22.06°N, 100.56°W, 2103 m, 13 July 1963, *R.L. McGregor, L.J. Harms, A.J. Robinson*, *R. del Rosario & R. Segal 607* (US). **Sonora:** along Arroyo El Kipor (Quipor) and on Cordon Las Taunas, from El Kipor E. to Tierra Panda (Las Taunas), 28.4°N, 108.5583°W, 1680 m,

*T.R. Van Devender & A.L. Reina G. 95-936* (ARIZ-322740). **Tlaxacala:** Parte alta de la Malinche, [19.38°N, 98.05°W], 26 June 1993, *E. Oviedo 39* (MEXU-1089796); Volcán Malinche, NW slopes, approached from Huamantla, 19.3°N, 98°W, 3340 m, 3 September 1962, *D. Ugent, V. Ugent & R. Flores-C. 1436* (US-2543137). **Veracruz:** Barranca El Caracol, Parque Nacional Cofre de Perote, 19.5°N, 97.1°W, 3200 m, 17 August 1983, *H. Narve F. 942* (MEXU-726958); Mpio. Xico, Barranca de Morei, cerca de la rancheria Paso Panal, 4 km al E de Tembladoras, 19.5°N, 97.15°W, 2900 m, 14 September 1983, *H. Narave F. 1008* (MEXU-793415); Mt. Orizaba, 19.0167°N, 97.22°W, 25–26 July 1901, *J.N. Rose & R. Hay 5733* (MEXU, US-395519. **PANAMA. Chiriqui:** Volcán de Chiriqui, Potrero Muleteo to summit, [8.79°N, 82.52°W], 3500–4000 m, 13–15 July 1940, *R.E. Woodson, Jr. & R.W. Schery 408* (GH, MO, US-1818226); Volcán de Chiriqui, Potrero Muleto to summit, Boquete District, [8.79°N, 82.52°W], 10,400 ft [3170 m], 18 July 1938, *M.E. Davidson 1047* (F-934768, US-1820854); Chiriqui Volcáno, [8.77°N, 82.5°W], 3000 m, 29–30 September 1911, *A.S. Hitchcock 8214* (MICH-1119234, US-1009552).


**FIGURE 37.** Geographical distribution of *Bromus exaltatus* in México and Central America.

11. ***Bromus frondosus*** (Shear) Wooton & Standley (1912: 144). Figs. 38, 39.

Basionym: *Bromus porteri* var. *frondosus* Shear (1900: 37). *Bromopsis frondosa* (Shear) Holub (1973: 167). Type:—UNITED STATES OF AMERICA. New México: Grant Co., Mangas Springs, 19 August 1897, *J.G. Smith s.n.* (holotype US-81587!).

Plants perennial, not rhizomatous. Culms 54–84 cm tall, 2–4 mm wide at base, erect to spreading, glabrous below inflorescences, nodes 3–5, glabrous, occassionally with a few short hairs. Leaf sheaths sparsely to densely pilose, hairs up to 1.2 mm long; auricles absent; ligules 0.5–2 mm long, glabrous; blades up to 29 cm × 4–6 mm, flat, adaxial and abaxial surfaces usually glabrous, sometimes pubescent, hairs up to 1 mm long distally, margins serrulate. Panicles 9–13 cm × 3–6 cm, open, nodding, branches ascending to spreading, 0.5–5 cm long, shorter or longer than spikelets, scabrous, 1–4 spikelets per branch. Spikelets 1.6–3 cm long, 7–9-flowered, elliptic to lanceolate, terete to moderately laterally compressed; glumes glabrous, scabrous or minutely pubescent, hairs when present sometimes restricted to margins, margins hyaline, midnerves glabrous or scabrous; lower glumes 6–8.5 mm × 0.6–1.0 mm, lanceolate, 3-nerved, green along and between the nerves, apices acute; upper glumes 8–10 mm × 0.9–1.3 mm, oblong-ovate, 3-nerved, green along and between the nerves, apices acute or mucronate, mucros to 1 mm long; lemmas 9–12 mm × 1.5–2.5 mm, elliptic to lanceolate, rounded over the backs, apices truncate, 5–7-nerved, green along and between the nerves, backs glabrous or sparsely to densely pubescent, margins pubescent on lower third to half, hairs up to 1 mm long; awns 3.5–6 mm long, arising 0–0.5 mm below lemma apex, straight;

paleas shorter than the lemmas, 9–10 mm long, backs glabrous or pubescent, keels ciliate, cilia up to 0.2 mm long; anthers 1.5–3.5 mm long; caryopses 6−8 mm long. 2*n* = 14 (Wagnon 1952).

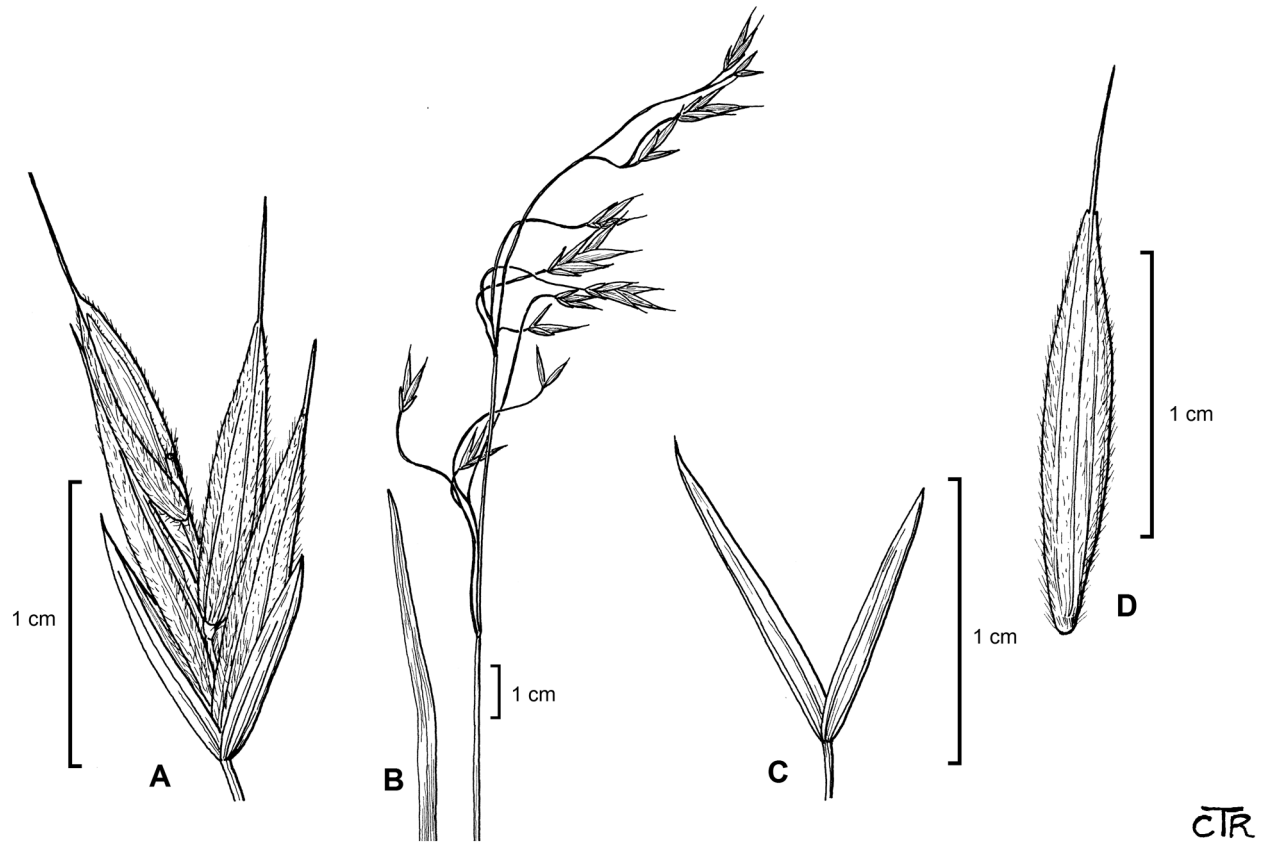


**FIGURE 38.** *Bromus frondosus.* A. Spikelet. B. Inflorescence. C. Glumes. D. Lemma. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:—**Native. In México *B. frondosus* is known from Chihuahua, Coahuila, Durango, Sinaloa and Sonora (Fig. 40). It extends northwards to Colorado, New México and Arizona (Pavlick & Anderton 2007).

**Ecology:**—*Bromus frondosus* is found on rocky slopes and rock outcrops, roadcuts and rocky meadows; associated with *Pinus cembroides*, *Pinus* spp., *Quercus*, spp., *Juniperus deppeana*, *Abies religiosa*, *Pseudotsuga menziesii*, *Cupressus arizonica*, *Rhamnus*, *Ceanothus*, *Arbutus*, *Arctostaphylos pungens*, *Cercocarpus* Kunth in Humboldt (1824: 6), *Salvia*, *Platanus wrightii* Watson (1875: 349), *Senecio* and *Garrya flavescens* Watson (1873: 301). Elevation: 1295–2745 m.

**Common Names:—**Weeping brome (English); bromo frondoso (Spanish).

**Comments:—***Bromus frondosus* is distinguished by its 3-nerved lower glumes.

**Specimens Examined:—MÉXICO. Chihuahua:** Mpio. Madera, Laguna de Babícora, Arroyo Las Varas, [29.0556°N, 106.8611°W], 2300 m, 10 September 1994, *G. Quintana & E. Estrada 3556* (NY); "Rancho el peñasco" km 150 carretera Chihuahua-Cd. Juárez, [29.77°N, 107.37°W], 1720 m, 9 August 1979, *M. Siqueiros 336* (MEXU-1098029); 20.3 km NE of Ignacio Zaragoza on MEX 23, [29.75°N, 107.64°W], 2400 m, 28 September 1989, *P.M. Peterson & R.M. King 8154* (CAN, US); 24.7 mi N of San Juanito on road towards Cuauhtémoc, 28.2636°N, 107.4931°W, 2233 m, 5 September 2008, *P.M. Peterson & J.M. Saarela 22028* (CAN, US); 30.2 km N of San Juanito on road to Creel, [28.26°N, 107.61°W], 2235 m, 10 September 1989, *P.M. Peterson, C.R. Annable & Y. Herrera-Arrieta 8002* (CAN, MO, US); 34 mi W of Balleza on road towards Guachochic, [27.12°N, 106.79°W], 2500 m, 29 October 1995, *P.M. Peterson, M.B. Knowles, C.H. Dietrich & S.M. Braxton 13539* (US); 8 mi N of Santo Tomás, 28.81°N, 107.5667°W, 2010 m, 8 October 1953, *J.R. Reeder & C.G. Reeder 2625* (US-2473583); ca. 23 (air) mi ENE of Villa Ahumada in NW canyon of Sierra de la Alcaparra NE of Rancho El Palmar, 30.6667°N, 106.1°W, 6000 ft [1828 m], 12 September 1973, *J. Henrickson 12864* (MEXU-1052580, RSA-POM-665758); Colonia Cumbres de Majalca, 33.8 km W of MEX 45, N of Chihuahua City, [28.8°N, 106.46°W], 2190

m, 7 September 1989, *P.M. Peterson, C.R. Annable & Y. Herrera-Arrieta 7969* (CAN, US); km 11 entre San Buenaventura y El Carmen, carratera Nuevo Casas Grandes, 29.84°N, 107.47°W, 1600 m, 19 September 1955, *E. Hernández X. & V. Mathus L. N-1941* (GH); km 18 de San José Babícora a Santa Ana Babícora, 2200 m, 30 October 1954, *E. Hernández X. & C. Tapia J. N-438* (GH); Majalca (Pilares), [28.68°N, 106.11°W], 12 September 1939, *L.H. Harvey 1485* (GH, mixed sheet with *B. carinatus* var. *carinatus*); Majalca, [28.73°N, 106.1°W], 18–20 September 1935, *H. LeSueur 30* (GH); Majalca, NW of Chihuahua, [28.73°N, 106.1°W], 2050–2100 m, 29 September 1934, *F.W. Pennell 19299* (GH); near Colonia Garcia, [29.97°N, 108.35°W], 7500 ft [2286 m], 14 September 1899, *C.H.T. Townsend & C.M. Barber* (MSC-229571); Río Negro, 28 August 1937, *H. LeSueur 0213* (GH); San Ysidro, SW of Barranca, [28.5667°N, 107.45°W], 13 May 1929, *Y. Mexia 2524* (MICH-1119284, NY, RSA-POM-364164); Sánchez, [31.77°N, 107.64°W], 8000 ft [2438 m], 12 October 1910, *A.S. Hitchcock s.n.* (MEXU); Santa Clara Canyon, [29.72°N, 107.08°W], 18 August 1936, *H. LeSueur 0123* (GH); Sierra de los Órganos, 28.25°N, 104.75°W, 9 August 1937, *H. LeSueur 211* (GH, mixed sheet with *B. carinatus* var. *marginatus*), US-1721654); Sierra Madre Mts., Colonia Juárez, [30.3°N, 108.06°W], 6000 ft [1829 m], 12 September 1903, *M.E. Jones s.n.* (RSA-POM-112405); Sierra Madre Mts., Meadow Valley, [30.3°N, 108.06°W], 7000 ft [2134 m], 17 September 1903, *M.E. Jones s.n.* (RSA-POM-112403); Sierra Madre Occidental, 12.1 mi W of San Juanito on road towards Baquiriachic, 27.9567°N, 107.76°W, 2530 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15358* (CAN, US); Sierra Madre Occidental, 16.7 mi W of Baquiriachic on Hwy. 16 towards Maycoba, 28.3543°N, 108.28°W, 2000 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15353* (CAN, MO, US); Sierra Madre Occidental, 20.3 mi S of Creel on road towards Rocheachic, 27.5387°N, 107.51°W, 2510 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15368* (CAN, US); Sierra Madres near Colonia Garcia, [29.97°N, 108.34°W], 7500 ft [2286 m], 14 September 1899, *C.H.T. Townsend & C.M. Barber 327* (F-103052, MEXU-5764, MICH-1119280, MSC-229571, NY, 2 sheets); SW slope of Sierra de la Ranchería (on Rancho Candelaria), 31.0167°N, 106.35°W, 1500–2180 m, 29 October 1972, *T.L. Wendt, F. Chiang & M.C. Johnston 9949* (MEXU-729813, NY); 19.6 km W of Balleza and 74.2 km E of Guachochi, [26.9453°N, 106.4783°W], 2120 m, 18 September 1991, *P.M. Peterson, C.R. Annable & J. Valdés-Reyna 10753* (US); along dirt road to Cuesta Blanca in Sierra Brena SW of Colonia Juárez, 2256 m, 21 September 1992, *K.W. Allred, T. Columbus & J. Valdés-Reyna 5727* (ANSM); 19.6 km W of Balleza and 74.2 km E of Guachochi, 2120 m, 18 September 1991, *P.M. Peterson, C.R. Annable & J. Valdés-Reyna 10753* (US); Boycoyna, La Junta, Alrededores, 13 September 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 32463* (US-3589121); Creel, Chih. 125 Creel km 90, Sitio 125 km 96.2, La Mesa de Yeguachi, 27°47.155'N, 107°38.611'W, 2248 m, 13 September 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 32541* (US-3589119); Guachochi, Norogachi, Planicie, 16 September 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 32771* (US-3589146). **Coahuila:** Mpio. Saltillo, area montañosa del Cañón "San Lorenzo", 25.3167°N, 101.95°W, 2000 m, *M.G. Villaseñor s.n.* (ANSM); Sierra del Carmen, 28.9867°N, 102.9739°W, 2432 m, 30 August 1997, *S. Wood, C. Crider & D. Doan-Crider s.n.* (ANSM); Maderas del Carmen, 2.0 mi from Campo Uno, up the road towards the summit, 29.0062°N, 102.6054°W, 2571 m, 22 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 21029* (CAN, MO, US); Sierra El Jardín, 29.0832°N, 102.6371°W, 2100 m, 3 September 2006, *P.M. Peterson & S. Lara-Contreras 19941* (CAN, US). **Durango:** Sierra Madre Occidental, 11 mi NE of Ojito de Camillones on road towards Papasquiaro, 25.0912°N, 106.136°W, 2580 m, 12 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15436* (US); Sierra Madre Occidental, W of Ciudad Durango, 6 mi W of El Salto, 23.7418°N, 105.452°W, 2745 m, 27 August 1958, *J.R. Reeder & C.G. Reeder 3123* (US-2473577); 30 km W of Durango on Hwy. 40, just E of Rio Chico crossing, 2200 m, 29 September 1988, *P.M. Peterson & C.R. Annable 6007* (US). **Sinaloa:** loop of the Río de Bavispe, NE Sonora, Cerro del Capulín, NW of Aribabi, 30.1°N, 109.083°W, 1875 m, 4 September 1939, *L.H. Harvey 1693* (US-1762717); Morelos, 30.8167°N, 109.2167°W, 15 September 1947, *J. Vera-Santos 1939* (US-2079260); region of the Río de Bavispe, NE Sonora, El Bilito, NE of El Tigre, 30.61°N, 109.17°W, 1890 m, 12 October 1941, *J. Vera-Santos 2128* (US-1938696). **Sonora:** Arroyo Hondo, 11.5 km E of El Kipor, 4 km W of Chihuahua border on Son., 28.4417°N, 108.78°W, 1460 m, 11 September 1996, *T.R. Van Devender, A.L. Reina G., G. Ferguson & L. Coyote 96-563* (ARIZ-332596, RSA-POM-610275); Cerro El Capulín, NW of Aribabi, [29.91°N, 109.99°W], 1875 m, 4 November 1939, *L.H. Harvey 1693* (MICH-1119279); El Bilito, NE of El Tigre, [30.59°N, 109.22°W], 6200 ft [1890 m], 12 October 1941, *J. Vera Santos 2128* (MICH-1119213) & *2136* (NY); El Picacho del Pilar, 7400 ft [2255 m], 13 October 1941, *J. Vera Santos 2167* (MICH-1119124); El Puerto del Cumarito, Sierra de la Cabellera, [30.92°N, 109.11°W], 5400 ft [1646 m], 6 October 1941, *J. Vera Santos 2079*

(MICH-1119282, NY); El Rancho de Robles, NE of El Tigre, [30.76°N, 109.18°W], 6000 ft [1829 m], 2–13 September 1941, *J. Vera Santos 1939* (ARIZ-124777, MICH-1119278, MEXU-537473, NY, US-1938676); La Matancita, 1 mi W of El Tigre, [30.76°N, 109.18°W], 4250 ft [1295 m], 30 August 1941, *J. Vera Santos 1915* (ARIZ-124955, MICH-1119277, MEXU-537476, NY, US-1938674); Morelos, 15 September 1947, *J. Vera Santos 1915* (MICH-119276); N of Cananea Ejido José María Morelos, [30.98°N, 110.3°W], 25 September 1981, *A.A. Beetle M-7869* (ARIZ-234251, MEXU, MO); region of the Río de Bavispe, NE Sonora, El Puerto del Cumarito, Sierra de la Cabellera, 30.0333°N, 109.3333°W, 1646 m, 6 October 1941, *J. Vera-Santos 2079* (US-2463582, US-1938690); Sierra Madre Occidental, 1.7 mi W of Maycoba on Hwy. 16 towards Yécora, 28.4065°N, 108.68°W, 1720 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15351* (US); Sierra Madre Occidental, 1.8 mi W of Yécora on Hwy. 16 towards Hermosillo, 28.3583°N, 108.95°W, 1860 m, 3 October 2000, *P.M. Peterson & J. Cayouette 15315, 15317* (CAN, MO, US); Sierra Madre Occidental, 12.3 mi W of Yécora on Hwy. 16 towards Hermosillo, 28.3772°N, 109.05°W, 1810 m, 3 October 2000, *P.M. Peterson & J. Cayouette 15305* (US); Sierra Madre Occidental, 16 mi W of Maycoba on Hwy. 16 towards Yécora, 28.4002°N, 108.8°W, 1520 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15346* (US).


**FIGURE 39.** *Bromus frondosus*. *Harvey 1693* (MICH-1119279).

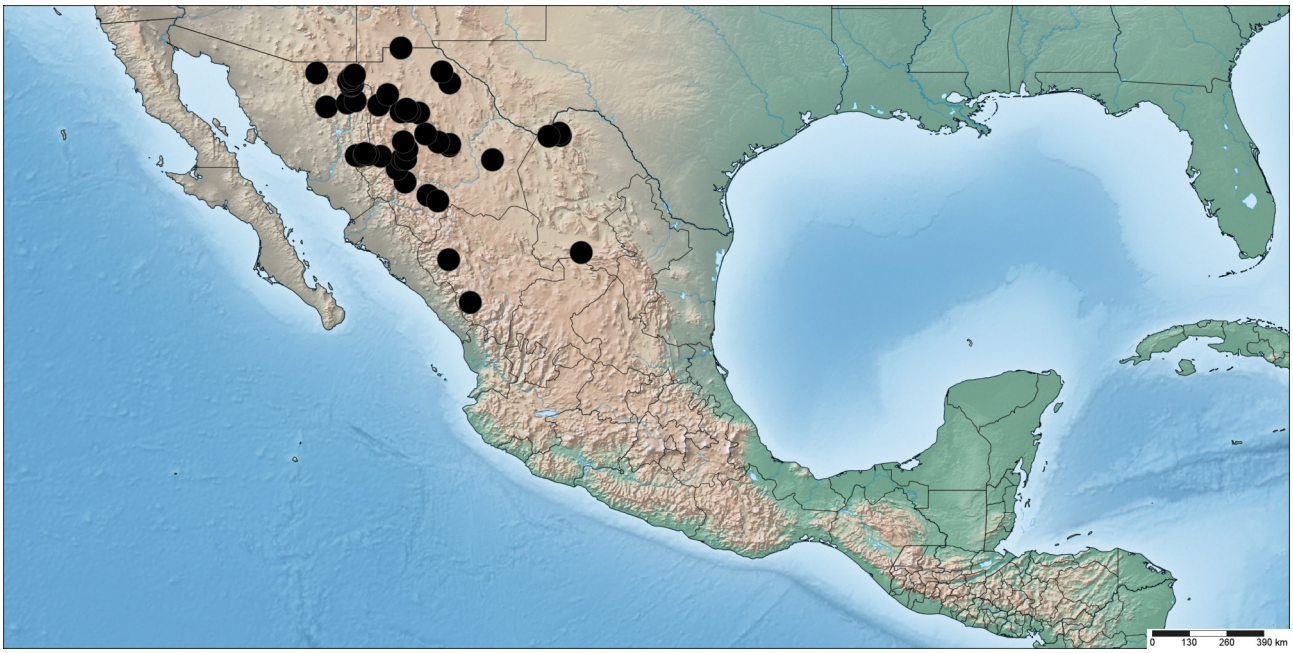


**FIGURE 40.** Geographical distribution of *Bromus frondosus* in México.

12. ***Bromus hordeaceus*** Linnaeus (1753: 77). Figs. 41, 42.

*Bromus secalinus* var. *hordeaceus* (L.) Linnaeus (1762: 122). *Bromus mollis* subsp. *hordeaceus* (L.) Hiitonen (1933: 219). Type:—[icon] "*Gramen avenaceum pratense, gluma breviore squamosa et villosa*" in Morison, Pl. Hist. Univ. 3: s. 8, pl. 7, f. 18. 1699 (lectotype designated by Smith in Cafferty *et al.* 2000: 248, epitype LINN-93.7!, designated by Smith in Cafferty *et al.* 2000: 248).

*Bromus mollis* Linnaeus (1762: 112). *Serrafalcus mollis* (L.) Parlatore (1840: 11). *Forasaccus mollis* (L.) Bubani (1901: 386). *Bromus hordeaceus* var. *mollis* (L.) Fiori (1923: 149). *Bromus hordeaceus* subsp. *mollis* (L.) Maire in Emberger & Maire (1941: 943). Type:—EUROPE. (lectotype LINN-93.6!, designated by Smith in Cafferty *et al.* 2000: 248).

Plants annual. Culms 7–110 cm tall, 0.8–5 mm wide at base, usually erect, sometimes ascending, bases sometimes decument, glabrous to sparsely pubescent below inflorescences; nodes 2–4, minutely to densely pubescent, hairs soft or stiff, up to 0.6 mm long. Leaf sheaths moderately to densely pilose, hairs up to 1.2 mm long; auricles absent; ligules 1–2.6 mm long, glabrous or pubescent, erose; blades 2.2–18 cm × 1–5.3(–7) mm, flat, adaxial surface densely pubescent with stiff hairs up to 1.2 mm long, abaxial surface pubescent with dense hairs up to 0.3 mm long or densely pubescent with stiff hairs up to 1.2 mm long, margins smooth or serrulate. Panicles 2.5–14 cm × 1–4 cm, erect, sometimes lax, dense, sometimes reduced to a single spikelet, branches ascending to erect, 0.2–1.2(–3) cm long, usually shorter than spikelets, scabrous to pubescent, 1–4 spikelets per branch. Spikelets 1.3–2(–2.2) cm long, 6–11-flowered, ovate-lanceolate, terete to moderately laterally compressed, rachillas sometimes visible at maturity; glumes sparsely to densely pubescent, margins hyaline, midnerves scabrous; lower glumes 5.2–7 mm long, oblong to ovate, 3–5-nerved, green along and between the nerves, apices acute; upper glumes 6–8.5 mm long, ovate to elliptic, 5–7-nerved, green along and between the nerves, apices acute to obtuse; lemmas 7.5–9 mm long, lanceolate, rounded over the backs, apices obtuse to truncate, often bifid, the cleft 0.3–0.7 mm deep, 7–9-nerved, green along and between the nerves, nerves conspicuously raised, particularly distally, backs densely pubescent, hairs up to 0.3 mm long, hyaline margins 0.3–0.6 mm wide, often bluntly angled, awns 4–7.6 mm long, arising 0.4–1.2 mm below lemma apex, straight or slightly divaricate; paleas shorter than lemmas, backs glabrous, keels ciliate, cilia up to 0.3 mm long; anthers 0.3–1.3 mm long; caryopses 4−6 mm long, terete in cross section to somewhat flattened. $2n = 28$ (Ainouche *et al.* 1999, Lövkvist & Hultgård 1999).

**Distribution:—**Introduced. In México known only from Baja California (Fig. 43). *Bromus hordeaceus* is thought to be native to the Mediterranean basin (Smith 1986) and is now distributed widely in North America (Pavlick & Anderton 2007, Saarela *et al.* 2008), Europe, Africa and Australia.

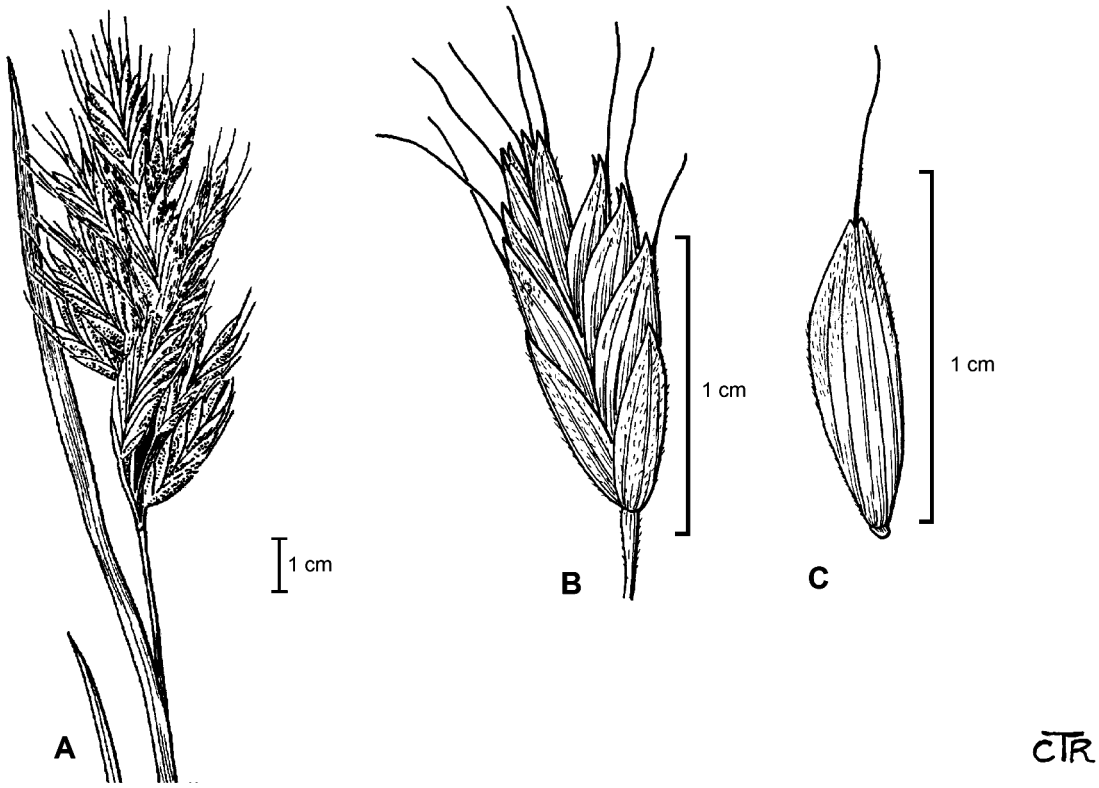


**FIGURE 41.** *Bromus hordeaceus.* A. Inflorescence. B. Spikelet. C. Lemma. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Ecology:—**This species is commonly found in disturbed sites along roadsides and railways, open pastures and near cultivated fields; associated with *Aesculus parryi* Gray (1882: 200), *Dudleya pulverulenta* var. *arizonica* (Rose 1923) Welsh (1987: 242), *Prunus* and *Hypochaeris glabra* Linnaeus (1753: 811). Elevation: 10–1475 m.

**Common Names:—**Soft chess, lopgrass, soft chess (English).

**Comments:—**Soderstrom & Beaman (1968) reported *B. hordeaceus* (as *B. mollis*) only from Gadalupe Island in Baja California, suggesting that the species has expanded its range in Baja California since the late 1960s. This appears to be the first report of *B. hordeaceus* from Baja California Sur (based on *M. Domínguez León 407*3, collected in 2008). We do not recognize varieties in *B. hordeaceus* in North America (see Saarela 2008 for discussion).

**Specimens Examined:—MÉXICO**. **Baja California:** "Ciénega de las Juntas", 28 May 1993, *Jaramillo V., Villegaas G. & Domínguez O. 72* (MEXU); 1.5 km NE of Las Delicias, ca. 17 km E of Ensenada, 31.9083°N, 116.425°W, 660 m, 20 May 1979, *R. Moran 27259* (SD-102448); arroyo 20 km SE of San Vicente, 31.1833°N, 116.15°W, 225 m, 12 May 1978, *R. Moran 25989* (MEXU, SD-100843); ca. 1 mi N of Camalú, [30.85°N, 116.07°W], 120 m, 26 March 1979, *J.R. Reeder & C.G. Reeder 7114* (MEXU, SD-116040, US); camino entre el Sausal y San Antonio de las Minas, al N de Ensenada, [31.99°N, 116.58°W], 28 April 1981, *R. Guzmán M. 1451* (MEXU); Cañada el Islay, 30.9917°N, 116.1083°W, 80 m, 10 May 1978, *R. Moran 25810* (SD-100846); City of Ensenada, 31.8703°N, 116.5864°W, 3 April 2007, *F. Casillas 81* (SD-182571); Coronado Islands, on NE slope above Hotel Cove, S Island, 32.5792°N, 117.2458°W, 100 m, 7 May 1976, *R. Moran 23103* (RSA-POM-283847, SD-95678); E of Saladito, 31.2583°N, 116.1375°W, 180 m, 10 April 1982, *R. Moran 30339* (SD-110828); Entrada a San Telmo de Abajo, [30.96°N, 116.1°W], 90 m, 27 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 87* (MEXU); Guadalupe Island, at airstrip camp, 29.0203°N, 118.2778°W, 585 m, 7 June 2000, *J.P. Rebman 6813* (SD-155060); Guadalupe Island, en route between NE Anchorage and spring, along W side of first large valley, [29.03°N, 118.3°W], 25 April 1958, I.*L. Wiggins & W.R. Ernst 105* (SD-48320); Guadalupe Island, slope above zigzags, 29.1583°N, 118.2875°W, 200 m, 25 April 1958, *R. Moran 6642* (SD-47592); in canyon, 1.0 km SW of Rancho de la Cruz, 31.9667°N, 116.5917°W, 360 m, 2 May 1982, *R. Moran 30493* (SD-111351); in field at SE


**FIGURE 42.** *Bromus hordeaceus*. *Moran 30418* (SD-111028).

edge of La Mesa, 32.4667°N, 116.9333°W, 50 m, 21 May 1977, *R. Moran 24150* (SD-97262); Islas de Todos Santos, S landing, S island, 31.8°N, 116.8°W, 11 May 1979, *R. Moran 27198* (SD-102482); just N of El López Portillo, ca. 5 mi S of Maneadero, [31.66°N, 116.52°W], 23 April 1984, *P.M. Peterson & C.R. Annable 02185* (US); La Misión, between Ensenada and Tijuana, in arroyo bottom along S side of river, 32.0908°N, 116.8767°W, 10 m, 18 April 1998, *J. Rebman, P. Flanagan & La Misión Community Group 5089* (RSA-POM-642759, SD-144704); Las Chichilhuas, on volcanic mesa 14 km SE of La Misión, 32.0083°N, 116.75°W, 350 m, 24 March 1979, *R. Moran 26769* (SD-101903); mesa near canyon rim SE of La Misión, 32.075°N, 116.8333°W, 250 m, 20 April 1969, *R. Moran 15792* (SD-71542); Mpio. Ensenada, "Cuesta del Lechero" km 35 carretera Ensenada-Ojos Negros, 31.9533°N, 116.3928°W, 700 m, 15 May 1997, *L. Aragón M. 566* (MEXU); Mpio. Ensenada, Coronel Esteban Cantu 14 km al SW de La Joya, 31.55°N, 116.6167°W, 100-570 m, 7 May 1987 *P. Tenorio L. & C. Romero de T. 13392* (MEXU); Mpio. Ensenada, Ensenada, [31.87°N, 116.59°W], 10 m, 21 April 1979, *Miguel Montoya 5* (MEXU); Mpio. Ensenada, 12 kms del Poblado de Sto. Tomás, rumbo al Ejido Nativos del Valle de Mexicali, 32.37°N, 116.95°W], 260 m, 8 April 1987, *L. Elena López 100* (MEXU-1110845). Mpio. Mexicali, Ejido Jacumé km 78 carretera Mexicali-Tijuana, [32.47°N, 116.18°W], 1260 m, 12 May 1997, *M.A. Vergara B. 83* (MEXU); Mpio. Tecate, Santa Verónica, [32.46°N, 116.36°W], 930 m, 26 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 16* (MEXU); N edge of Tijuana Airport, 32.5417°N, 116.9833°W, 150 m, 8 June 1969, *R. Moran 16060* (SD-71464); on cleared flat back from low seabluff, 2.0 km NNW of Primo Tapia, 32.2333°N, 116.925°W, 10 m, 17 April 1982, *R. Moran 30418* (SD-111028); Rancho (solo) Sierra Blanca, Sierra Blanca, 32.075°N, 116.525°W, 675 m, 15 May 1976, *R. Moran 23170* (ASU-0010738, SD-94850); Rancho San Faustino, [32.21°N, 116.16°W], 4 May 1981, *A. Preciado & C. Aguirre 269* (MEXU); S side of Arroyo Santo Tomás, 31.55°N, 116.5833°W, 30 m, 25 April 1976, *R. Moran 22867* (MSC-266305, SD-96759); San Antonio de los Buenos, km 10 on old Tijuana-Ensenada road, 32.45°N, 117.0167°W, 250 m, 29 April 1972, *R. Moran 19102* (SD-83044); San Isidoro, 30.6667°N, 115.5333°W, 900 m, 2 June 1975, *R. Moran 22240* (MEXU, SD-91712); Sierra San Pedro Mártir, ex-Misión San Pedro Mártir, 30.8°N, 115.45°W, 1475 m, 1 June 1975, *R. Moran 22159* (SD-91511); Sierra San Pedro Mártir, in arroyo NE of Mesa el Barrial, 5.5 km W of San José, 30.9583°N, 115.8°W, 700 m, 9 May 1978, *R. Moran 25793* (SD-100730); Valle de la Trinidad, [31.88°N, 116.67°W], 7 May 1981, *V. Morales C. & Aguirre 241* (MEXU); Valle de Sierra de Ulloa, rumbo al norte del Mpio. Ensenada, [31.87°N, 116.59°W], 27 May 1987, *V. Morales 58* (MEXU); April 1979, *s.c. 26A* (MEXU-1098009); between La Humarosa [Rumarosa] and Tecate, 32.53°N, 116.38°W, 27 April 1981, *A.A. Beetle & R. Alcaraz M-6518* (MICH-1119273); Canyon de Agua Viva between Ensenada and Ojos Negras, [31.89°N, 116.6°W], 1 May 1981, *A.A. Beetle & R. Alcaraz M-6638* (MICH-1119272). **Baja California Sur:** Sierra de la Laguna, Cieneguita del Picacho, 23.551°N, 109.9926°W, 1810 m, 12 May 2008, *M. Domínguez León 4073* (SD-188570).


**FIGURE 43.** Geographical distribution of *Bromus hordeaceus* in México.

13. ***Bromus inermis*** Leysser (1761: 16). Figs. 44, 45.

*Festuca inermis* (Leyss.) Candolle & Lamarck (1805: 49). *Schedonorus inermis* Palisot de Beauvois (1812: 177). *Forasaccus inermis* (Leyss.) Lunell (1915: 225). *Zerna inermis* (Leyss.) Lindman (1918: 101). *Bromopsis inermis* (Leyss.) Holub (1973: 167). Type:—GERMANY. *in pratis fertilibus succulentis Pomariis in den Pulverweiden im Amstgarten ad Belberg Crollwitz et alibi frequens*, *Leysser s.n.* (holotype S-LINN!).

*Bromus pumpellianus* var. *melicoides* Shear (1900: 50). Type:—UNITED STATES OF AMERICA. Colorado: Beaver Creek Camp, alt. ca. 3400 m, 8 July 1896, *L.H. Pammel s.n.* (holotype US-81589!).

*Bromus inopinatus* Brues & Brues (1911: 73). Type:—UNITED STATES OF AMERICA. Wisconsin: Milwaukee, McKinley Park, along shores of Lake Michigan, 21 June 1908, *B.B. Brues 78* (holotype GH-00023241!, isotypes GH-00023242!, US-3168443! fragm.).

*Bromus inermis* f. *bulbiferus* Moore (1941: 76). Type:—UNITED STATES OF AMERICA. Minnesota: Ramsey County, on Cleveland Avenue 4 mi N of the campus of Minnesota College of Agriculture, 11 October 1938, *C. Kaufman s.n.* (holotype MIN-347786!).

Plants perennial, strongly rhizomatous. Culms 21–150 cm tall, 2.9–6 mm wide at base, erect, glabrous below the inflorescences; nodes 3–4, brown, glabrous or minutely pubescent, hairs up to 0.2 mm long. Leaf sheaths glabrous or pubescent, hairs soft and up to 1.2 mm long, or stiff and up to 0.6 mm long; auricles absent or rudimentary; ligules 1.5–3.5 mm long, glabrous, erose; blades 10–21.5 cm × 3.8–11.5 mm, flat, adaxial surfaces glabrous with occasional long, soft hairs up to 1.2 mm long or with dense soft hairs up to 0.8 mm long, abaxial surfaces glabrous or pubescent with short hairs up to 0.3 mm long distributed along blade center, margins serrulate. Panicles 6.5–22 cm × 3.5–14 cm, open, often nodding at maturity, branches erect to ascending, usually longer than spikelets, scabrous, 1–5 spikelets per branch. Spikelets 1.7–3.3 cm long, 7–10-flowered, elliptic to lanceolate, terete to moderately laterally compressed; glumes glabrous, margins hyaline, midnerves scabrous or pubescent with hairs up to 0.2 mm long, apices obtuse; lower glumes 4.1–7 mm long, oblong-lanceolate, 1(–3)-nerved, green to purplish-green along and between the nerves; upper glumes 6–9.5 mm long, oblong-ovate, 3-nerved, green to purplish-green

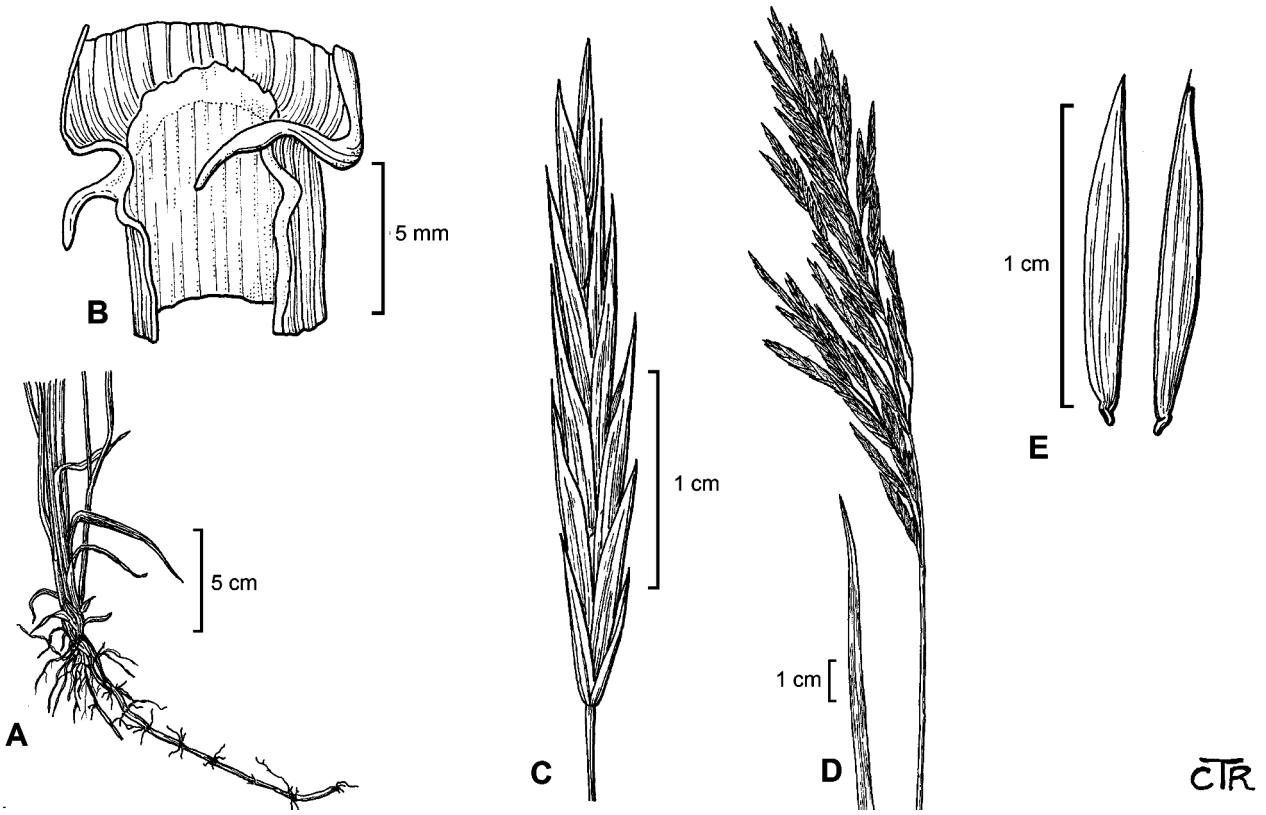


**FIGURE 44.** *Bromus inermis*. A. Rhizome B. Ligule and auricles. C. Spikelet. D. Inflorescence. E. Lemmas. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.


**FIGURE 45.** *Bromus inermis*. *M. de Koninck 46* (US-2153560).


**FIGURE 46.** Geographical distribution of *Bromus inermis* in México and Central America.

along and between the nerves; lemmas 10–13.5 mm × 1.5–2.5 mm, elliptic to lanceolate, rounded over the backs, apices obtuse, 7-nerved, green to purplish-green along and between the nerves, glabrous or scabrous to puberulent on lower sixth to quarter, nerves scabrous; awns absent or up to 3 mm long, arising 0–0.5 mm below lemma apex, straight; paleas shorter than lemmas, 8–10.5 mm long, backs glabrous or pubescent, keels ciliate, cilia up to 0.2 mm long; anthers 4–5.5 mm long; caryopses 6−10 mm long. $2n = 28$ (Armstrong 1982, 1984, 1987, Kong 1991), 56 (Wagnon 1952, Armstrong 1987, Lövkvist & Hultgård 1999), 56+B's (Armstrong 1987).

**Distribution:**—Introduced. Known in México from two collections in Coahuila, and in Guatemala from one collection in Quezaltenango (Fig. 46). *Bromus inermis* was previously reported from Coahuila (Beetle 1987, Espejo-Serna *et al.* 2000). Espejo-Serna *et al.* (2000) also reported this species from Chihuahua, but we have not seen specimens to confirm this report. The current status of the species in México and Guatemala is unknown.

**Ecology:—**This species is usually found along roadsides and areas that are heavily grazed by livestock. Elevation: 1642−1742 m in México.

**Common Names:**—Austrian brome, awnless brome, Hungarian brome, Hungarian fodder grass, Russian brome, smooth brome (English); brome inerme, brome de Hongrie, brome sans arêtes (French); bromo inerme, bromo suave (Spanish).

**Comments:**—*Bromus inermis* was introduced for forage into North America in 1884 by the California Agricultural Experimental Station. It is native across central Eurasia and introduced in Africa, Australia, North America and South America. It is distributed widely across North America, where it is extremely common (Pavlick and Anderton 2007). *Bromus inermis* was not reported from Guatemala by Swallen & McClure (1955) or Soderstrom and Beaman (1968). The species has been reported as being used as fodder in México (Saulés & Dávila Aranda 1992), indicating it may be more widespread than existing collections suggest.

**Specimens Examined:—GUATEMALA. Quezaltenango:** introducido de Portugal, September 1954, *M. de Koninck 46* (US-2153560). **MÉXICO. Coahuila:** Buenavista, a 6 km al S de Saltillo por la carreterra Saltillo-Zacatecas, carretera 54, 25.3667°N, 100.5667°W, 1742 m, 15 May 1977, *J. Valdés-Reyna 920* (ANSM); Buenavista, Saltillo, Bajío-UAAAN, [25.4333°N, 101.0167°W], 1650 m, 20 August 1981, *M.G. Villaseñor s.n.* (ANSM).

14. ***Bromus japonicus*** Houttuyn (1772: 315). Figs. 47, 48.

*Bromus japonicus* Thunb. in Murray (1784: 119), *nom. illeg. Bromus arvensis* var. *japonicus* (Thunb. in Murr.) Fiori (1923: 149). *Serrafalcus japonicus* (Thunb.) Wilmott in Babington & Wilmott (1922: 510). Type:—JAPAN. *Thunberg s.n.* (holotype UPS).

Plants annual. Culms 17–85 cm tall, 1–2.2 mm wide at base, erect or ascending, glabrous below inflorences; nodes 3–4. Leaf sheaths densely pilose, hairs up to 1.2 mm long; auricles absent; ligules 1–2.2 mm long, glabrous, apex erose; blades 3.5–13 cm × 1–6 mm, flat, adaxial and abaxial surfaces densely pubescent with short, stiff hairs up to 0.6 mm long, margins smooth or serrulate. Panicles 3–26 cm × 6–16 cm, open, nodding, branches spreading to ascending, usually longer than spikelets, glabrous or scabrous, 1–6 spikelets per branch. Spikelets 1.8–4 cm long, 7–15-flowered, broadly oblong to ovate-lanceolate, terete to moderately laterally compressed, rachillas sometimes visible at maturity; glumes glabrous, margins sometimes hyaline, midnerves glabrous proximally, scabrous distally, apices obtuse; lower glumes 4–7 mm long, oblong to ovate, 3–5(–7)-nerved; upper glumes 5–8 mm long, ovate to elliptic, 7–9-nerved; lemmas 7–9.2 mm × 1.2–2.2 mm, ovate to elliptic, rounded over the backs, apices obtuse to truncate, often minutely bifid, the cleft to 1 mm deep, 7–9-nerved, nerves not conspicuous, backs glabrous or scabridulous, scabrules ca. 0.1 mm long, hyaline margins 0–0.5 mm widest point; awns 4.2–13 mm long, awn on lowest lemma usually shorter, arising 1.5–2.6 mm below lemma apex, straight to strongly divergent, widest at base; paleas 6–7 mm long, backs glabrous, keels ciliate, cilia 0.3–0.5 mm long; anthers 0.6–1.1 mm long; caryopses 5−6 mm long, terete in cross section to somewhat flattened. $2n = 14$ (Venter & Spies 2008).

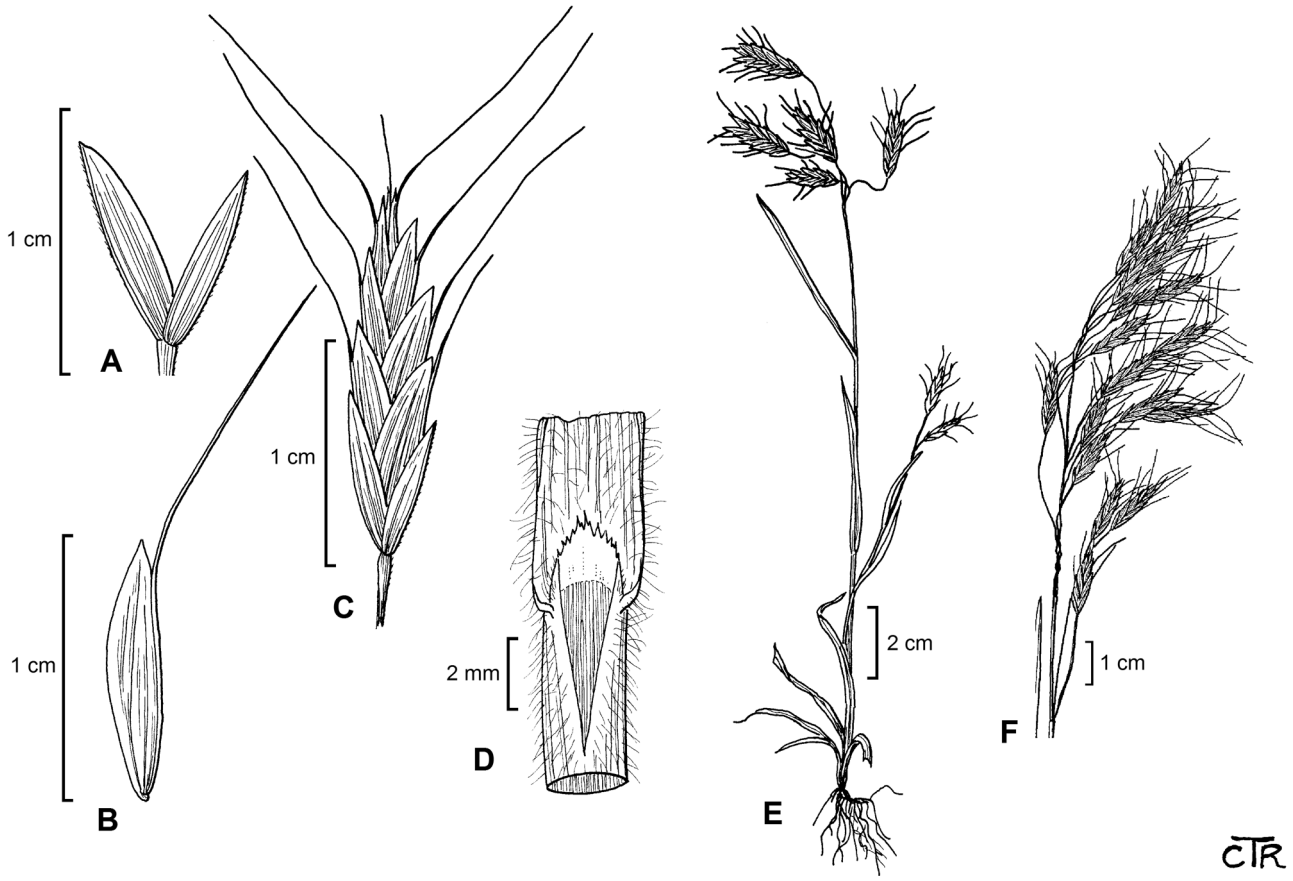


**FIGURE 47.** *Bromus japonicus.* A. Glumes. B. Lemma. C. Spikelet. D. Ligule. E. Habit. F. Inflorescence. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution**:—Introduced. In México *B. japonicus* is known from a few collections from Chihuahua, Coahuila and Jalisco (Fig. 49). Beetle (1987) noted that *B. japonicus* has been collected in Jalisco, but is not established there. McVaugh (1983) noted that *B. japonicus* is present in abandoned experimental plots south of Ocotlán, Jalisco; a specimen from this area is cited below. The Chihuahua collections were made from cultivated plants. The current status of the species in México is unknown. *Bromus japonicus* is native to Europe. In North America, *B. japonicus* is distributed widely throughout the U.S.A. and in southern Canada (Pavlick & Anderton 2007).

**Ecology:**—*Bromus japonicus* is found in disturbed sites in pastures and near cultivated fields. Elevation: 1500−2460 m.

**Common Names:**—Japanese chess, Japanese bromegrass, Japanese brome, spreading brome (English).


**FIGURE 48.** *Bromus japonicus*. *González-Elizondo 838* (SD-126969).


**FIGURE 49.** Geographical distribution of *Bromus japonicus* in México.

**Specimens Examined:—MÉXICO. Chihuahua:** Rancho Exp. La Campana, Chihuahua, Jardín de observacion (cultivated), 1540 m, 14 May 1977, *M.S. González-Elizondo 838* (SD-126969); Rancho Experimental La Campana-Chihuahua, [28.63°N, 106.08°W], 1540 m, 5 August 1977, *M.S. González E. s.n.* (ANSM); Rancho Experimental La Campana**,** 82 kms al norte de la Cd. de Chihuahua, 1500 m, 26 August 1978, *s.c.* (MEXU-243518). **Coahuila:** Mpio. Arteaga, ejido La Escondida, Bosque aciculiesclerofilo, 2460 m, 21 Junio 1994, *P. Moya 447* (MEXU-1089017, MEXU-1089018). **Jalisco:** ca. 3 km al S de Ocotlán por la carretera a La Barca, parcela experimental abandonada, 20.2889°N, 102.8389°W, 21 May 1978, *R. Guzmán Mejía 792* (MEXU-250562, as *B. squarrosus* L.).

15. ***Bromus lanatipes*** (Shear) Rydberg (1906: 52). Fig. 50, 51.

Basionym: *Bromus porteri* var. *lanatipes* Shear (1900: 37). *Bromus anomalus* var. *lanatipes* (Shear) Hitchcock (1933: 449). *Bromopsis lanatipes* (Shear) Holub (1973: 168). Type:—UNITED STATES OF AMERICA. Colorado: Idaho Springs, 27 August 1895, *C.L. Shear 739* (holotype US-81588!, isotype RM-150554!).

Plants perennial, not rhizomatous. Culms to 120 cm tall, (1–)2–3 mm wide at base, glabrous or pubescent below inflorescences; nodes 3–4, light to dark brown, pubescent. Leaf sheaths lanate, occasionally densely pilose, hairs up to 1.2 mm long; auricles absent; ligules 0.5–1.5 mm long, glabrous; blades up to 22 cm × 4–7 mm, flat, adaxial and abaxial surfaces glabrous or minutely pubescent, margins serrulate. Panicles 16–20 cm × 2–8 cm, open, nodding, branches ascending to spreading, shorter or longer than spikelets, scabrous, 1–4 spikelets per branch. Spikelets 1.7–3 cm long, florets 7–9-flowered, elliptic to lanceolate, terete to moderately laterally compressed; glumes glabrous, pubescent along margins or pubescent throughout, margins hyaline, midnerves glabrous or scabrous; lower glumes 4–6 mm long, lanceolate, 1-nerved, green along the nerve, apices acute; upper glumes 6.5–8 mm long, obovate-lanceolate, 3-nerved, green along and between the nerves, apices acute or mucronate, mucros up to 1 mm long; lemmas 8–10 mm × 1–2 mm, elliptic to lanceolate, rounded over the backs, apices truncate, 5-7-nerved, green along and between the nerves, densely pubescent or hairs restricted to margins, marginal hairs sometimes longer than those on back, hairs up to 0.6 mm long; awns 2–6.5 mm long, arising 0–0.5 mm below lemma apex, straight; paleas usually equal in length to the lemma, 7–10 mm long, backs pubescent, keels ciliate, cilia up to 0.2 mm long; anthers 2–4 mm long; caryopses 6−7 mm long, light brown. $2n = 28$ (Wagnon 1952, Ward & Spellenberg 1988).

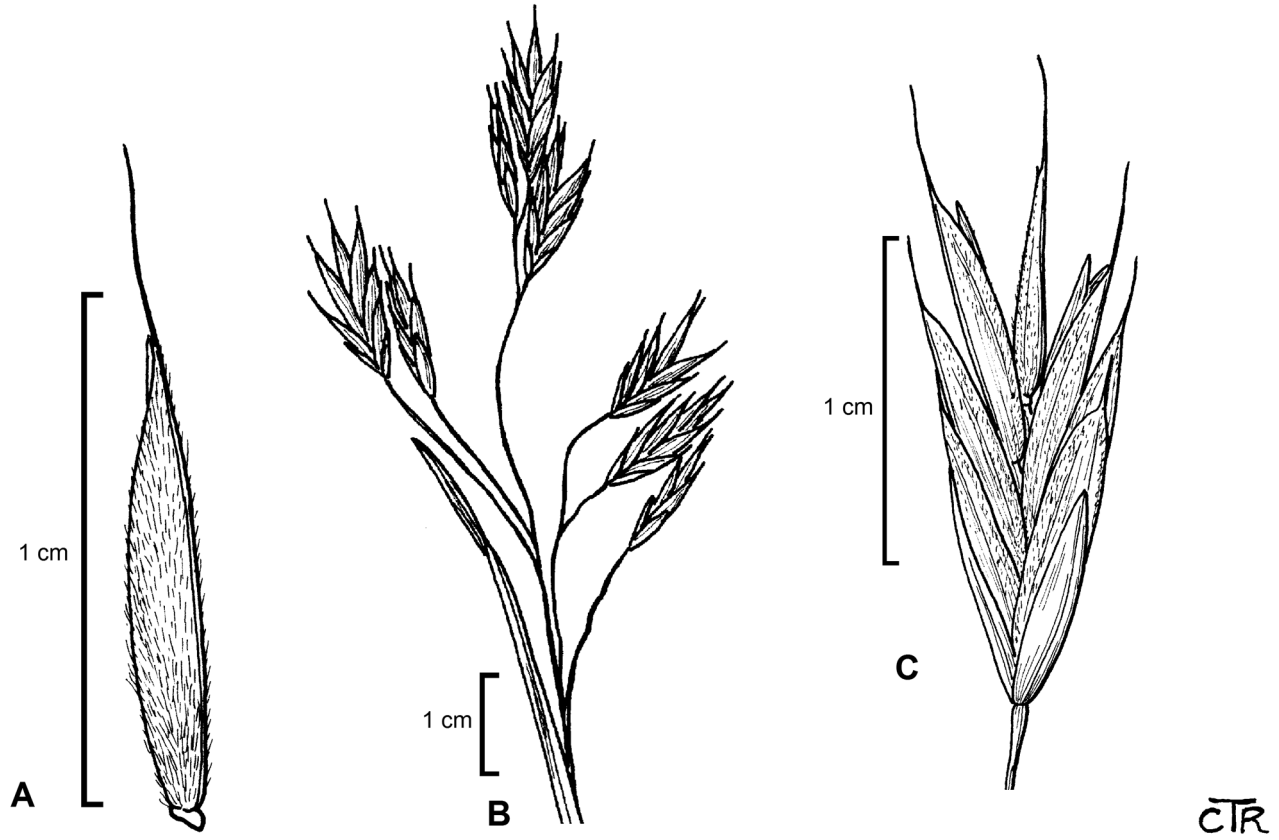


**FIGURE 50.** *Bromus lanatipes*. A. Lemma. B. Inflorescence. C. Spikelet. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:—**Native. *Bromus lanatipes* is known only from northern Coahuila in México, near the United States border (Fig. 52). In the United States its range includes western Texas, New México, Arizona, Nevada, Utah, Colarado and Wyoming (Pavlick & Anderton 2007).

**Ecology:**—*Bromus lanatipes* is found along ridgetops and steep slopes; associated with *Pinus* spp., *Abies*, *Pseudotsuga menziesii*, *Quercus* spp., *Juniperus*, *Cupressus arizonica*, *Arbutus*, *Salvia*, *Salix* Linnaeus (1753: 1753), *Rhamnus* and *Ceanothus*. Elevation: 1676–2627 m.

**Common Names:—**Woolly brome, shaggy brome (English); bromo veluludo (Spanish).

**Comments:—***Bromus lanatipes* is distinguished by its lanate lower sheaths. A photograph of this character is given in Allred (1993: 334). Circumscribing this taxon required examination of material from the adjacent United States, which is cited below.

**Specimens Examined:—MÉXICO. Coahuila:** ca. 12 (air) mi E of Boquillas in Sierra del Carmen, 10.4 (rd) mi NW of Rancho El Jardín, 29.2°N, 102.23°W, 5650 ft [1722 m], *J. Henrickson 11512* (RSA-POM-664819); ca. 12 (air) mi E of Boquillas, 8.3 (rd) mi NW of Rancho El Jardín, 29.1667°N, 102.23°W, 5500 ft [1676 m], 27 July 1973, *J. Henrickson 11487* (RSA-POM-665612); Maderas del Carmen, 12.2 mi NW of Pilares near "old cabin", 28.9401°N, 102.5978°W, 2300 m, 7 September 2005, *P.M. Peterson & J. Valdés-Reyna 18889* (ANSM, CAN, MO, US); Maderas del Carmen, 16.3 mi NE of Los Pilares on road towards Campo Dos, 28.9626°N, 102.5643°W, 2235 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20983* (CAN, MO, P-03216868, US); Maderas del Carmen, 17.7 mi NE of Los Pilares on road towards Campo Dos, 28.9645°N, 102.56°W, 1954 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 21010* (CAN, MO, US); Sierra El Jardín, 29.0832°N, 102.6371°W, 2100 m, 3 September 2006, *P.M. Peterson & S. Lara-Contreras 19938* (CAN, MO, US); Madera del Carmen, at Campo Dos, 29.0106°N, 102.6083°W, 2627 m, 16 September 2012, *P.M. Peterson & K. Romaschenko 24531* (US). **UNITED STATES OF AMERICA. Arizona:** Navajo Indian Reservation, about the N end of the Carizo Mtns., 29 July 1911, *P.C. Standley 7386* (US-686353); Cococino Co., 30 mi E of Canyon Padre, Flagstaff, 7–11 August 1915, *A.S. Hitchcock 13243* (US-906049);


**FIGURE 51.** *Bromus lanatipes*. *Peterson & Lara-Contraras 19938* (CAN, unmounted).


**FIGURE 52.** Geographical distribution of *Bromus lanatipes* in México.

Cochise Co., Huachuca Mtns., September 1893, *J.G. Lemmon s.n.* (US, 2 sheets); Dos Cabezos, 31 October 1937, *L.N. Goodding s.n.* (US-1721928). **New México:** Gray's Peak, 6500 ft, *F.S. Earle 162* (US-1008675); Grant Co., about the S end of the Black Range, 6000 ft, 1904, *O.B. Metcalfe s.n.* (US-690339); Santa Fe Co., Glorieta, 2 July 1926, *A.S. Hitchcock 22994* (US-1296512); Glorieta, 24 August 1910, *E.O. Wooton s.n.* (US-726304); Santa Fe, 3 July 1926, *A.S. Hitchcock 23011* (US-1296516); Santa Fe, 1884, *G. Vasey s.n.* (US-1008802); Lincoln Co., Gray, 6000–6500 ft, July 1900, *F.S. Earle & E.S. Earle 162* (US-382342); Ft. Stanton on El Paso road, 3 August 1937, *L.N. Goodding 3514* (US-1723783); between Ft. Stanton and Ruidoso, 26 August 1937, *L.N. Gooding & C. Goodding 3519* (US-1723785); San Miguel Co., Las Vegas, 23 June 1891, *L.H.D. s.n.* (US-749847); vicinity of Las Vegas, 27 June 1928, *G.E. Osterhout 7048* (US-1389144). **Oklahoma:** Cimarron Co., Mesa de Maya (Black Mesa), 3 mi N of Kenton, 9 July 1947, *C.M. Rogers 4747* (US-2010965); N slopes of Black Mesa, 3 mi N of Kenton, 30 May 1952, *U.T. Waterfall 10749* (US-2077766). **Texas:** Guadalupe Mts., 1881, [?] *s.n.* (US-132953); Brewster Co., Chisos Mtns., Green Gulche, below Casa Grande, 26 August 1944, *C.L. Lundell 13222* (US-1913218); Jeff Davis Co., Sawtooth Mountain, Davis Mountains, 3 October 1926, *E.J. Palmer 31833* (US-1297432); Trans-Peco Texas, Davis Mtns., High Mt. Livermore, 22 July 1936, *L.C. Hinckley 607a* (US-1871685); Uvalde Co., Black Mt., 13 August 1926, *B.C. Tharp 4105* (US-1296999).

16. ***Bromus madritensis*** Linnaeus (1755: 5). Figs. 53, 54.

*Anisantha madritensis* (L.) Nevski (1934 : 21). *Festuca madritensis* (L.) Desfontaines (1798: 91). *Genea madritensis* (L.) Dumortier (1868: 67). *Zerna madritensis* (L.) Gray (1821: 117). Type:—SPAIN. Manifesto prope Madritum, *Loefling s.n.* (neotype LINN-93.35!, designated by Smith 1985: 500).

Plants annual. Culms 10–75(–120) cm long, 0.5–1 mm wide at base, erect or ascending, glabrous below inflorescences; nodes 1–5, glabrous. Leaf sheaths glabrous or minutely pubescent, occassionally densely pubescent with hairs up to 0.5 mm long; ligules 1.5–4 mm long, glabrous, lacerate; blades 2–27 cm × 2–6 mm, flat, sometimes convolute, abaxial and adaxial surfaces glabrous to minutely pubescent, or densely pubescent, hairs up to 0.3 mm long, margins serrulate. Panicles 3–22 cm × 2.5–10 cm, loosely obovoid to oblong-ovoboid, erect, ± compact, sometimes reduced to a single spikelet, often purple, branches ascending to spreading, 0.2–5 cm long, usually shorter than spikelets, occassionally longer than spikelets, pubescent, most branches visible, shortest branch on lowest node 6–24 mm long, longest branch on lowest node branched 0–2 times, internodes reduced upwards. Spikelets 2.7–4.5 cm long (3–6.5 cm including awns), 4–13-flowered, linear-elliptic to cuneate, moderately laterally compressed, florets not overlapping at maturity; glumes glabrous, margins hyaline, 0.1–0.2

mm wide, midnerves glabrous proximally, scabrous distally, apices acute; lower glumes 6–11 mm long, narrowly lanceolate, 1-nerved, green to purple along nerve; upper glumes 10–17 mm long, lanceolate, 3-nerved, green to purple along and between nerves; lemmas 11–23 mm long, linear-lanceolate, rounded over the backs, apices bidentate, teeth 1–3 mm long, 5–7-nerved, green to purple along and between the nerves, glabrous or scabrous, margins hyaline, 0.2–0.4 mm wide; awns 12–30 mm long, inserted 1.5–4 mm below lemma apices, straight or arcuate, scabrous; paleas shorter and narrower than lemmas, backs glabrous or pubescent, keels ciliate, cilia 0.1–0.6 mm long; anthers 0.6–1.2 mm long; caryopses 8−11 mm long. $2n = 4x = 28$ (Esnault 1984, Sánchez Anta *et al.* 1988, Sheidai & Fadaei 2005).

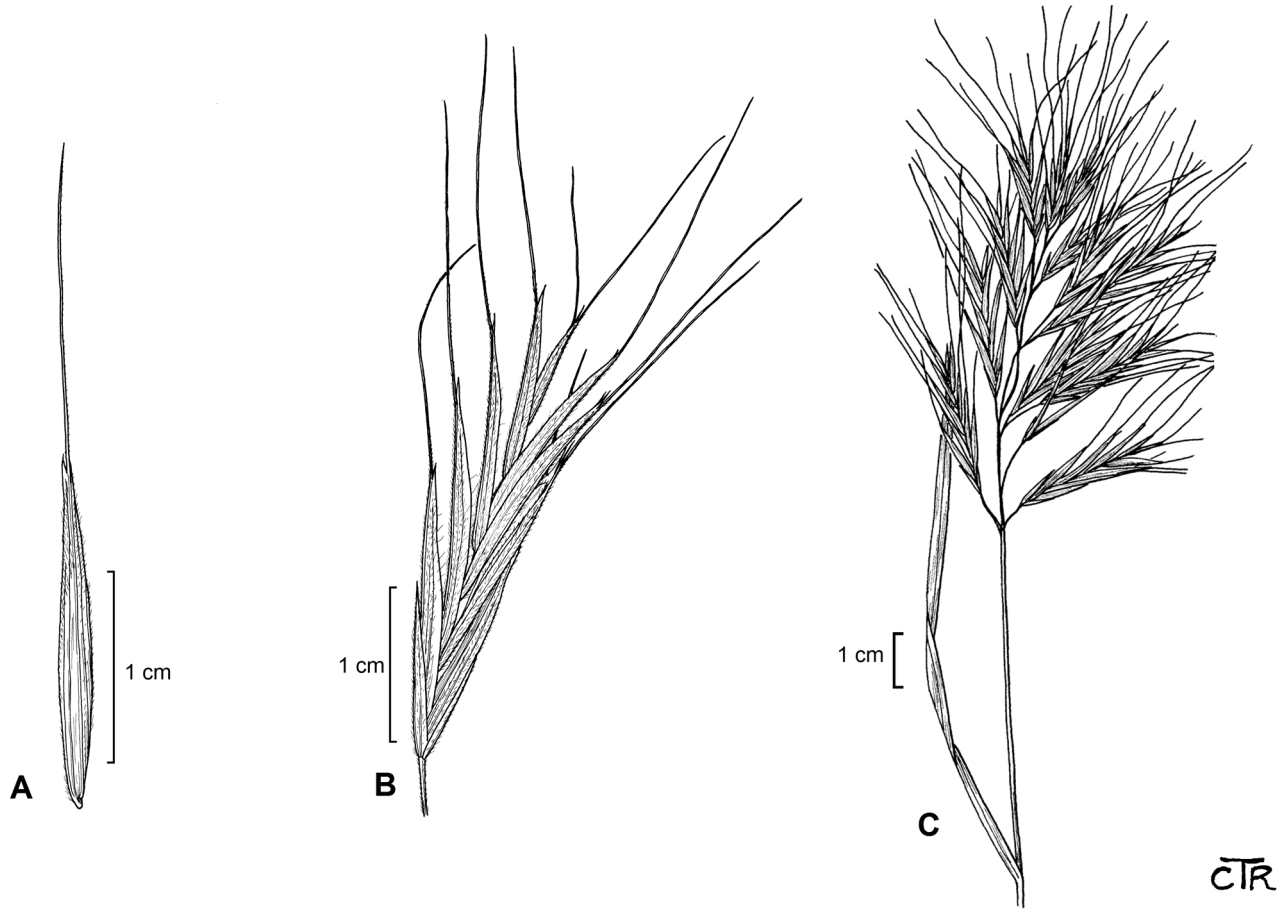


**FIGURE 53.** *Bromus madritensis*. A. Lemma. B. Spikelet. C. Inflorescence. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:—**Introduced. In México *B. madritensis* is known only from Baja California (Fig. 55). In the United States its range includes California, southern Oregon and Arizona (Pavlick *et al.* 2007). Native to the Mediterranean region and Central and Atlantic Europe (Sales 1994).

**Ecology:—**Open, xeric, mostly disturbed sites. Elevation: 20–900 m.

**Common Names:—**Foxtail chess, madrid brome, Spanish brome, compact brome (English).

**Comments:—**Soderstrom & Beaman (1968) did not recognize *B. madritensis* in México, but it was treated by Gould & Moran (1981) for Baja California.

*Bromus madritensis* and *B. rubens* (sect. *Genea*) are part of the polymorphic *B. madritensis* complex, a group of morphologically similar taxa in which multiple taxa have been described (Scholz 1981, Sales 1993, Sales 1994). The complex is distinguished from other taxa in sect. *Genea* by a combination of small lemmas and erect, contracted to somewhat contracted inflorescences during flowering (Sales 1994). They have mostly been recognized as distinct species (Gould & Moran 1981), although their recognition as species has been questioned on the basis of considerable morphological variation (Esnault 1984, Esnault & Huon 1985, Sales 1993). Sales (1994) conducted a multivariate analysis of the polymorphic *B. madritensis* complex and accepted one species and two subspecies (*B. madritensis* subsp. *madritensis* and *B. madritensis* subsp. *rubens*). Some recent treatments have

followed this circumscription (Jones *et al.* 1997, Saarela & Peterson 2012), whereas others have maintained the taxa as distinct species (Felger 2000, Aryavand 2002, Jessop *et al.* 2006, Pavlick & Anderton 2007).


**FIGURE 54.** *Bromus madritensis*. *Moran 27265* (SD-102443).


**FIGURE 55.** Geographical distribution of *Bromus madritensis* in México.

Molecular studies have shed independent light on the evolutionary history of these taxa, informing their classification. Isozyme evidence suggests that the taxa have independent origins, in line with their recognition as species (Oja & Jaaska 1996, Oja 2002). A recent study of plastid and nuclear ribosomal loci, and the *Waxy* gene, demonstrated that these two taxa are allopolyploids that arose independently from different diploid parental taxa: *B. madritensis* from a *B. sterilis* × *B. fasciculatus* Presl (1820: 39) cross, and *B. rubens* from a *B. fasciculatus* × *B. tectorum* cross (Fortune *et al.* 2008). In both taxa the maternal genome is derived from the *B. fasciculatus* lineage (Fortune *et al.* 2008). Given their independent origins, we treat these taxa as species, a classification that reflects their evolutionary history. The morphological variation in the complex globally may reflect multiple origins of these taxa or hybridization among them.

The character states related to pubescence of the culms, glumes and lemmas given in the key may not always distinguish *B. madritensis* and *B. rubens*, as these characters apparently vary in the complex and *B. madritensis* can sometimes be pubescent (Sales 1994), but they distinguish the species in México based on the specimens examined here.

**Specimens Examined:—MÉXICO. Baja California:** 25 km SE of Tijuana, at bottom of Cañón la Presa, 32.3958°N, 116.8333°W, 190 m, 13 May 1982, *R. Moran 30700* (SD-111163); at roadside 1.5 km NE of Las Delicias, ca. 17 km E of Ensenada, 31.9083°N, 116.425°W, 660 m, 20 May 1979, *R. Moran 27265* (SD-102443); between La Humarosa [Rumarosa] and Tecate, 32.53°N, 116.38°W, 27 April 1981, *A.A. Beetle & R. Alcaraz M-6745* (ARIZ-229626, MICH-1119160, MEXU); Guadalupe Island, S slope of cañon above NE Anchorage, 29.1542°N, 118.2833°W, 20 m, 14 February 1957, *R. Moran 5688* (SD-47529); La Flor de Sol, 32.425°N, 116.95°W, 220 m, 22 June 1977, *R. Moran 24273* (SD-97340); La Misión, between Ensenada and Tijuana, on steep slopes and in arroyo bottom along S side of river, 32.0936°N, 116.8694°W, 50 m, 18 April 1998, *J. Rebman, P. Flanagan & La Misión Community Group 5046* (RSA-POM-643071, SD-144705, SD-144706); Rancho ontiveros, Sern foothills of Otay Mountain just S of the US/MEX border between Tijuana and Tecate, along a side canyon of the Río Tecate just W of the MEX Hwy. 2 toll booth, 32.5461°N, 116.8544°W, 85 m, 26 April 2005, *J. Rebman, J. Delgadillo, M. White & K. Comer 11830* (SD-161420); San Carlos Canyon, S of Ensenada, [31.87°N, 116.59°W], 29 April 1981, *A.A. Beetle & R. Alcaraz M 6600* (MEXU); San Isidoro, 30.7667°N, 115.5333°W, 900 m, 2 June 1975, *R. Moran 22257* (SD-91369); Descando Valley, 32.1833°N, 116.8667°W, 15 m, 29 April 1972, *R. Moran 19110* (MEXU, SD-83045).

17. ***Bromus pinetorum*** Swallen (1943: 77). Fig. 56.

*Bromopsis pinetorum* (Swallen) Holub (1973: 168). Type:—MÉXICO. Coahuila: Sierra del Pino: vicinity of La Noria, 20–26 August 1940, *I.M. Johnston & C.H. Mueller 497* (holotype US-2209362!, isotypes US-1981050! fragm., GH-00023262!).

Plants perennial, not rhizomatous. Culms 80–120 cm tall, 2.5–3 mm wide at base, erect or ascending; nodes 3–7, moderately to densely pubescescent. Leaf sheaths densely pubescent, hairs up to 1.5 mm long; auricles absent; ligules 1.5–4 mm long, lacerate, glabrous, sometimes with a few hairs along the margins; blades 14.5–32 cm × 5–10 mm , flat, firm, abaxial and adaxial surfaces sparsely to densely pubescent, sometimes glabrous, margins serrulate. Panicles 16.5–22 cm long, open, nodding, branches erect to ascending, stiff, scabrous, 1–2(–3) spikelets per branch, lower branches longer than spikelets, upper branches shorter or longer than spikelets. Spikelets 2.5–3 cm long, 7–9-flowered, elliptic to lanceolate, terete to morderately laterally compressed; glumes pubescent, hairs up to 0.5 mm long, green to purplish green, margins narrowly hyaline, midnerves glabrous proximally, scabrous to pubescent distally; lower glumes 7.5–9 mm long, narrowly lanceolate, 1-nerved, apices acute; upper glumes 9.5–11 mm long, obovate-lanceolate, 3-nerved, apices mucronate, mucros up to 1.5 mm long; lemmas 10–11 mm long, elliptic to lanceolate, rounded over the backs, apices obtuse to truncate, 7-nerved, pubescent across the backs and margins, hairs up to 0.5 mm long; awns (6–)6.5–8 mm long, inserted up to 0.5 mm below lemma apex, straight; paleas shorter than the lemmas, backs pubescent, keels ciliate, cilia 0.1–0.2 mm long; anthers (3–)3.5–4 mm long; caryopses 8.5−9.5 mm long, light brown. 2*n* = unknown.

**Distribution**:—Native. Endemic to Coahuila, where it is known only from Sierra de la Madera and Sierra del Pino in western Coahuila (Fig. 57).

**Ecology:**—Pine-oak forests in rocky arroyos derived from calcareous parent materials; associated with *Juniperus deppeana*, *Quercus gravesii* Sudworth (1927: 86), *Q. intricata* Trel. in Standley (1922: 185), *Pinus arizonica*, *Prunus serotina*, *Arbutus xalapensis* and *Fallugia paradoxa.* Elevation: 1615–1980 m.

**Common Names:**—Unknown.

**Comments:**—*Bromus pinetorum* is a poorly understood taxon, known from only a few collections. Johnston (1943) considered the material here included in *B. pinetorum* to be a hairy robust form of *B. anomalus*. Described by Swallen (1943), the species was recognized by Wagnon (1952), but most other authors have included *B. pinetorum* in *B. lanatipes* (Soderstrom & Beaman 1968, Beetle 1977, Espejo-Serna *et al.* 2000, Pavlick *et al.* 2003). Beetle (1987) did not mention the taxon. We experienced difficulty placing plants included here into *B. lanatipes*, from which it differs by its longer awns [(6–)6.5–8 mm vs. 2–6.5 mm], longer lemmas [10–11 mm vs. 8–10 mm], longer glumes [lower glumes 7.5–9 mm vs. 4–6 mm, upper glumes 9.5–11 mm vs. 6.5–8 mm], pubescent leaf sheaths [vs. lanate leaf sheaths], stiffer inflorescence branches [vs. laxer inflorescence branches] and stiffer and generally wider leaf blades [5–10 mm wide vs. laxer and 4–7 mm wide]. *Bromus pinetorum* differs from *B. richardsonii* by its longer anthers [(3–)3.5–4 mm vs. 1–2.6(–3.4) mm], longer awns [(6–)6.5–8 mm vs. 3.1–6.5 mm], panicle branches that are stiff and erect to ascending [vs. lax and ascending to nodding] and stiff leaf blades [vs. lax].

The stiffly erect to nodding panicles of *B.pinetorum* are similar to those of *B. pumpellianus* Scribner (1888: 9), a widespread western North American species of sect. *Bromopsis* that does not occur in México. The known southernmost distribution of *B. pumpellianus* is in northern New Mexico (Pavlick & Anderton 2007). *Bromus pinetorum* differs from *B. pumpellianus* in lacking rhizomes [vs. rhizomatous], lemma apices obtuse to truncate [vs. subulate to acute], shorter anthers [(3–)3.5–4 mm vs. 3.5–7 mm], and longer lemmatal awns [(6–)6.5–8 mm vs. 1–4.5(–5) mm]. Pavlick & Anderton (2007) reported lemmatal awns up to 7.5 mm long in *B. pumpellianus*, whereas in other treatments the awns of this species are reported as 1.5–5 mm (Tzvelev 1976), 1–4.5(–5) mm (Saarela 2008), 2–3 mm (Allred 1993) and <3 mm (Weber & Wittmann 2001). The measurements in Pavlick & Anderton (2007) may have included specimens of *B. riparius* Rehmann (1872: 10), a closely-related Old World species (Saarela *et al.* 2007) used in North America as forage, which has awns (3–)4–7.1 mm long (Saarela 2008). *Peterson & Annable 10676* is placed here even though it has short-awns (2−3.5 mm long); in other respects it agrees with characteristics of *B. pinetorum*. *Bromus pinetorum* is unique in sect. *Bromopsis* in México in having firm leaf blades and stiff inflorescence branches. However, these characters are described only from a few herbarium specimens. This curious taxon should be studied more closely in the field.

**Specimens Examined:—MÉXICO**. **Coahuila:** vicinity of La Noria, a broad valley in the calcareous Sierra del Pino, [28.23°N, 102.87°W], 28 August 1941, *R.M. Stewart 1213* (GH); Sierra El Pino, 39.5 km W of Rancho El Cimarron, 15 Sep 1991, *P.M. Peterson & C.R. Annable 10676* (US); W Coahuila, Sierra de la Madera, vicinity of La Cueva in Corte Blanco fork of Charretera Canyon, 27.14°N, 102.53°W, 1615–1981 m, 11–15 September 1941, *I.M. Johnston 8926* (GH, US-90887, US-1817802).


**FIGURE 56.** Holotype of *Bromus pinetorum* (*Johnston & C.H. Mueller 497,* US-2209362).


**FIGURE 57.** Geographical distribution of *Bromus pinetorum* in México.

18. ***Bromus pseudolaevipes*** Wagnon (1950: 64). Figs. 58, 59.

*Bromopsis pseudolaevipes* (Wagnon) Holub (1973: 168). Type:—UNITED STATES OF AMERICA. Cultivated: grown at the Botanical Gardens, University of Michigan, Ann Arbor, 2 June 1948, *H.K. Wagnon 1507*; original source from seed reproduced at the Univeristy of California, Berkeley, originally collected by *G.L. Stebbins Jr. 2862* along the Ridge Route W of Castaic, Los Angeles Co. (holotype MICH-1108615!, isotypes CAS-0027837!, MO-1600838!).

Plants perennial, not rhizomatous. Culms 60–125 cm tall, 2–4 mm wide at base, erect or ascending, pubescent below inflorescences; nodes 2–5, pubescent. Leaf sheaths glabrous or densely pilose, hairs up to 1.2 mm long;

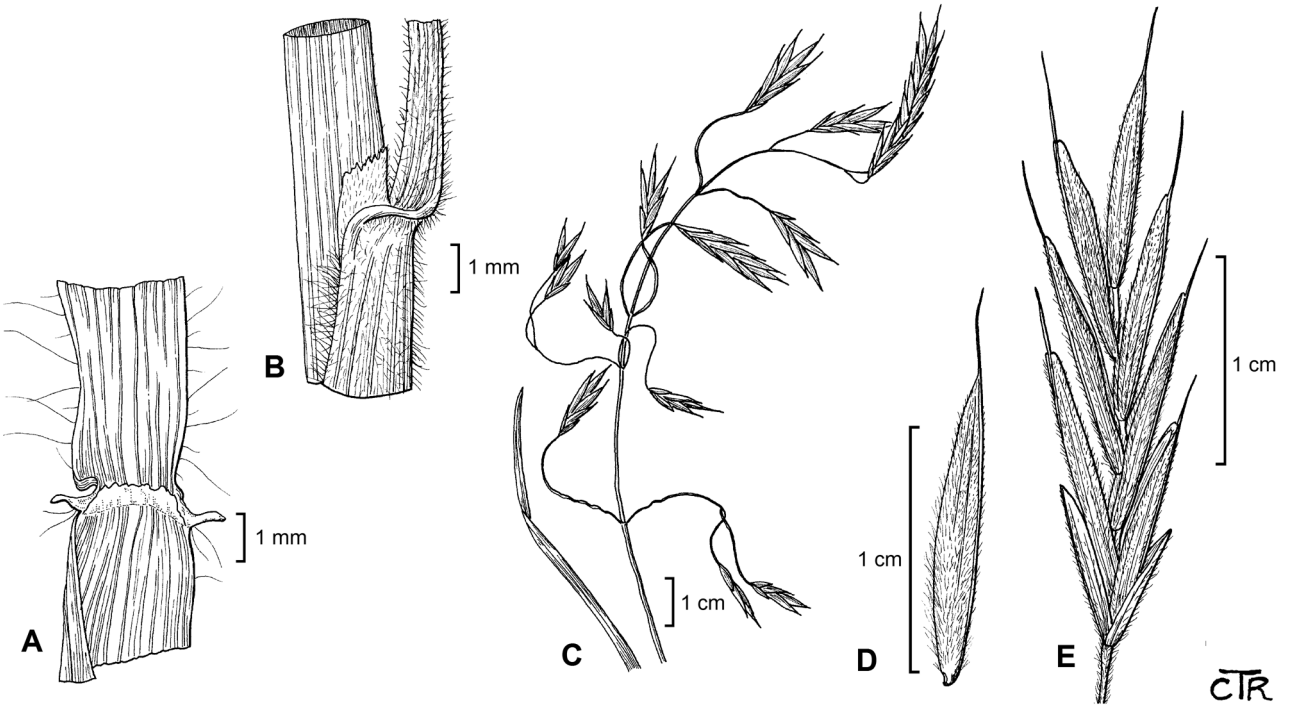


**FIGURE 58.** *Bromus pseudolaevipes*. A. Ligule and auricles. B. Ligule and leaf sheath. C. Inflorescence. D. Lemma. E. Spikelet. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.


**FIGURE 59.** *Bromus pseudolaevipes*. *Peterson & Cayouette 15211* (CAN, unmounted).

auricles usually present on the lower leaves, sometimes absent; ligules 0.4–1(–2) mm long, glabrous or pubescent; blades up to 35 cm × 2–9 mm, flat, adaxial and abaxial surfaces pubescent throughout or on margins, hairs up to 0.6 mm long, rarely glabrous, margins serrulate. Panicles 7.5–20 cm × up to 14 mm, open, nodding, branches erect to ascending, 0.3–4 cm long, longer or shorter than spikelets, pubescent, 2–3(–4) spikelets per branch. Spikelets 1.5–3.5 cm long, 4–10-flowered, elliptic to lanceolate, terete to moderately laterally compressed; glumes scabrous or pubescent, hairs up to 0.3 mm long, margins hyaline, midnerves pubescent; lower glumes 4–7 mm long, lanceolate to oblong, 3-nerved, green along and between the nerves, apices acute; upper glumes 6–9 mm long, oblong-ovate, 5-nerved, green along and between the nerves, apices acute to obtuse; lemmas 10–12.5 mm long, elliptic to lanceolate, rounded over the backs, apices obtuse to truncate, 7-nerved, green along and between the nerves, pubescent throughout or hairs restricted to margins, hairs up to 0.5 mm long; awns 2–5.5 mm long, inserted up to 0.5 mm below lemma apex, straight; paleas shorter and narrower than the lemmas, backs pubescent, keels ciliate, cilia up to 0.3 mm long; anthers 3.5–5.5 mm; caryopses 8−10 mm long, dark brown to black. 2*n* = 14 (Wagnon 1950).

**Distribution:**—Native. In México *B. pseudolaevipes* is known from northern Baja California (Fig. 60). We have seen only a single specimen of the taxon from México. Gould & Moran (1981) also reported *B. pseudolaevipes* from Baja California. They noted the specimen they cited (*Beetle M-2696*, near and E of Rosarito; not seen) to be "atypical in having blades to 14 mm broad" (Gould & Moran 1981: 30), which is outside the range of variation known for this species (Pavlick & Anderton 2007, Saarela & Peterson 2012). *Bromus pseudolaevipes* has been considered to be endemic to California (Wagnon 1952, Peterson & Soreng 2007), but it is not, given its occurrence in Baja California. Pavlick & Anderton (2007) state that *B. pseudolaevipes* is not known from México, which is incorrect. In the United States it occurs in the Coastal ranges of California (Pavlick & Anderton 2007, Saarela & Peterson 2012).

**Ecology:—**Shaded or semi-shaded sites in chaparral, coastal sage scrub and open woodland; associated with *Arctostaphylos*, *Ceanothus*, *Rhus* and *Eriogonum fasciculatum* Bentham (1836: 411) Elevation: 1350 m in México.

**Common Names:**—Woodland brome (English).

**Comments:**—*Bromus pseudolaevipes* is distinguished by its five-nerved upper glumes. It is the only species in sect. *Bromopsis* in México with this character.

**Specimen Examined:**—**MÉXICO. Baja California:** Sierra San Pedro Martír, 1.1 mi SW of Mike's Sky Ranch on road towards Meling Ranch, 1350 m, 31.109°N, 115.6508°W, 25 September 2000, *P.M. Peterson & J. Cayouette 15211* (CAN, US).


**FIGURE 60.** Geographical distribution of *Bromus pseudolaevipes* in México.

19. ***Bromus richardsonii*** Link (1833: 281). Figs. 61, 62.

*Zerna richardsonii* (Link) Nevski (1934: 17). *Bromus ciliatus* var. *richardsonii* (Link) Boivin (1967: 521). *Zerna canadensis* subsp. *richardsonii* (Link) Tzvelev (1971: 54). *Bromopsis richardsonii* (Link) Holub (1973: 168). *Bromopsis canadensis* subsp. *richardsonii* (Link) Tzvelev (1976: 214). Type:—*Hab. in America septentrionali occidentali. Semina misit cl. Dr. Richardson* [Grown in Berlin from seed provided by Dr. Richardson] (holotype B, destroyed *fide* Wagnon 1952).

*Bromus purgans* var. *longispicatus* Hooker (1840: 252). Type:—CANADA. Rocky Mountains, *T. Drummond s.n.* (isotype US-A865460! fragm.).

*Bromus mucroglumis* Wagnon (1952: 67). *Bromopsis mucroglumis* (Wagnon) Holub (1973: 168). Type:—UNITED STATES OF AMERICA. Cultivated: grown in the greenhouse of the Botanical Garden, University of Michigan, from seed reproduced by the Soil Conservation Service (A-5712), Albuquerque, New México, and originally collected by Goodding, Locke, & Johnson at South Cave Creek, Chiricahua Mts., Cochise Co., Arizona, 28 July 1948, *H.K. Wagnon 1520* (holotype MICH-1108614!, isotype US-2154824!).

*Bromus thysanoglottis* Soderstrom & Beaman (1968: 509). Type:—MÉXICO. Durango: pine-oak region, Sierra Madre Occidental, W of Ciudad Durango, 2 mi SW of Buenos Aires, 8800 ft, on precipitous slope, 8 September 1960, in clay soil, *J.R. Reeder, C.G. Reeder & T.R. Soderstrom 3348* (holotype US-2457688!, isotypes ARIZ-246155!, ARIZ-226130!, YU-000863!).

Plants perennial, not rhizomatous. Culms up to 120 cm tall, 1.5–6 mm wide at base, erect or ascending, sometimes decumbent at the base, glabrous below inflorescences; nodes 2–6, glabrous or pubescent. Leaf sheaths glabrous or pubescent to pilose, hairs sometimes restricted to distal sheath margins, hairs up to 1.5 mm long; auricles absent; ligules 0.6–3.3 mm long, glabrous or minutely pubescent, erose-lacerate; blades up to 38 cm × (3–)4–10.5(–13) mm, flat, glabrous or pubescent to pilose, hairs up to 1.5 mm long, margins smooth or serrulate. Panicles 12–35 cm× 2–17.5 cm, open, nodding, branches ascending to spreading or drooping, shorter or longer than spikelets, glabrous, scabrous or pubescent, 1–5 spikelets per branch. Spikelets 1.7–3.2(–3.6) cm long, 3–9(–12)-flowered, elliptic to lanceolate, terete to moderately laterally compressed, rachillas sometimes visible at maturity; glumes glabrous or minutely to strongly pubescent, hairs sometimes restricted to margins, hairs up to 1 mm long, margins hyaline, midnerves glabrous, scabrous or pubescent; lower glumes 5.5–9.5(–12) mm long, narrowly lanceolate to ovate–lanceolate, 1(–3)-nerved, green to purplish-green along and between the nerves; upper glumes (7–)8–12.5(–14.5) mm long, 3-nerved, obovate-lanceolate, green to purplish-green along and between the nerves, apices acute to mucronate, mucros 0.3–1.5(–2) mm long; lemmas (9–)10–13.5(–15) mm × 2–2.8 mm, elliptic to lanceolate, rounded over the backs, apices entire or minutely bifid, the cleft to 0.2 mm long, 7-nerved, green to purplish-green along and between the nerves, margins pubescent, hairs up to 1 mm long, backs glabrous or weakly to densely pubescent proximally and glabrous to scabridulous distally, hairs up to 0.7 mm long; awns 3.1–6.5 mm long, arising 0–0.5 mm below lemma apex, straight; paleas shorter and narrower than lemmas, backs glabrous or puberulent to pubescent, keels glabrous or ciliate, cilia up to 0.4 mm long; anthers 1–2.6(–3.4) mm long; caryopses 7−10 mm long. *2n* = 28 (Mitchell & Wilton 1965, Armstrong 1983, Ward & Spellenberg 1988, Peterson *et al.* 2001).

**Distribution:—**Native. In México *B. richardsonii* is known from Baja California, Baja California Sur, Chihuahua, Durango, Coahuila, Michoácan, Nuevo León, Querétaro and Tlaxcala (Fig. 63). In North America, *B. richardsonii* is generally distributed west of the continental divide from the Yukon territory to central México, with disjunct populations known from the Cypress Hills in southern Alberta and Saskatchewan, the Black Hills in South Dakota and western Texas (Peterson *et al.* 2001, Pavlick & Anderton 2007).

**Ecology:—**Steep to gentle slopes on rock outcrops or wooded habitats in granitic or calcareous soils, often in roadcuts, cliffs and arroyos; associated with *Pinus durangensis*, *P. cooperi* Blanco (1949: 185), *P. jeffreyi*, *P. quadrifolia* Parl. ex Sudworth (1897: 17), *P. teocote*, *P. ayacahuite*, *Quercus arizonica* Sargent (1895: 92), *Q. durifolia* Seemen in Loesener (1900: 95), *Q. emoryi*, *Q. rugosa*, *Q. sideroxyla*, *A. concolor* Lindl. ex Hildebrand (1861: 261), *Pseudotsuga menziesii*, *Picea engelmannii*, *Cupressus arizonica*, *Juniperus deppeana*, *Arbutus arizonica*, *A. tessellata* Sørensen (1987: 263), *A. xalapensis*, *Holodiscus dumosus* (S. Watson in Brewer 1876: 170) Heller (1898: 4), *Arctostaphylos pungens*, *A. patula* Greene (1891: 171), *A. pringlei* Parry (1887: 494), *Populus tremuloides* Michaux (1803b: 243), *Platanus wrightii*, *Symphoricarpos oreophilus* Gray (1873: 14), *Alnus*, *Prunus serotina*, *Pachistima myrsinites*, *Garrya macrophylla*, *Cornus stolonifera*, *Ribes*, *Salvia*, *Heuchera* Linnaeus (1753: 226), *Lupinus*, *Senecio*, *Ceanothus*, *Baccharis*, *Brickellia* Elliott (1824[1823]: 290), *Cercocarpus*, *Stevia* Cavanilles (1797: 32), *Geranium*, *Thalictrum*, *Pedicularis* Linnaeus (1753: 607), *Rubus*, *Sedum* Linnaeus (1753:

430), *Yucca* Linnaeus (1753: 319), *Physocarpus*, *Silene* Linnaeus (1753: 416) and *Cerastium* Linnaeus (1753: 437). Elevation: 1500−3250 m. Espejo-Serna (2000) noted *B. richardsonii* (as *B. ciliatus*) to be introduced in México, which is incorrect.

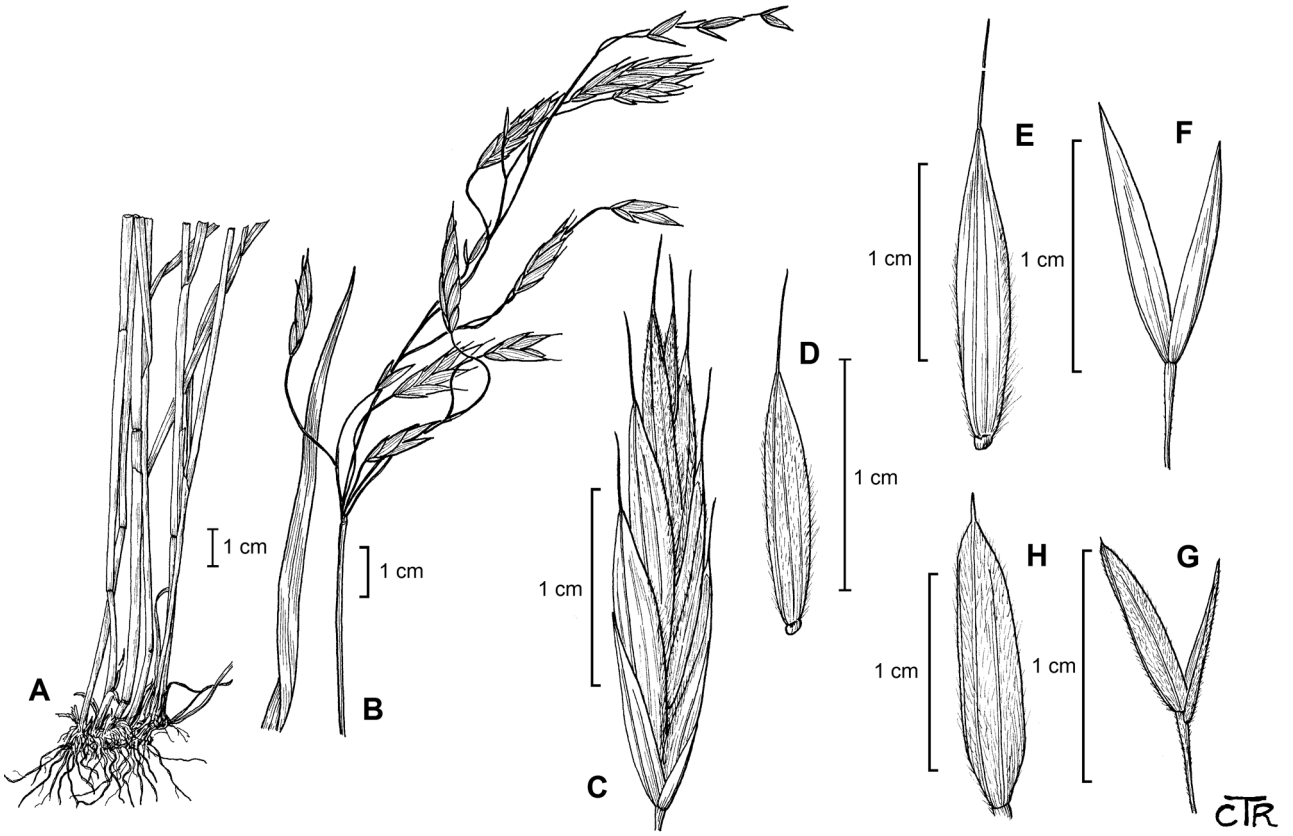


**FIGURE 61.** *Bromus richardsonii.* A. Habit. B. Inflorescence C. Spikelet. D, E. Lemmas F, G. Glumes. H. Upper glume. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Common Name:—**Richardson's brome (English).

**Comments:—**Plants treated here as *B. richardsonii* were recognized (in part, see discussion of *B. mucroglumis* below) as *B. ciliatus* in several Mexican treatments (Soderstrom & Beaman 1968, Beetle 1977, 1987, Gould & Moran 1981), while a more recent treatment recognized them as *B. richardsonii* (Herrera Arrieta 2001). The distinctions between *B. ciliatus* and *B. richardsonii* were, for a long time, unclear. *Bromus richardsonii* has been variously recognized as a distinct species (Shear 1900, Hitchcock 1913, Wagnon 1952, Kearney & Peebles 1960, Mitchell & Wilton 1965, Mitchell 1967, Hultén 1968, Welsh 1974, Pavlick 1995, Peterson *et al.* 2001, Saarela *et al.* 2005, Pavlick & Anderton 2007, Saarela 2008, Saarela & Peterson 2012) or as a synonym of *B. ciliatus* (Hitchcock 1951, Soderstrom & Beaman 1968, Allred 1993, Kartesz & Allen 1999, Espejo-Serna *et al.* 2000, Douglas *et al.* 2001, Hatch & Haile 2012). In a detailed study of the complex, Peterson *et al.* (2001) identified distinctive morphological, cytological and genetic differences that support recognition of these taxa as distinct species (also see Saarela 2008, Saarela & Peterson 2012). *Bromus ciliatus* is distributed across southern Canada and the United States, except south-central and southeastern U.S.A. (Pavlick & Anderton 2007); it is not known from México.

Two collections from Municipio de Yécora, Sonora (*Reina 98-1389A & Van Devender*; *Van Devender 98-1590*, *Reina & Trauba*) are unusual in having 3-nerved lower glumes and long awns (to 6.5 mm). A specimen from Volcán Tequila in Jalisco (*Webster 15862*, MICH) was treated as *B. anomalus* by McVaugh (1983), who noted this and another collection (*Puga 6347*, not seen) to be "robust, up to 1.2 m tall, with woolly sheaths and spikelets 2–4 cm long, suggesting in these characters *B. lanatipes* (Shear) Rydb., which has by some authors been treated as a variety of *B. anomalus*" (McVaugh 1983: 101). We treat this collection as *B. richardsonii*, along with others from Cerro Volcán (*Peterson & Rosales 16061*, *16067*).

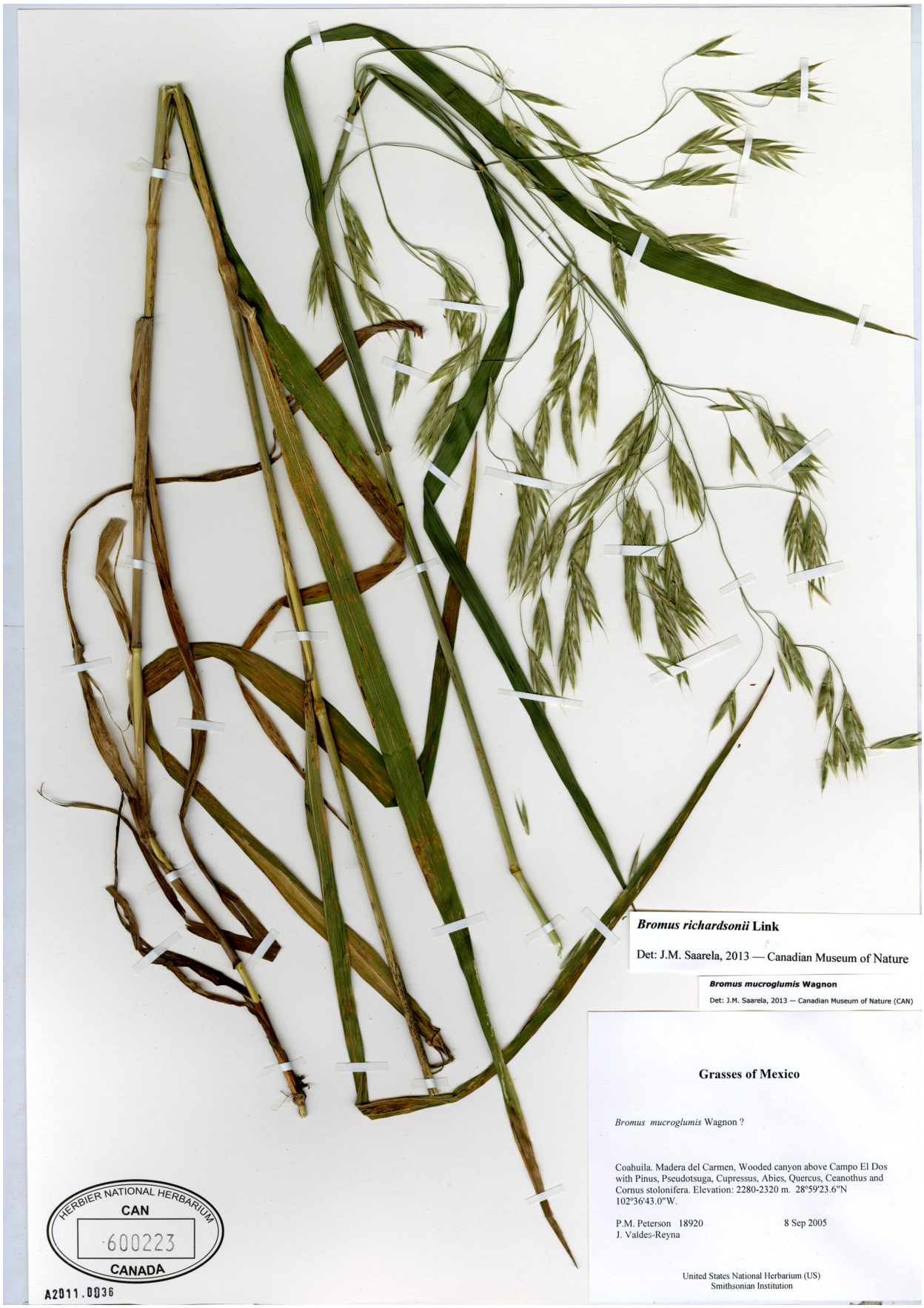


**FIGURE 62.** *Bromus richardsonii*. *Peterson & Valdes-Reyna 1892* (CAN-600223).

***Taxonomic Status of Bromus mucroglumis—****Bromus mucroglumis* was described from the Chiricahua Mts. in Arizona by Wagnon (1950), but has not generally been recognized until relatively recently, when it was resurrected by Beetle (1987) and Pavlick (1995) (Peterson *et al.* 2001). *Bromus mucroglumis* has since been reported from Colorado, southwestern New México, Arizona (San Francisco Mountains), Chihuahua, Sonora, Durango, Coahuila, Nuevo León and Baja California Sur (Beetle 1987, Pavlick 1995, Herrera Arrieta 2001, Peterson *et al.* 2001, Clayton *et al.* 2002 onwards, Pavlick & Anderton 2007, Shaw 2008). *Bromus mucroglumis* was included in *B. richardsonii* by Kearney & Peebles (1960), whereas Allred (1993) treated it as as a synonym of *B. lanatipes* in New México.

Soderstrom & Beaman (1968) noted difficulties with the circumscription of *B. mucroglumis*. They found that several paratypes of *B. mucroglumis* represent multiple species, indicative of some confusion in the limits of the species when it was described by Wagnon (1950). We agree with Soderstrom & Beaman (1968), as did Gould & Moran (1981), that the paratype collections *Carter et al. 2341* and *Brandegee 73* are *B. anomalus*, and we recognize the paratype collection *Pennell 1929* (GH!, US, not seen), which was treated as *B. porteri* by Soderstrom & Beaman (1968), as *B. frondosus*. We have not seen *Le Sueur 092* (MO, US), which Soderstrom & Beaman (1968) recognized as *B. thysanoglottis* (see below for discussion of this taxon).

Peterson *et al.* (2001) included four individuals of *B. mucroglumis* (three from Arizona, one from Chihuahua) in their taxonomic study of *B. ciliatus* and *B. richardsonii*. In a discriminant analysis, *B. mucroglumis* was well-separated from the other taxa, the most important characters and states for its separation being lower glume length, lemma pubescence (hairs not restricted to margins) and adaxially hairy top culm blades. The four individuals of *B. mucroglumis* fell among the lower range of variation of *B. richardsonii* or were more or less intermediate between clusters of *B. ciliatus* and *B. richardsonii* in multiple bivariate comparisons of morphological and ecological (i.e., elevation) characters. The bivariate plots did not consider glume and lemma pubescence. Based on AFLP data, Peterson *et al.* (2001) found individuals of *B. mucroglumis* (all collected from a single population) to fall within a larger cluster comprising individuals of *B. richardsonii*. Based on their small sample of *B. mucroglumis*, Peterson *et al.* (2001) did not make a conclusion on the taxonomic status of *B. mucroglumis*.

In México it is generally straightforward to identify a plant as a member of the *B. richardsonii–B. mucroglumis* complex; however, throughout México in the field and in the herbarium we have experienced considerable difficulties understanding the differences between these species, as there is considerable variation in the vestiture of their glumes, lemmas, leaf sheaths and leaf blades of plants. Wagnon (1950) described *B. mucroglumis* as differing from *B. richardsonii* by its pubescent nodes, blades pilose above, glumes pubescent to pilose, rarely glabrous, second glumes mucronate and paleas puberulent to pilose. He observed that many plants are intermediate between *B. mucroglumis* and *B. richardsonii*, with the variation in the direction of *B. richardsonii*, and noted that these plants could arbitrarily be placed in either taxon. He suggested there may be introgression with *B. richardsonii*, and possibly with *B. lanatipes*. We have seen two of the supposedly intermediate collections cited from Baja California: *Wiggins & Demaree 4873* (RSA-POM) and *Wiggins & Demaree 4960* (NY, RSA-POM), which have glabrous glumes and lemmas that are pubescent along the margins and weakly to moderately puberulent or pubescent on the backs proximally and glabrous distally, glabrous blades and sheaths pubescent to pilose with stiff hairs. Wagnon (1950) did not indicate in his paper how the specimens varied, but he annotated the two RSA-POM sheets as "*Bromus richardsonii* Link. Atypical form with pubescent nodes; approaching *B. mucroglumis*". Although most specimens from Baja California (Sierra San Mártir) have glabrous nodes, several have weakly pubescent (*Moran 15626*, SD; *Witham 407*, SD; *Thorne et al. 57251*, RSA-POM) or pubescent nodes (*Rebman & Vinton 5558*, SD, RSA-POM; *Moran & Thorne 14127*, SD; *Thorne et al. 61430*, RSA-POM; *Noyes et al. 699*, RSA-POM). Pubescent nodes are known in *B. richardsonii* elsewhere in its range (Peterson *et al.* 2001, Saarela 2008).

There is considerable variation in the pubescence of the lemmas and glumes in the complex: some plants have lemmas that are pubescent throughout, while others are pubescent along the margins and on the lower backs and glabrous to scabridulous proximally. Similarly, some plants have pubescent glumes, while others have glabrous glumes. These differences in lemma pubescence have been emphasized previously in distinguishing *B. mucroglumis* from *B. richardsonii* (e.g., Beetle 1987 (as *B. ciliatus*), Herrera Arrieta 2001). However, this range of variation is recognized in *B. richardsonii* in North America north of México in some recent treatments (e.g., British Columbia: Saarela 2008; California: Saarela & Peterson 2012). Examples of specimens from British Columbia with lemmas pubescent throughout include *Malte s.n.* (CAN-93967) and *Saarela et al. 728* (CAN-590409), and the latter specimen also has pubescent glumes.

Like Wagnon (1950), previous authors have described *B. mucroglumis* as having blades that are pilose on at least one surface (Beetle 1987, Pavlick 1995, Pavlick & Anderton 2007). Based on our examination of herbarium specimens we find that leaf blade pubescence varies independently with lemma and glume pubescence. Some plants with pubescent lemmas have pilose blades (e.g., *Peterson et al. 15418*, *15441*, *15443*, *16923*, *20135*; *Peterson & Brothers 16999*, *17029*; *Peterson & Annable 12443*; *Peterson & Cayouette 15354*; *Peterson & González-Elizondo 16012*, *16029*) and others have glabrous blades (e.g., *Peterson et al. 15416*, *16940*, *17869*, *10052*, *20064*; *Peterson & Sánchez Alvarado 20008*; *Peterson & Cayouette 15408*). Conversely, many plants from México with lemmas pubescent only along the margins have glabrous blades, but there are also several with pubescent blades (e.g., Chihuahua: *Peterson & Cayouette 15363*, *Peterson et al 20069*; Durango: *Peterson & Cayouette 15387*, *Peterson & González-Elizondo 16027*, *Peterson et al. 21197*). Although plants with pubescent blades are not known in *B. richardsonii* in North America north of México (Peterson *et al.* 2001, Pavlick & Anderton 2007, Saarela 2008, Saarela & Peterson 2012), we attribute the pubescence in Mexican plants to local variation in this wide-ranging species. Similarly, we find the mucronate glume characters Wagnon used to distinguish *B. mucroglumis* from *B. richardsonii* to also vary independently with lemma and glume pubescence, and with leaf blade pubescence. Mucronate second glumes are present in many individuals of the complex in México, as well as in plants as far north as British Columbia (Saarela *et al.* 2008).

Given the broad range of variation in the *B. mucroglumis–B. richardsonii* complex, it is not possible to circumscribe taxa with a suite of co-varying morphological characters. Consequently, we recognize all plants as a single taxon, *B. richardsonii*. Plants in the southwestern United States recognized as *B. mucroglumis* should be studied closely to characterize their variation in relation to sympatric *B. richardsonii*.

***Taxonomic status of Bromus thysanoglottis*—***Bromus thysanoglottis* was described from the Sierra Madre Occidental in Durango by Soderstrom & Beaman (1968); they also cited specimens from Chihuahua. They diagnosed this taxon based on the presence of long hairs on the adaxial surface of the blade behind the ligule, and stated this character does not occur in other *Bromus* species in México and Central America. They considered *B. thysanoglottis* to be most closely related to *B. anomalus*. Most subsequent authors have recognized the taxon (Espejo-Serna *et al.* 2000, Herrera Arrieta 2001, Clayton *et al.* 2002 onwards, Herrera Arrieta & Cortés Ortiz 2009, Espejo Serna 2012), but without critical examination. By contrast, Beetle (1977) treated it as a synonym of *B. mucroglumis* (here included in *B. richardsonii*), a circumscription with which we agree. Plants recognized as *B. thysanoglottis* by previous authors fall within the range of variation recognized here in *B. richardsonii*.

**Specimens Examined:—MÉXICO. Baja California:** Arroyo de la quinta, Ejido "El Largo", 2100 m, 13 October 1990, *A. Benítez P. 2837* (ANSM); along observatory road 1/4 mi below gate, [31.0372°N, 115.4542°W], ca. 2650 m, 18 September 1983, *R.F. Thorne, K. Kubitzki, P. Peterson & C. Annable 57251* (RSA-POM-345660); below road N of Corral de Sam, 31.0667°N, 115.5667°W, 2000 m, 30 July 1970, *R. Moran 18051* (RSA-POM-231175, SD-76461); Sierra San Pedro Mártir, Cerro "2828", [31.0372°N, 115.4542°W], 2800 m, 9 August 1969, *H.V. Witham 407* (SD-71764, RSA-POM-364159); Sierra San Pedro Mártir, La Sanca creek, ca. 5 mi NW of La Grulla, [30.99°N, 115.4°W], 6700 ft [2042 m], 17 September 1930, *I.L. Wiggins & D. Demaree 4873* (NY, RSA-POM-218732); NW end of the Sierra San Pedro Mártir, 8 mi N of Vallecitos, 30.9556°N, 115.4239°W, 6800 ft [2073 m], 20 September 1968, *D.E. Breedlove 16309* (MICH-1119214); Sierra San Pedro Mártir, Cerro Vanado Blanco, 30.0667°N, 115.4833°W, 2550 m, 15 September 1968, *R. Moran 15626* (SD-69097); Sierra San Pedro Mártir, S summit ridge, 31.0833°N, 115.4833°W, 2750 m, 15 September 1968, *R. Moran 15638* (SD-69100); La Víbora, Arroyo la Grulla 4 km SW of La Grulla, 30.8667°N, 115.5083°W, 1900 m, 9 August 1977, *R. Moran 24429* (SD-97767); Sierra San Pedro Mártir, Yerba Buena, [31°N, 115.45°W], 2475 m, 16 August 1967, *R. Moran & R.F. Thorne 14127* (RSA-POM-222140, SD-76631); Sierra San Pedro Mártir, 1 mi S of La Tasajera, SW of Vallecitos off main road to observatory, [31.0372°N, 115.4542°W], 20 July 1988, *S. Boyd, Ross, Liston, Arnset, Meury, Nordin, Charlton & Thorne 2748* (RSA-POM-572680); Sierra San Pedro Mártir, [31.0372°N, 115.4542°W], 25 September 1982, *Adán Preciado 297* (MEXU-1089736); Sierra San Pedro Mártir, at La Encantada, [31.0372°N, 115.4542°W], 7290 ft [2222 m], 20 September 1930, *I.L. Wiggins & D. Demaree 4960* (F-770041, GH, NY, RSA-POM-14472, RSA-POM-219089, US-1614966,); Sierra San Pedro Mártir, E slope of Cerro "2828" on E rim, 30.0333°N, 115.45°W, 2800 m, 24 August 1968, *R. Moran 15408* (MEXU-167459, MICH-1119212, MSC-241660, RSA-POM-207303, SD-68941US); Sierra San Pedro Mártir, La Tasajera region, SW of observatory, ca. 7 mi S of the Observatory Road, [31.0372°N, 115.4542°W], 14 September 1998, *J. Rebman & B. Vinton 5558* (RSA-POM-644316, SD-152081); within 1/2 mile of observatory in Sierra San Pedro Mártir National

Park, [31.0372°N, 115.4542°W], 9200 ft [2804 m], 19 September 1983, *P.M. Peterson & C.R. Annable 01972* (US); Sierra San Pedro Mártir, Los Llanitos, 30.9667°N, 115.33°W, 2400 m, 17 August 1967, *R. Moran & R.F. Thorne 14253* (MEXU-227200, RSA-POM-222141, SD-76636); Parque Nacional Sierra San Pedro Mártir, along Observatory road, [31.0372°N, 115.4542°W], 2 September 1985, *R.F. Thorne, M.Z. Thorne, L. Thorne & T. Petrella 61490* (RSA-POM-386718); Sierra San Pedro Mártir, Vallecitos, 31.0333°N, 115.45°W, 1 September 1985, *R.F. Thorne, M.Z. Thorne, L. Thorne & T. Petrella 61430* (RSA-POM-346352, US-3643143); Sierra San Pedro Mártir, W facing slope along Upper Vallecitos road, ca. 1 mi S of junction with the observatory road, [31.0372°N, 115.4542°W], 28 August 1988, *R. Noyes, R.F. Thorne, P. Peterson & C. Annable 699* (RSA-POM-486563); Sierra San Pedro Mártir, 2.9 km S of Vallecitos Meadow on road to upper Vallecitos Meadow, [30.81°N, 115.22°W], 2485 m, 27 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R.D. Noyes 05147* (US); Sierra San Pedro Mártir, 5.1 km E of W park entrance, [31.0372°N, 115.4542°W], 2470 m, 27 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R.D. Noyes 5108* (CAN, US); Sierra San Pedro Mártir, Vallecitos, [31.0372°N, 115.4542°W], 9000 ft [2743 m], 19 September 1983, *P.M. Peterson, C.R. Annable, R.F. Thorne & K. Kubitzki 2000* (CAN, US); Sierra San Pedro Mártir, 55 mi SE of Hwy. 1 on road towards Villecentos at Arroyo Los Alamillos, 31.0112°N, 115.54°W, 2270 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15190* (CAN, MO, US); Sierra San Pedro Mártir, N-facing ridges of cerro E of Observatory peak and toward Cañada del Diablo, 31.0333°N, 115.35°W, ca. 2780 m, 1 September 1985, *R.F. Thorne, M.Z. Thorne, L. Thorne & T. Petrella 61465* (MEXU-835920); Sierra San Pedro Mártir, 62 mi SE of Hwy. 1 towards on road towards Villecentos, 31.0332°N, 115.34°W, 2490 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15203* (CAN, MO, US); Sierra San Pedro Mártir, 62 mi SE of Hwy. 1 towards on road towards Villecentos, 31.0333°N, 115.35°W, 2490 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15209* (MO, US); 55 mi SE of Hwy. 1 on road towards Villecentos at Arroyo Los Alamillos, 31.0333°N, 115.35°W, 2270 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15183* (CAN, MO, US); Sierra San Pedro Mártir, Parque Nacional San Pedro Mártir, 13.1 m E of W park entrance at end of road at gate,2675 m, 28 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R. Noyes 5214* (US). **Baja California Sur:** on N ridge of Cerro Azufre, 27.5°N, 112.6°W, 1600 m, 20 October 1971, *R. Moran 18751* (SD-80246); Sierra de La Laguna, La Laguna, Los Encinos Blancos, 23.5333°N, 109.9833°W, 1750 m, 27 September 1992, *J.L. León de la Luz 5074* (SD-147259). **Chihuahua:** Arroyo de la Quinta, Ejido "El Largo", 2340 m, 30 August 1990, *A. Benítez 2087* (ANSM); Sierra Madre Occidental, 5.8 mi N of Creel on road (Hwy. 25) towards San Juanito, [27.8273°N, 107.6°W], 2480 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15363* (CAN, MO, US); at Río Verde Crossing (Hwy. 24), 21 mi SW of El Vergel, 26.2793°N, 106.49°W, 2330–2360 m, 14 September 2006, *P.M. Peterson, F. Sánchez Alvarado & E.P. Gómez Ruíz 20069* (CAN, US); ca. 22.5 mi NE of Cienegulta de Barranca on road towards Creel, 27.3086°N, 107.5773°W, 2160 m, 5 September 2003, *P.M. Peterson, P. Catalán, C. López-González & G. Villegar-Guzmán 17697* (CAN, US); ca. 39 km carretera Chihuahua-Namiquipa, [28.76°N, 106.37°W], 2300 m, 24 September 1997, *M.A. Vergara B. 176* (MEXU); camino Gauchochic-Creel, 5 km antes del entronque a la Bufa, 27.33°N, 107.58°W, 2700, 24 September 1981, *M. E. Siqueiros 1614* (MEXU-1089737); mountain 15 mi E of El Vergel on road to Parral, 26.99°N, 105.43°W, 2286 m, 21 October 1959, *D.S. Correll & H.S. Gentry 23255* (US-2378629); Mpio. Guachochi, Arroyo Chichimuchi, ca. 15 km SE of Norogachi, 26.77°N, 107.01°W], 2146–2153 m, 18 October 2006, *R. Bye 34824, M. Luna, M. Mendoaz, L. Mera, D. Castro & E. Chave*z (MEXU); Mpio. Guazapares, E drainage of Barranca de Chinipas, NW of San Rafael, [27.34°N, 108.5°W], 11 November 1973, *R.A. Bye 5860* (MEXU); Mpio. Madera, Arroyo de la Quinta, Ejido "El Largo", [29.69°N, 108.27°W], 30 August 1990, *A. Benítez 2087* (MEXU-563188); Mpio. Madera, Ejido El Largo, [29.69°N, 108.27°W], 2100 m, 13 October 1990, *A. Benítez P. 2837* (MEXU-583582); Mpios. Guadalupe y Calvo, N side od Cerro Mohinora ca. 13 mi SW of Guadalupe y Calvo, 25.95°N, 100.96°W, 2950 m, 20 August 1988, *G. Nesom & A. McDonald 6474* (MEXU-505993); near Cumbre Mohinora, Sierra Mohinora, 25.9594°N, 107.05°W, 3250–3300 m, 13 September 2006, *P.M. Peterson, F. Sánchez Alvarado & E.P. Gómez Ruíz 20047* (CAN, MO, US); near Mirador de Cascada de Basaseachic, 28.1647°N, 108.2°W, 2022 m, 7 September 2008, *P.M. Peterson & J.M. Saarela 22083* (CAN, MO, US); Parque Cumbres de Majalca, [28.8042°N, 106.485°W], 2065 m, 26 September 1997, *C. Yen & E. Estrada 8750a* (ANSM); Sánchez, 27.7333°N, 107.6833°W, 2438 m, 12 October 1910, *A.S. Hitchcock 7713* (US-1009568); Sierra Madre Occidental, 48.6 mi S of Creel on road towards Rocheachic, 27.2785°N, 107.4947°W, 2630 m, 5 October 2000, *P.M. Peterson & J. Cayouette 15371* (CAN, MO, US); Sierra Madre Occidental, along road to viewing area of Cascada de Basaseachic, 28.1643°N, 108.2°W, 2220 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15355* (CAN, US); Sierra Madre Occidental, W of Casas

Grandes, 3 mi E of Cuesta Blanca, 26.6°N, 107.54°W, 1950 m, 4 September 1958, *J.R. Reeder & C.G. Reeder 3232* (ARIZ-214727, US-2473580); Sierra Madre Occidental, hills S of Laguna de Babícora, 18 airline km SSW of Gómez Farías, [29.2167°N, 107.8333°W], 2250 m, 28 August 1975, *N.H. Holmgren & T.K. Lowrey 8028* (MEX-830906, NY, RSA-POM-339980); Soldier Canyon [Arroyo Soldado], [30.0667°N, 108.2333°W], 6600 ft [2012 m], 16 September 1903, *M.E. Jones s.n.* (RSA-POM-112404); Strawberry Creek, NE of Colonia Pacheco, Sierra Madre Occidental, 30.1°N, 108.35°W, 1900–2000 m, 22–24 September 1934, *F.W. Pennell 19171* (US-1841215); Temosachi, Nabogame, 28.5°N, 108.5°W, 1800 m, 30 August 1988, *J.E. Laferriére 1880* (SD-131507); Canyon de St. Diego, 16 September 1891, *C.V. Hartman 802* (NY); SW Chihuahua, August to November 1885, *E. Palmer s.n.* (NY); 15.2 mi E of Ocote on Hwy. 24 towards El Vergel, 26.1392°N, 106.66°W, 2580 m, 14 September 2006, *P.M. Peterson, F. Sánchez Alvarado & E.P. Gómez Ruíz 20064* (CAN, MO, US); Sierra Madre Occidental, 15.5 mi W. Baquiriachic on Hwy. 16 towards Maycoba, 28.3452°N, 108.27°W, 1990 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15354* (CAN, US); 5.5 mi E of Cienegulta de Barranca on road towards Cree, 27.2809°N, 107.74°W, 1940 m, 5 September 2003, *P.M. Peterson, P. Catalán, C. López-González & G. Villegas-Guzmán 17698* (CAN, MO, US); Sierra Madre Occidental, 38 km W of Hwy. 45 on road towards Benito Juarez, 29.0769°N, 106.6097°W, 2230–2450 m, 17 October 1992, *P.M. Peterson & C.R. Annable 12576* (US); Urique, Cuiteco a 8.8 kms al N de Cuiteco, por la barranca, rumbo a San Rafael, 27°26'10.9"N, 108°00'04.1"W, 1740 m, 22 September 2002, *P. Tenorio, G. Morales & J. Rodriguez 22111* (US-3589051); Bocoyna, entronque carretera Creel, entrada Bocoyna, Ladera S Rancho Cima, Rancho Lucía, 27°41.428'N, 107°24.699"W, 7538 ft, 10 September 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 31944* (US-3589147); Bocoyna, Colecta 3, Rancho, 10 September 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 3206* (US-3589105); Maguarichi, Poblado de Maguarichic, 2a. Colecta Comida, 24 October 2003, *R. Bye, M. Mendoza, G. Morales, J. Rodríguez & M. Hilerio 33069* (US- 3589136). **Coahuila:** Sierra Zapalinamé, E of Saltillo, 25.3468°N, 100.9016°W, 2700 m, 2 September 2005, *P.M. Peterson & J. Valdés-Reyna 18784* (MO, US); Sierra Zapalinamé, 25.3468°N, 100.908°W, 2800 m, 20 September 2003, *P.M. Peterson, J. Valdés-Reyna & R.H. Cárdenas 17869* (CAN, US); camino de Cuatro, antes de llegar a las Palapas, en ladera baja de exposción noroeste de la sierra Zapalinamé, 25.3678°N, 100.5334°W, 1940 m, 15 September 2004, *J.A. Encina & M.A. Llanas de L. 1207* (ANSM); 51.6 km SE of Saltillo and 13 km SE of Jame on road to Sierra La Viga, 25.33°N, 100.55°W, 3240 m, 26 September 1990, *P.M. Peterson, C.R. Annable & J. Valdés-Reyna 10052* (CAN, MO, US); campus of La Escuela Superior de Agricultura, Buenavista, ca. 5 mi SE of Saltillo, 28.25°N, 99.7594°W, 18 June 1952, *F.W. Gould 6381* (ANSM); Sierra del Carmen, Moreno Canyon, 28.7167°N, 103.0342°W, 2466 m, 26 August 1997, *G. Harper, J. Medel & D. Doan-Cuder s.n.* (ANSM); Cañon del Agua (N-draining), mid-canyon, 2.5 mi S of ranchito, 27.0653°N, 102.4111°W, 1830 m, *T. Wendt & J. Valdés-Reyna VR-1043* (MEXU-773997); Maderas del Carmen, 13.7 mi NW of Pilares and 0.4 mi S of El Cinco Junction, 28.9538°N, 102.5853°W, 2365 m, 7 September 2005, *P.M. Peterson & J. Valdés-Reyna 18897* (CAN, MO, P-03631110, US); Maderas del Carmen, 13.8 mi NE of Los Pilares, 28.9536°N, 102.5854°W, 2335 m, 21 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 20976* (CAN, MO, US); Maderas del Carmen, 0.5 mi from Campo Uno, up the road towards the summit, 28.9962°N, 102.6113°W, 2355 m, 22 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 21020* (CAN, MO, P-03216869, US); Maderas del Carmen, 2.8 mi from Campo Uno, up the road towards the summit, 29.0139°N, 102.6034°W, 2594 m, 22 September 2007, *P.M. Peterson, J.M. Saarela, S. Lara Contreras & J. Reyna Álvarez 21035* (CAN, US); Maderas del Carmen, wooded canyon above Campo El Dos, 28.9899°N, 102.6119°W, 2280 m, 8 September 2005, *P.M. Peterson & J. Valdés-Reyna 18921* (CAN, US); Maderas del Carmen, wooded canyon above Campo El Dos, 28.9899°N, 102.6119°W, 2280 m, 8 September 2005, *P.M. Peterson & J. Valdés-Reyna 18920* (ANSM, CAN, MO, US); Maderas del Carmen, 13.3 mi NW of Pilares, 28.9491°N, 102.5862°W, 2320 m, 7 September 2005, *P.M. Peterson & J. Valdés-Reyna 18891* (CAN, MO, US); Madera del Carmen, between Campo Cinco and Campo Dos, 28.9767°N, 102.6153°W, 2456 m, 15 September 2012, *P.M. Peterson & K. Romaschenko 24508* (US); Madera del Carmen, 28.9958°N, 102.6114°W, 2374 m, 16 September 2012, *P.M. Peterson & K. Romaschenko 24514* (US); Madera del Carmen, 29.0042°N, 102.6111°W, 2434 m, 16 September 2012, *P.M. Peterson & K. Romaschenko 24528* (US) & *24529* (US); Mpio. Arteaga, Sierra la Marta, el rincón de la sierra y el Moro, límites con Nuevo León, 25.0833°N, 100.1167°W, 3000 m, 9 October 1992, *J.A. Villareal, M.A. Carranza & Grupo de Botanica Forestal s.n.* (US-3288338); Sierra del Pino, Ejido Acebuches, Cañón La Vaca, 28.25°N, 99.7594°W, 1850 m, 2 October 2003, *M.A. Carranza & I. Ramírez C-4073* (ANSM); Sierra las Vigas, al NE de Arteaga, cañon la Carbonera, en la cuesta rumbo al Tunal, 25.45°N,

100.5606°W, 2800 m, *M.A. Carranza & J. Valdés-Reyna C-2623* (ANSM); Sierra Madre Oriental, 34.4 mi NW of San Juanito on road towards Baquiriachic, 28.1068°N, 107.953°W, 2800 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15356* (CAN, MO, US). **Durango:** 3 mi S of Guachichiles, upper slopes of Cerro Huehento, 24.0786°N, 105.7433°W, 3078 m, 30 September 2008, *P.M. Peterson & J.M. Saarela 22453* (CAN, US); 9.6 mi W of La Ciudad and 22.6 mi NE of El Palmito on Hwy. 40, 23.6594°N, 105.7403°W, 2680 m, 9 October 2002, *P.M. Peterson & L.E. Brothers 17041* (US); Mpio Mezquital, 19.7 mi S of Mezquital on road towards Mesa La Gloria, 23.3172°N, 104.3381°W, 2500 m, 19 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19032* (CAN, MO, US); Sierra Nevada Occidental, 4 mi N of Hwy. 40 on road towards Neveros, 23.7309°N, 105.7318°W, 2850 m, 9 October 2000, *P.M. Peterson & J. Cayouette 15408* (CAN, MO, US); transect from Paseo de Cerro Gordo to the top (cumbre), 23.2086°N, 104.9481°W, 3136 m, 9 September 2006, *P.M. Peterson, F. Sánchez Alvarado 20008* (CAN, US); 0.8 mi S of Fancisco I. Madero and 2.3 mi N of Canoas, 22.6482°N, 104.2895°W, 2720 m, 2 October 2001, *P.M. Peterson & M.S. González-Elizondo 16029* (CAN, MO, US); 2 mi S of Fancisco I. Madero and 1.2 mi N of Canoas, 22.6322°N, 104.2926°W, 2700 m, 1 October 2001, *P.M. Peterson & M.S. González-Elizondo 16012* (CAN, US); 6 mi SW of San Miguel de Cruces, 24.4036°N, 105.9104°W, 2610 m, 9 October 2002, *P.M. Peterson & L.E. Brothers 17029* (CAN, MO, P-03216841, US); Arroyo La Sidia Crosing, 1 mi above La Madroño, 24.4796°N, 105.7889°W, 2250 m, 8 October 2002, *P.M. Peterson & L.E. Brothers 16999* (CAN, US); Puerto Buenos Aires, at the crest of the Sierra Madre Occidental, W of Cd. Durango, 2743 m, 10 October 1966, *J.R. Reeder & C.G. Reeder 4656* (MSC-231767, US-2982193); grown in garden in New Haven, Connecticut from seed collected at Puerto Buenos Aires (*J. & C. Reeder 4656*), 14 October 1967, *J.R. Reeder & C.G. Reeder 4656-G* (MSC-231766); 23 mi N of Hwy. 40 turnoff on road towards San Luis de Villa Corona, 24.0727°N, 105.4898°W, 2194 m, 29 September 2008, *P.M. Peterson & J.M. Saarela 22424* (CAN, US). Sierra Madre Occidental, at Río Mimbres 45 km W of Durango on Hwy. 40 towards El Salto, 23.9273°N, 105.13°W, 2430 m, 8 October 2000, *P.M. Peterson & J. Cayouette 15387* (CAN, MO, US); Sierra Madre Occidental, S of Durango on road towards La Flor and 4.7 mi N of Tableteros, 23.7106°N, 104.7206°W, 2135 m, 1 October 2007, *P.M. Peterson, J.M. Saarela, M.S. González-Elizondo, D.J. Rosen & C.S. Reid 21197* (CAN, MO, P-0361108, US); Sierra Madre Occidental, 0.5 mi SE of Los Charcos near small arroyo, 23.016°N, 104.29°W, 2690 m, 21 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19047* (US); Sierra Madre Occidental, 10.8 mi S. of Tableteros on road towards La Flor, 23.5657°N, 104.72°W, 2860 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15414* (US); Sierra Madre Occidental, 11 mi NE of Ojito de Camillones on road towards Papasquiaro, 25.0912°N, 106.136°W, 2580 m, 12 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15435* (CAN, MO, US) & *15437* (CAN, US); Sierra Madre Occidental, 17 mi SW of El Salto on Hwy. 40 towards Mazatlán, just E of a small puebla called Pericos, 23.7433°N, 105.5507°W, 2940 m, 8 October 2000, *P.M. Peterson & J. Cayouette 15407* (CAN, US); Sierra Madre Occidental, 3.2 mi SW of Las Bayas on road towards Ceballos, 23.4983°N, 104.86°W, 2780 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15420* (US); Sierra Madre Occidental, 5 mi NW of Vasco Gil on road towards Topia, 25.1425°N, 106.42°W, 2700 m, 12 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15446* (US); Sierra Madre Occidental, 5 mi W of La Ventana on road towards La Guajolota slopes, 22.9667°N, 104.6333°W, 2486 m, *P.M. Peterson & P. Catalán 17764* (NY, MO, RSA-POM-725716, US); Sierra Madre Occidental, 5.8 mi W of El Salto on Hwy. 40 towards La Ciudad, 23.7575°N, 105.4387°W, 2790 m, 8 October 2000, *P.M. Peterson & J. Cayouette 15404* (CAN, MO, US); Sierra Madre Occidental, at 21 km mark up road towards Topia and 19.8 mi NW of Papasquiaro, 25.1092°N, 105.59°W, 2650 m, 11 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15430* (US); Sierra Madre Occidental, at 35 km mark up road towards Topia and 28.2 mi NW of Papasquiaro, 25.0773°N, 105.6433°W, 2850 m, 11 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15431* (CAN, US); Sierra Madre Occidental, at 47 km mark up road towards Topia and 35.6 mi NW of Papasquiaro, 25.028°N, 105.73°W, 2610 m, 11 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15434* (US); Sierra Madre Occidental, SW slope of Cerro Gordo just below twin rock outcrops, 23.209°N, 104.9484°W, 3130 m, 26 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19143* (CAN, MO, US); Sierra Madre Occidental, 2 mi N of Tepehuana on road towards Mezquital, 23.3089°N, 104.3457°W, 2522 m, 11 September 2003, *P.M. Peterson & F. Sánchez-Alvarado* 17737 (US); Sierra Madre Occidental, El Salto (Aserraderos), 23.78°N, 105.36°W, 2500–2530 m, 31 August 1934, *F.W. Pennel 18537* (MICH-1119153, NY, GH, US-1841186); Sierra Madre Occidental, SW facing slope of Cerro Gordo, 23.2017°N, 104.9488°W, 3060 m, 26 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19137* (CAN, MO, US); Sierra Madre Occidental, 2 mi N of Tepehuana on road towards Mezquital, 23.3089°N, 104.29°W, 2522

m, 11 September 2003, *P.M. Peterson & P. Catalán 17737* (MO, RSA-POM-725676); Sierra Madre Occidental, 0.4 mi W of Pericos, E of La Ciudad on Hwy. 40, 23.7404°N, 105.5478°W, 2804 m, 3 October 2007, *P.M. Peterson & J.M. Saarela 21263* (CAN, MO, P-03631109, US); Sierra Madre Occidental, 1.6 mi W of Aserradero La Flor on road towards Las Bayas, 23.524°N, 104.7437°W, 2785 m, 25 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19118* (CAN, MO, US); Sierra Madre Occidental, 1.5 mi W of La Flor on road towards Las Bayas, 23.5238°N, 104.744°W, 2910 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15416* (CAN, MO, US); Sierra Madre Occidental, 4.7 mi NE of El Encinal on road towards Minas Promontoria, 25.1885°N, 105.1516°W, 2575 m, 2 October 2002, *P.M. Peterson, M.S. González-Elizondo & L.E. Brothers 16923* (CAN, MO, US); 6.9 mi NE of El Encinal on road towards Minas Promontoria, 25.2087°N, 105.1433°W, 2800 m, 3 October 2002, *P.M. Peterson, M.S. González-Elizondo & L.E. Brothers 16940* (CAN, US); Sierra Madre Occidental, 1.8 mi NW of Cienaga de Nuestra Senora on road towards Topia, 25.083°N, 106.3413°W, 2570 m, 12 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15441* (CAN, MO, US); Sierra Madre Occidental, Sierra Murata, 5.3 mi W of La Ventana, 22.9604°N, 104.5003°W, 2540 m, 20 September 2005, *P.M. Peterson & F. Sánchez Alvarado 19043* (CAN, US); Sierra Madre Occidental, 14.3 mi E of La Ventenata and 2.7 mi W of Los Charcos, 23.0053°N, 104.32°W, 2875 m, 13 September 2003, *P.M. Peterson & P. Catalán 17768* (MO, RSA-POM-721707, US); Sierra Madre Occidental, 14.6 mi S of Tepehuana and 4.7 mi N of Mesa la Gloria, 23.15°N, 104.19°W, 27603 m, 11 September 2003, *P.M. Peterson & P. Catalán 17740* (NY, RSA-POM-725678, US); Sierra Madre Occidental, 3.2 mi SW of Las Bayas on road towards Ceballos, 23.4983°N, 104.8607°W, 2780 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15418* (CAN, US); Sierra Madre Occidental, 3.5 mi N of La Flor on road towards Tableteros, 23.5632°N, 104.7158°W, 2880 m, 10 October 2000, *P.M. Peterson, J. Cayouette & Y. Herrera-Arrieta 15415* (CAN, US); Sierra Madre Occidental, 3.9 mi NW of Cienaga de Nuestra Senora on road towards Topia, 25.1056°N, 106.35°W, 2580 m, 12 October 2000, *P.M. Peterson, J. Cayouette & M.S. González-Elizondo 15443* (CAN, US); 2.8 mi N of Ciénega del Oro and 7.3 mi N of Fancisco I. Madero, 22.7434°N, 104.2525°W, 2780 m, 1 October 2001, *P.M. Peterson & M.S. González-Elizondo 16027* (CAN, MO, US); 5 km al 0 de Los Altares, 24.98°N, 105.92°W, 2410 m, 19 September 1985, *P. Davila, P. Tenorio & I. Solis 103* (GH, MEXU); 7.5 mi SW of San Miguel de Cruces, 24.3927°N, 105.9244°W, 2490 m, 9 October 2002, *P.M. Peterson & L.E. Brothers 17035* (CAN, US); Mpio. Durango, 65–75 km SW of Durango City on road to La Flor, 2620 m, 17 September 1979, *D.E. Breedlove 44273* (NY); Mpio. El Mezquital, 16 km de La Guajolota, por el camino a Platanitos, [22.95°N, 104.41°W], 2650 m, 7 October 1983, *S. & M. González & S. Acevedo 2638* (MEXU-774799); Mpio. El Mezquital, camino La Escondida-Charcos a un km del Santo Niño, [22.95°N, 104.41°W], 28 October 1992, *S. Acevedo 549* (MEXU-607117); Mpio. Santiago Papasquiaro, ca. 145 km al W de Santyiago Papasquiaro, 2400 mn, 6 October 1985, *S. González 3509* (ANSM); Quebrada de San Juan, 26 road mi N of railroad at Coyotes, on road to San Luis, 24.25°N, 104.7°W, 1900–2100 m, 7 August 1955, *J.H. Maysilles 8258* (MICH-1119158, MEXU-6128). **Jalisco:** Cumbre de Volcán Tequila, 11.2 mi S of Tequila, 20.7878°N, 103.847°W, 2920 m, 5 October 2001, *P.M. Peterson & O. Rosales 16071* (CAN, US); Volcán Tequila, along road to microwave station, 20.45°N, 103.8333°W, 8900–9000 ft [2712–2743 m], 23 October 1970, *G.L. Webster & G.J. Breckon 15862* (MEXU-792920, MICH-1119143**);** 9.8 mi S of Tequila on road to top of Volcán Tequila, 20.795°N, 103.847°W, 2620 m, 4 October 2001, *P.M. Peterson & O. Rosales 16063* (CAN, US); Cerro de Tequila, Tequila, [20.81°N, 103.84°W], 2400 m, 28 August 1972, *C.L. Diaz Luna 3460* (RSA-POM-301463); 10.1 mi S of Tequila on road to top of Volcán Tequila, 20.7908°N, 103.847°W, 2670 m, 4 October 2001, *P.M. Peterson & O. Rosales 16067* (CAN, US). **Michoácan**: Mpio. Zinapécuaro, Cañada La Yerbabuena, al SW de La Presa Laguna Larga, [19.8669°N, 101.2078°W], 2750 m, 17 September 1988, *M.J. Jasso 534* (MEXU-720158); near Zacapu, 19.8167°N, 101.7833°W, 28 September 1946, *E. Hernández-Xolocotzi, J. Ruppert & J. Guevara X-283*4 (US-1962222) & *X-2824* (US-1962214); 1 km al SE de Zíngiro, sobre el camino a Erongarícuaro, 2400 m, 2 November 1989, *J. Rzedowski 49209* (ANSM). **Nuevo León:** Cerro El Potosí, Galeana, [24.8667°N, 100.9028°W], 3500 m, November 1980, *J. Ochoa s.n.* (MEXU); Cerro El Potosí, localizado en Galeana, 24.8667°N, 100.2167°W, 2950 m, 15 August 1998, *J. Garza C., M. Castillo B. 207* (MEXU); Cerro El Potosí, Galeana, [24.82°N, 100.07°W], 3500 m, November 1980, *J. Ochoa 986* (MEXU-1097966). **Querétaro:** Mpio. Colón, Antena TV El Zamorano, [20.78°N, 100.05°W], 3355 m, 24 June 1981, *A. Mora Benítez & Fco. J. Ramírez Rodríguez 416* (MEXU-1089001). Mpio. Colón, Cerro Zamorano, 1 km al SW de la cumbre, [20.9333°N, 100.2167°W], 3100 m, 13 November 1971, *J. Rzedowski & R. McVaugh 412* (MICH-1119154, NY). **Sonora:** Cerro de las Flores, summit, [30.93°N, 109.95°W], 2625 m, *M. Fishbein, R.S. Felger, F. Garza S., M. Haro R., J. Malusa & D. Turner 710a*

(ARIZ-300623, MEXU-945974); E of Cananea, Sierra de Los Ajos, [30.97°N, 110.32°W], 26 September 1981, *A.A. Beetle M-7864* (ARIZ-234250, MEXU); Sierra de los Ajos, Rancho de los Ajos, Cañónj de Evans, [30.97°N, 110.32°W], 1650 m, 8 October 1992, *R.S. Felger, M. Fishbein, M. Haro Rodriguez, F. Garza Salazar, J. Malusa & D. Turner 92-801A* (ARIZ-300004, MEXU-571407); Sierra de los Ajos, Cañon Frijolito, 30.9333°N, 109.9583°W, 2300 m, 8 October 1992, *R.S. Felger, M. Fishbein, M. Haro Rodriguez, F. Garza Salazar, J. Malusa & D. Turner* 92-859 (ARIZ-299796, MEXU); Mpio. Yécora, 7.9 km E of Restaurant La Palmita on MEX 16, N slopes of Mesa del Campanero, 28.3742°N, 109.0539°W, 1560 m, 19 Sepember 1998, *A.L. Reina G. & T.R. Van Devender 98-1389A* (SD-159208); ca. 1 km NNW of Agua Blanca, S of Cerro Mazatlán, Arroyo Blanca, 28.5458°N, 108.9292°W, 1500 m, 24 Sepember 1998, *T.R. Van Devender, A.L. Reina & G. W. Trauba 98-1590* (SD-159207); Cañón Internacional, 23 August 1940, *S.S. White 3482* (ARIZ-45609, MICH-1119152, GH); Las Tierritas del Temblor, 20 August 1940, *E.A. Phillips 638* (MICH-1119274); Sierra Madre Occidental, 1.7 mi W of Maycoba on Hwy. 16 towards Yécora, 28.4065°N, 108.68°W, 1720 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15350* (CAN, US); Sierra Madre Occidental, 12.3 mi W of Yécora on Hwy. 16 towards Hermosillo, 28.3772°N, 109.05°W, 1810 m, 3 October 2000, *P.M. Peterson & J. Cayouette 15304* (CAN, MO, US); Sierra Madre Occidental, 16 mi W of Maycoba on Hwy. 16 towards Yécora, 28.4002°N, 108.8°W, 1520 m, 4 October 2000, *P.M. Peterson & J. Cayouette 15345* (CAN, MO, US); W of Yécora on Hwy. 16 towards Hermosilo, 28.3778°N, 109.04°W, 1830 m, 12 October 1992, *P.M. Peterson & C.R. Annable 12443* (CAN, US) 3.2 mi S of La Peña on road towards La Puerta, 23.5561°N, 105.3666°W, 2760 m, 15 September 2003, *P.M. Peterson, S. González-Elizondo & G.A. Teña-González 17784* (NY, MO, US, RSA-POM-721712). **Tlaxcala:** Mpio. Chiautempan, San Rafael Tepatlaxco, 19.2917°N, 98.1125°W, 2620 m, 20 October 1988, *J. Barrágan N. 214* (MEXU); Volcán La Malinche, [19.38°N, 98.05°W], 3010 m, 1 November 1985, *A. Miranda 229* (MEXU).

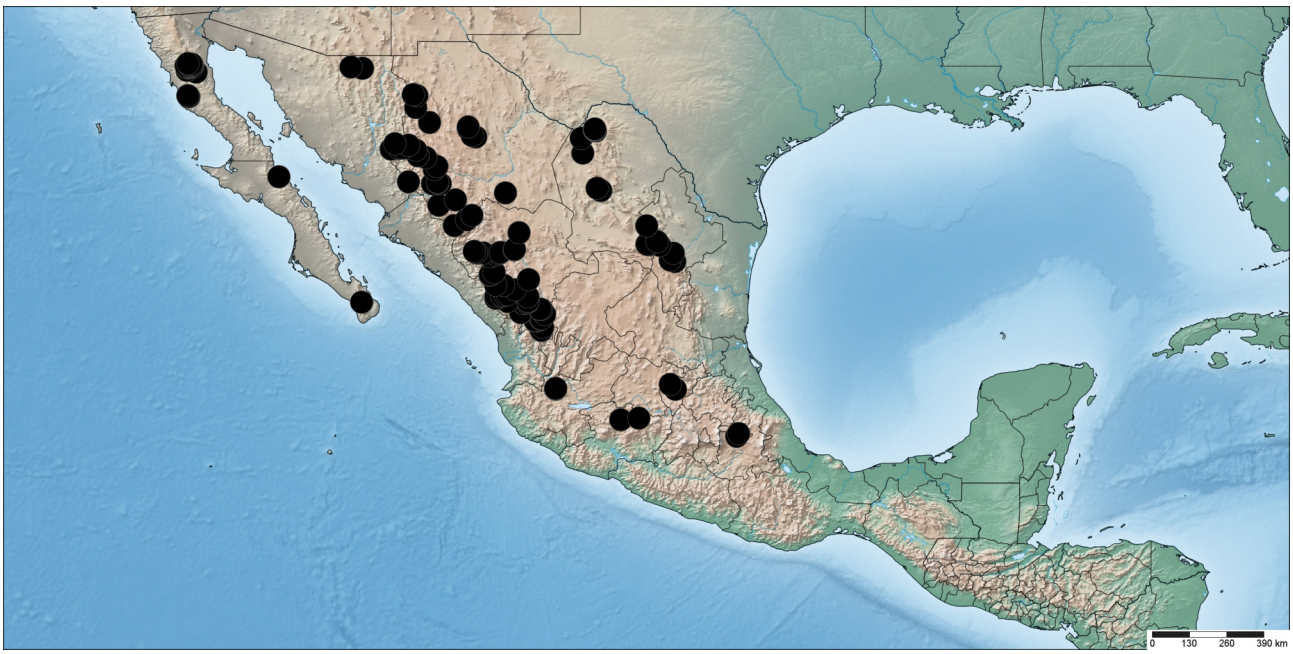


**FIGURE 63.** Geographical distribution of *Bromus richardsonii* in México.

20. ***Bromus rubens*** Linnaeus (1755: 5). Figs. 64, 65.

*Bromus madritensis* subsp. *rubens* (L.) Husnot (1899: 71). *Festuca rubens* (L.) Persoon (1805: 94). *Bromus scoparius* var. *rubens* (L.) Saint-Amans (1821: 45). *Anisantha rubens* (L.) Nevski (1934: 19). *Zerna rubens* (L.) Grossheim (1939: 306). Type:—SPAIN. *habitat in Hispania, Loefling 84* (neotype LINN-93.28!, designated by Smith 1985: 500).

Plants annual. Culms 4.5–46 cm cm tall, 0.5–1.5(–3) mm wide at base, erect or ascending, pubescent below inflorescences; nodes 1–3, glabrous. Leaf sheaths densely pubescent to pilose, hairs up to 1 mm long; auricles absent; ligules 1.8–4 mm long, lacerate, glabrous, occassionally with a few hairs along the margin; collars pubescent or pilose; blades up to 12.5(–27) cm × (0.7–)2–4(–7) mm, flat, sometimes convolute, densely pubescent

abaxially and adaxially, hairs up to 0.3 mm long, margins serrulate. Panicles 3.5–10 cm long including awns, (0.5–)2–6 cm wide, erect, compact, obovoid, usually reddish-brown to purplish at maturity, sometimes reduced a single spikelet, branches erect to strongly ascending, 0.1–0.8 cm long, shorter than spikelets, pubescent, hairs up to 0.2 mm long, usually not readily visible, shortest branch on lowest inflorescence node ≤ 6 mm, longest branch on lowest node branched 2–5 times, internodes much reduced upwards. Spikelets 2–2.5 cm long (3–4 cm including awns), florets 4–11, linear-elliptic to cuneate, moderately laterally compressed, overlapping at maturity; glumes pubescent, hairs up to 0.3 mm long, occassionally glabrous, margins hyaline, 0.1–0.2 mm wide, midnerves glabrous proximally, scabrous distally, apices acute, sometimes acuminate; lower glumes 6–9.5 mm × 0.5–1 mm, 1-nerved, narrowly lanceolate, green to purple along nerve; upper glumes 9–12 mm long, lanceolate, 3-nerved, green to purple along and between nerves; lemmas 10–15 mm × 1.5–3 mm, elliptic to lanceolate, rounded over the backs, apices bidentate, teeth 1–3 mm long, 5–7-nerved, green to purple along and between nerves, scabrous or pubescent, hairs on back ca. 0.2 mm long, marginal hairs often longer, up to 0.6 mm long, margins hyaline, 0.2–0.4 mm wide; awns 8–21 mm long, inserted 1.5–4 mm below lemma apices, straight, slightly spreading at maturity, scabrous; paleas shorter and narrower than the lemmas, backs pubescent, keels ciliate, cilia 0.1–0.6 mm long; anthers 0.5–0.7 mm long; caryopses 8−10 mm long. $2n = 4x = 28$ (Sánchez Anta *et al.* 1988, Vogt & Aparicio 1999, Sheidai & Fadaei 2005).

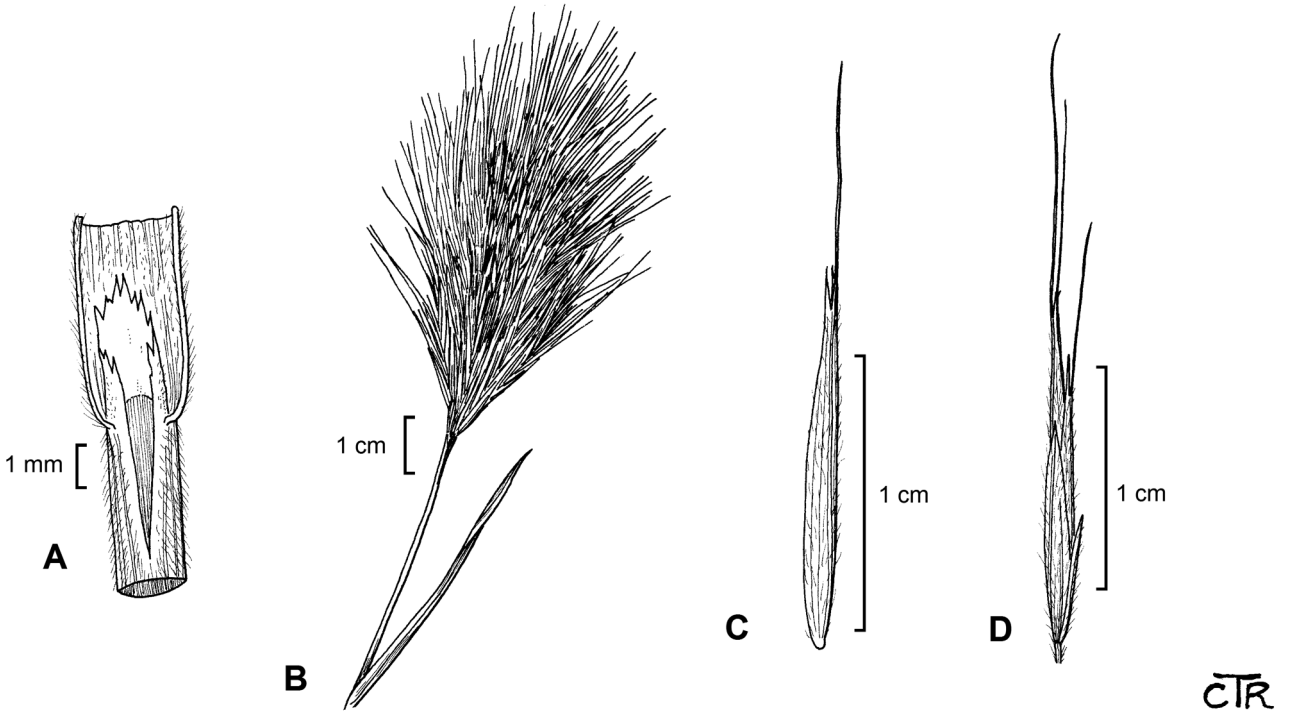


**FIGURE 64.** *Bromus rubens*. A. Ligule. B. Inflorescence. C. Lemma. D. Spikelet. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:**—Introduced. *Bromus rubens* is known only from northern Baja California and northwestern Sonora in México (Fig. 66). In the United States it occurs in California, Oregon, Washington, Nevada, Arizona, Colorado, New México, Utah and Texas (Pavlick *et al.* 2007, Salo 2005). Native to Europe.

Salo (2005) traced the origins and spread of *B. rubens* (as *B. madritensis* subsp. *rubens*) in North America. The first record of the taxon in México was collected on Guadalupe Island in 1931–1932 (*Howell 8280*, not seen) (Howell 1942). It was first collected on mainland Baja California in 1956 (*Howell s.n.*, ARIZ-169348) (Salo 2005), and was first collected in Sonora in the early 1980s (Felger 2000, Salo 2005). The species is expanding in Sonora, particularly in the Sierra Pinacate, and is now common in northern Sonora east of Pinacate Peak (Felger 2000). *Bromus rubens* is outcompeting *B. berteroanus* in the Sierra Pinacate (Felger 2000).

**Ecology:—**Disturbed habitats along drainages, flats and slopes; natural habitats in the Sierra Pinacata at higher elevations (Felger 2000). Elevation: 0–1325 m.

**Common Names:—**Red brome, foxtail brome, foxtail chess (English); bromo rojo (Spanish).

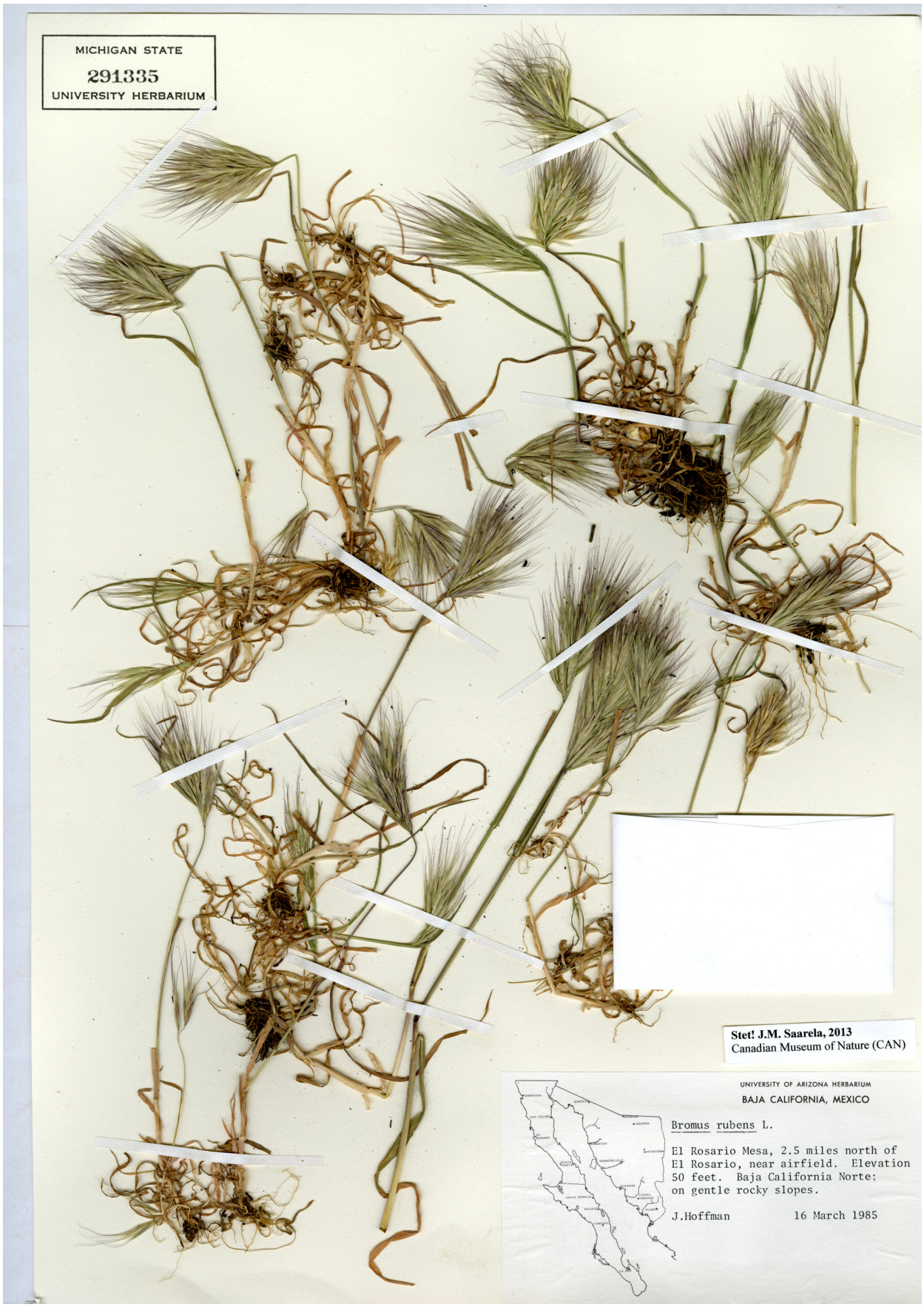


**FIGURE 65.** *Bromus rubens*. *Hoffman s.n.* (MSC-291335).

**Comments:**—See discussion under *B. madritensis*.

**Specimens Examined:**—**MÉXICO. Baja California:** 4–6 mi N of El Rosario, [30.05°N, 115.7167°W], 1 March 1987, *R. Perrill 5762* (ANSM, ARIZ-281950); near La Misión, [32.0928°N, 116.8522°W], 28 April 1981, *A.A. Beetle & R. Alcarus M-6751* (ANSM, ARIZ-230436); Punta Banda, [31.8°N, 116.5833°W], 15 km al S de Ensenada, 25 April 1986, *J.L. Elizondo 316* (ANSM, ARIZ-284704); BajaMarch entre La Misión y Ensenada, 28 April 1981, *A.A. Beetle & R. Alcaraz M-6568* (ANSM, ARIZ-230430); 2.5 km S of El Condor, 32.4417°N, 116.1583°W, 1300 m, 26 May 1979, *R. Moran 27334* (SD-103404); 3 mi E of Los Héroes de la Independencia, on road from Ensenada to San Felipe, [32.49°N, 116.87°W], 1040 m, 17 May 1979, *J.R. Reeder & C.G. Reeder 7203* (ARIZ-216255, SD-116087); 4 mi S of Tijuana, [32.49°N, 116.95°W], 13 March 1956, *J.T. Howell 30929* (ARIZ-169348, SD-72023); 400 yards downstream from Gilberto Castro's house, in canyon draining Santa Catarina Spring, 64 mi SE of Ensenada, [31.09°N, 116.18°W], 3700 ft [1128 m], *20 May 1961* (MEXU); a 10 km de Santa Verónica hacia Ojos Negros, [32.47°N, 116.37°W], 930 m, 26 May 1996, *Jaramillo V., Villegas G. & Domínguez O. 31* (MEXU); Agua Colorado, 1 mi NE of Santa Catarina, 64 mi SE of Ensenada, 31.63°N, 115.79°W, 1181 m, 22 April 1962, *R.E.Broder 693* (US-2523566); Aguaje Vargas, Isla de Cedros, [28.19°N, 115.21°W], 600 m, 24 June 1977, *L.M. Villareal de Puga, 10643* (MEXU); along highway S of Rosarito, 32.3333°N, 117.0333°W, 10 m, 12 April 1980, *R. Moran 28182* (SD-104985); along the highway ca. 10 mi SE of El Rosario, 30.05°N, 115.55°W, 14 February 1988, *R. Moran 7648* (SD-129163); Arroyo de Agua Caliente, 32.11°N, 116.4°W, 1 May 1981, *R. Guzmán 1341-b* (MEXU); Arroyo de Colonet, [30.97°N, 116.33°W], 5 May 1981, *M. Montoya & V. Morales 240* (MEXU); Arroyo Nueva York just below the old ranch site, 30.7167°N, 115.7167°W, 485 m, 22 April 1975, *R. Moran 21916* (SD-91210); Arroyo Santa Catarina 5 mi from the mouth, 29.5833°N, 115.2333°W, 75 m, 27 March 1970, *R. Moran 16990* (SD-76754); at W base of Cerro Piñon, 3 mi N of El Álamo, 31.6333°N, 116.0333°W, 1175 m, 29 May 1970, *R. Moran 17629* (SD-75040); ca. 1 mi N of Camalú, 30.88°N, 116.0667°W, 120 m, 26 March 1979, *J.R. Reeder & C.G. Reeder 7117* (ARIZ-215925, US-2861058, MEXU, SD-116064); ca. 23 mi S of Tecate, 32.24°N, 116.6333°W, 23 March 1974, *J.Taylor & C. Taylor 15619* (MO, NY, US-2914792); camino entre El Sauzal y San Antonio de las Minas, al N de Ensenada, [31.99°N, 116.58°W], 28 April 1981, *R. Guzmán M. 1213* (MEXU); Cañón de Guadalupe, 32.15°N, 115.81°W, ca. 500 m, 23 March 1986, *R.F. Thorne, S. Boyd et al. 61788* (RSA-POM-349192); Cañón el Saladito, 14 km SE of San Vicente, 31.2458°N, 116.1333°W, 170 m, 11 April 1982, *R. Moran 30363* (SD-110844); Cedros Island, Cerro de Cedros, 28.15°N, 115.2167°W, 1050 m, 16 April 1983, *T. Oberbauer, H. Wier & E. Wier 48* (SD-127653); Cedros Island, S slope of Cedros Mountain, 28.1333°N, 115.2167°W, 1000 m, 15 April 1963, *R. Moran 10624* (SD-53994); Cerro Bola, [32.3167°N, 115.82°W], 1275 m, 14 March 1987, *R.F. Thorne, A. Liston & O. Mistretta 62138* (RSA-POM-431268); City of Ensenada, 31.8758°N, 116.6131°W, 3 April 2007, *F. Casillas 82* (SD-182572); Ejido Reforma Agraria Integral, 29 April 1994, *Jaramillo V., Villegas G. & Miranda 948* (ANSM, MEXU); El Rosario Mesa, [32.5°N, 116.87°W], 2.5 mi N of El Rosario, near airfield, 16 March 1985, *J. Hoffman s.n.* (ARIZ-253838, MSC-291335); Guadalupe Island, canyon mouth ca. 3 mi S of NE Anchorage, 29.1083°N, 118.275°W, 5 m, 18 April 1957, *R. Moran 5976* (MEXU, SD-47199); Guadalupe Island, [29.04°N, 118.34°W], 5 June 1983, *A.E. Meling L. 43* (SD-119455); Guadalupe Island, [29.04°N, 118.34°W], April 1982, *A.E. Meling L. 1* (SD-119460); Guadalupe Island, [29.04°N, 118.34°W], ca. 1000 m, 28 March 1988, *R.F. Thorne 63057* (RSA-POM-494579); Guadalupe Island, [29.04°N, 118.34°W], July 1983, *A.E. Meling L.* (SD-119438); Guadalupe Island, 29.1181°N, 118.3181°W, 1000 m, 28 March 1988, *R.F. Thorne 63057* (MEXU); Guadalupe Island, Campamento bosque, [29.04°N, 118.34°W], 27 March 1982, *A.E. Meling L. 38* (SD-119489); Guadalupe Island, mouth of Long Canyon, 29.0083°N, 118.2333°W, 50 m, 16 April 1970, R. *Moran 17363* (SD-74766); Guadalupe Island, NE ridge, 29.175°N, 118.2833°W, 550 m, 12 April 1970, *R. Moran 17278* (SD-74773); Guadalupe Island, North Twin Canyon, [29.04°N, 118.34°W], 24 April 1958, *I.L. Wiggins & W.R. Ernst 76* (GH); Guadalupe Island, S of Oak Canyon, [29.04°N, 118.34°W], 850 m, 1 March 1965, *R. Moran 12026* (RSA-POM-172519, US-2461506, SD-59964); head of San Matías Pass, N of Hwy. 3, [31.3°N, 115.51°W], ca. 920 m, 19 April 1985, *R.F. Thorne & D. Charlton 60098* (RSA-POM-351834); La Concepción, [31.0167°N, 115.6167°W], 1600 m, 31 May 1968, *R. Moran 15008* (MEXU); La Huerta, Sierra Juárez, 31.9333°N, 116.1333°W, 950 m, 1 September 1969, *L. Hinton 1* (SD-75204); La Misión, between Ensenada and Tijuana, in arroyo bottom along S side of river, 32.0908°N, 116.8767°W, 10 m, 18 April 1998, *J. Rebman, P. Flanagan & La Misión Community Group 5093* (SD-144707); Laguna Hanson, Constitución National Park, Sierra de Juárez, [31.97°N, 115.84°W], 1610–1625 m, 28 May 1983, *R.F. Thorne, W. Wisura, W. Steinmetz et al. 55765* (RSA-POM-310490); Las Chichihuas, 14 km SE of La Misión, 32.0083°N, 116.75°W, 350 m, 14 March 1979, *R. Moran 26739*

(SD-101889); Los Coronados Islands, on NE slope above Hotel Cove, S Island, 32.5792°N, 117.2458°W, 100 m, 7 May 1976, *R. Moran 23106* (SD-95655); mesa near canyon rim SE of La Misión, 32.075°N, 116.8333°W, 250 m, 20 April 1969, *R. Moran 1578*7 (SD-71489); mouth of arroyo ca. 2 mi NE of Yubay, 29.2167°N, 114.0167°W, 775 m, 19 April 1973, *R. Moran 20578* (SD-87141); Mpio. Ensenada, "Llano Colorado" km 77 carretera Ensenada-San Felipe, [31.68°N, 115.93°W], 1160 m, 15 May 1997, *L. Aragón M. 570* (MEXU); Mpio. Ensenada, 1.5–2.5 mi upstream from Rincon, 4.5 mi NE of Santa Catarina, 64 mi SE of Ensenada, 31.67°N, 115.76°W, 1250 m, 22 April 1962, *R.E.Broder 705* (US-2523567); Mpio. Ensenada, 400 yds downstream from Gilberto Castro's house, in canyon draining Santa Catarina Spring, Santa Catarina, 31.6167°N, 115.8°W, 64 m, 1128 m, 20 May 1961, *R.E. Broder 423* (US-2523565); Mpio. Ensenada, El Tigre, en el km 30 de la carretera libre Ensenada-Tijuana, 32°N, 116.86°W, 400 m, 12 March 1987, *L. Elena López 19* (MEXU); Mpio. Ensenada, en el km 46 de la carretera Ensenada-San Felipe, Ejido Real del Castillo Nuev., [31.87°N, 116.14°W], 800 m, 18 March 1987, *L. Elena López 33* (MEXU); Mpio. Ensenada, NE of Mission San Fernando Velicata, W of Progreso, 29.9733°N, 115.2178°W, 600 m, 12 February 1998, *T. R. Devender, M. C. Penalba, J.L. Betancourt, S. H. Bullock 98-70* (MEXU); Mpio. Ensenada, Rancho El Potrero, 40 km al SW de el Observatorio de San Pedro Mártir, 30.9°N, 115.65°W, 1050 m, 1 May 1987, *P. Tenorio L. & C. Romero de T. 13236* (MEXU); Mpio. Ensenada, Rancho La Concepción, 33 km al SW de el Observatorio San Pedro Mártir, 31.05°N, 115.6167°W, 1300 m, 30 April 1987, *P. Tenorio L. & C. Romero T. 13169* (MEXU); Mpio. Ensenada, Sierra de Juárez, 32.4578°N, 116.5439°W, 12 May 1997, *M.A. Vergara B. 93* (MEXU); Mpio. Ensenada, Sur de San Quintín, 30.56°N, 115.94°W, 0 m, s.*d.*, *Espejel I. & Andrade N. 778* (MEXU); Mpio. Tecate, Santa Verónica, [32.47°N, 116.37°W], 930 m, 26 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 19* (MEXU); N slope just below summit of Cerro Jamau, 31.5667°N, 115.5917°W, 1890 m, 23 May 1976, *R. Moran 23256* (SD-95106); near Descanso, [32.02°N, 116.89°W], 24 March 1982, *E.A. Purer 2559* (SD-39687); NW ridge of Cerro San Juan de Dios, 30.15°N, 115.15°W, 900 m, 30 April 1973, *R. Moran 20621* (SD-87050); Rancho (solo) Sierra Blanca, Sierra Blanca, 32.075°N, 116.525°W, 675 m, 15 May 1976, *R. Moran 23179* (SD-94909); Rancho Meling, Sierra de San Pedro Mártir, [30.85°N, 115.29°W], 940 m, 27 May 1993, *Jaramillo V., Villegas G., O. Domínguez et al. 66* (MEXU); S Island fide E.R.B, along foot trail on rocky slope near center of island, 200 m, 14 March 1964, *E.R. Blakey 6440* (SD-61784) & *6452* (SD-61792); S of Decanso, [32.02°N, 116.89°W], 24 March 1932, *E. Purer & F. Detmers 15061* (RSA-POM-364165); S of Descanso, [32.02°N, 116.89°W], 24 March 1932, *E.A. Purer 2664* (SD-39689); S of Ensenada, 31.81°N, 116.6°W, 25 March 1937, *E.A. Purer 7166* (SD-39688); San Isidoro, 30.7667°N, 115.5333°W, 900 m, 2 June 1975, *R. Moran 22228* (MEXU, SD-91724; San Martín Island, 30.4833°N, 116.1083°W, 10 m, 11 April 1963, *R. Moran 10544* (SD-54258, US-2545381); Sierra La Asamblea, heading in from El Crucero off Hwy. 1, 13.5 mi N of junction with main rd to Bahia de Los Angeles, in cyn SE side of Cerro La Gobernadora, [31.98°N, 116.56°W], 700–1100 m, 30 March 1991, *S. Boyd & T. Ross 5593* (RSA-POM-575640); Sierra San Pedro Mártir, La Concepcion, 31.0167°N, 115.6167°W, 1600 m, 31 May 1968, *R. Moran 15008* (SD-69301, US-2597942); Sierra San Pedro Mártir, near La Corona de Abajo, 0.75 mi up main road from entrance gate, [31.0167°N, 115.6167°W], 2100 m, 20 July 1988, *S. Boyd & T. Ross 2769* (RSA-POM-519443); slopes of Cañón de Guadalupe, [32.15°N, 115.81°W], ca. 350–600 m, 18–19 February 1984, *R.F. Thorne, W. Wisura & A. Romsport 57819* (RSA-POM-331338); sumitt of Cerro Martomi, [30.3667°N, 114.99°W], 1600 m, 3 May 1973, *R. Moran 20753* (RSA-POM-262021, SD-87021); Tecate, 1 km S of Cerro Monje and 12 km SW of La Rumorosa, 32.4667°N, 116.1167°W, 1325 m, 8 May 1982, *R. Moran 30621* (SD-110814); Tecate, 4 km NE of Jacomún, 32.5167°N, 116.2833°W, 840 m, 14 May 1977, *R. Moran 24022* (SD-97121); Tecate, 5 km W of La Rumorosa, 32.55°N, 116.1°W, 1325 m, 15 May 1977, *R. Moran 24087* (SD-97109); Tinajas de Moraga, SE base of Cerro Matomí, 30.3667°N, 115.1167°W, 1150 m, 2 May 1973, *R. Moran 20705* (ARIZ-203760, SD-87020); Yubay Mesa area, [29.19°N, 113.86°W], 22 March 1990, *D. Harder & W. Appleby 1046* (MO, RSA-POM-552983); 2 mi N of El Rosario, [30.08°N, 115.78°W], 180 m, 6 February 1977, *J.R. Reeder & C.G. Reeder 6817* (ARIZ-208289, MEXU); Rancho Meling, Sierra de Pedro Mártir, [31.0372°N, 115.4542°W], 940 m, 27 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 61* (MEXU); Valle de Ojos Negros, 32.45°N, 116.98°W, 980 m, 26 May 1993, *Jaramillo V., Villegas G., Domínguez O. 36* (MEXU); Islas de Todos Santos, S island, [31.81°N, 116.8°W], ca. 15 m, 15 March 1980, *R.F. Thorne, W. Wisura, D. Michener et al. 53918* (RSA-POM-306982, SD-121193); near San Vicinte, [29.93°N, 115.48°W], 17 April 1925, *M.E. Jones s.n.* (RSA-POM-114181); San Martín Island, 3 mi off the cinder cones of San Quintín, [30.4833°N, 116.11°W], ca. 10 m, 21 February 1986, *R.F. Thorne 61582* (MEXU, RSA-POM-349692); Arroyo Amargo at Pacific coast, 14.5 km N, 30.306°N, 114.8667°W, 6.8 km W of El Rosario, 10 m, *T.L. Burgess & T.R. Van Devender 7628* (NY); Hwy. 10 mi

N of Ensenada (6 mi N of El Sauzal), [31.17°N, 115.8683°W], 5 April 1961, *P.C. Fisher, R.H. Hevly & M. Pitman 340* (ARIZ-155887); Mpio. Tijuana, La Presa, [32.0853°N, 115.8397°W], 50 m, 20 April 1979, *J. Delgadillo 10398* (ARIZ-220976); Isla de Cedros, Aguaje de Vargas, [28.0317°N, 114.9589°W], 550 m, 21 June 1977, *C.L. Diaz Luna 7932* (ARIZ-221308); 16 km WNW of Santa Cecilia, 548 m, 15 June 1980, *J.R. Reeder & C.G. Reeder 7267* (ARIZ-224187); 3 mi W of La Rumorosa, 32.1028°N, 115.9775°W, 1 April 1961, *P. Fischer, M. Pitman & R.H. Hevly 2038* (ARIZ-235713); Arroyo Palmerito at México Hwy. 1, 1.9 mi NW of Catavina, 29.73333°N, 114.7333°W, ca. 550 m, 17 March 1991, *T.R. & R.K. Van Devender, T.L. Burgess, E.M. Clark, R.J. Rondeau & J.F. Wiens 91-414* (ARIZ-291710); Punta Banda, exposed flat on top of ridge on Pico Banda above Ensenada Bay, 37.7417°N, 116.728°W, 300 m, 6 March 1992, *T.R. & R.K. Van Devender & E. Mellink 92-320* (ARIZ-303224). **Baja California Sur:** Escondido Spring, [25.8106°N, 111.3078°W], 31 March 1936, *C.F. Harbison* (SD-14865); Todos Santos del Sur, S of Landing Cove, [23.4486°N, 110.2233°W], 25 August 1968, *R.N. Philbrick & M.R. Benedict B68-482b* (RSA-POM-638841). **Sonora:** 8 km on MEX Hwy. 2 W of Río Sonoyta bridge at Sonoyta, 31.8958°N, 112.8708°W, 405 m, 3 March 1992, *R.S. Felger & K. Cliffton 92-142* (ARIZ-300134, MEXU); Pinacate region, 1.1 km N of Pinacate Peak, 31.7847°N, 113.4903°W, 930 m 13 October 1986, *R.S. Felger & G.E. Joseph 86-428* (MEXU); Pinacate region, ca. 1.2 km N of Pinacate Peak, 1 March 1987, [31.7667°N, 113.4903°W], 960 m, *R.S. Felger & C. Baker 87-44* (ARIZ-269899, MEXU, MSC, RSA-POM-444058); Puerto Peñasco, N slope of Pinacate Peak, [31.7667°N, 113.51°W], 750 m, 24 March 1970, *R.S. Felger 19471* (ARIZ-357953, SD-179378); summit of Pinacate Peak, [31.7667°N, 113.49°W], ca. 1250 m, 1 March 1987, *R.S. Felger, C. Baker & G. Joseph 87-53* (ARIZ-269901, MEXU, MSC-265391); Mpio. de Altar, NE Sierra El Humo, 10 km (by air) S of Rancho San Joaquín, ca. 42 km (by air) WSW of El Sasabe, 31.25 N, 111.964 W, 1144 m, 7 May 2005, *T.R. Van Devender, A.L. Reina G., A. Flesch & S. Jacogs 2005-836* (ASU-0010742); Pinacate region, ca. 2 km E of Crater Salvatierra, 3 April 1983, *E. Ezcurra s.n.* (ARIZ-270774); Pinacate Region, Sierra Pinacate, ca. 1100 m, 5 October 1981, *E. Ezcurra, M. Equihua & J. López-Portillo s.n.* (ARIZ-270775); El Papalote, 11.3 mi W of Sonoyta on MEX Hwy. 2 (directly S of Aguajita Spring), [31.1675°N, 112.9933°W], 20 February 1988, *R.S. Felger & C. Baker 88-25* (ARIZ-287605); Arroyo Guadalupe. Rancho Puerta Blanca (Cuenca Los Ojos Reserve), ca. 40 km E of Agua Prieta, 31.3125°N, 109.11°W, 2 April 2007, *A.L. Reina G., T.R. Van Devender, J.F. Wiens & J. Moore 2007-337* (ARIZ-385379); 41.3 km (by air) E of Agua Prieta, along MEX 2, Cuenca Los Ojos Foundation property, 31.3194°N, 109.0833°W, 1323 m, 19 May 2010, *T.R. Van Devender & A.L. Reina-G. 2010-578* (ARIZ-406206).


**FIGURE 66.** Geographical distribution of *Bromus rubens* in México.

21. ***Bromus secalinus*** Linnaeus (1753: 76). Fig. 67.

*Bromus mollis* var. *secalinus* (L.) Hudson (1778: 49). *Avena secalina* (L.) Salisbury (1796: 22). *Serrafalcus secalinus* (L.) Babington (1843: 374). *Forasaccus secalinus* (L.) Bubani (1901: 388). Type:—EUROPE. *habitat in Europae agris secalinis arenosis*, Anon. (neotype LINN-93.1!, designated by Smith 1985: 498).

*Bromus submuticus* Steudel (1854: 351). Type:—UNITED STATES OF AMERICA. Missouri: St. Louis, 1838, *N. Riehl s.n.* (isotype US-865472! fragm.).

Plants annual. Culms 23–130 cm tall, 1–5(–7) mm wide at base, smooth; nodes 3–5, finely to densely retrorsely pubescent, hairs 0.1–0.4 mm long. Leaf sheaths glabrous or sparsely pilose, hairs soft, 0.5–0.6 mm long; auricles absent; ligules 1.7–2.8 mm long, glabrous, apex erose; blades 8–28.5 cm × 2–9 mm, flat, abaxial surface pilose, hairs up to 1.5(–2) mm long, soft and wavy, adaxial surface glabrous with occasional hairs up to 0.5 mm long, margins smooth. Panicles 11–22 cm × 2–9 cm, open, branches stiffly erect, sometimes secund, one or more lower branches usually longer than spikelet, smooth to scabrous, 1–3 spikelets per branch. Spikelets 1–2 cm long, 5–12-flowered, ovate-lanceolate, terete to slightly compressed, rachilla zigzagged and visible at maturity; glumes glabrous or scabrous, margins serrulate, midnerves glabrous, occasionally scabrous distally; lower glumes 3.6–4.9 mm long, oblong to ovate, 3–5(–7)-nerved; upper glumes 4.2–6.1 mm long, ovate to elliptic, 7–nerved, sometimes mucronate, mucros 0.2–0.6 mm long; lemmas 6–7.7 mm × 1.6–3 mm, obovate-lanceolate, apex entire or minutely bifid, the cleft 0.1–0.2 mm deep, 7–9-nerved, nerves not conspicuous, backs glabrous and shiny, occasionally scabrous distally, margins dinstinctly inrolled in fruit; awns 1–6.5 mm long, occasionally reduced to mucro or absent, arising 0.5–0.7 mm below lemma apex, usually straight, occasionally twisted once near base, widest at base; paleas ± equal in length to lemmas, apex usually visible at lemma summit, backs glabrous, keels ciliate, cilia up to 0.3 mm long; anthers 1–1.3 mm long; caryopses 6−7 mm long, U- or V-shaped, margins strongly infolded in cross section. $2n = 28$.

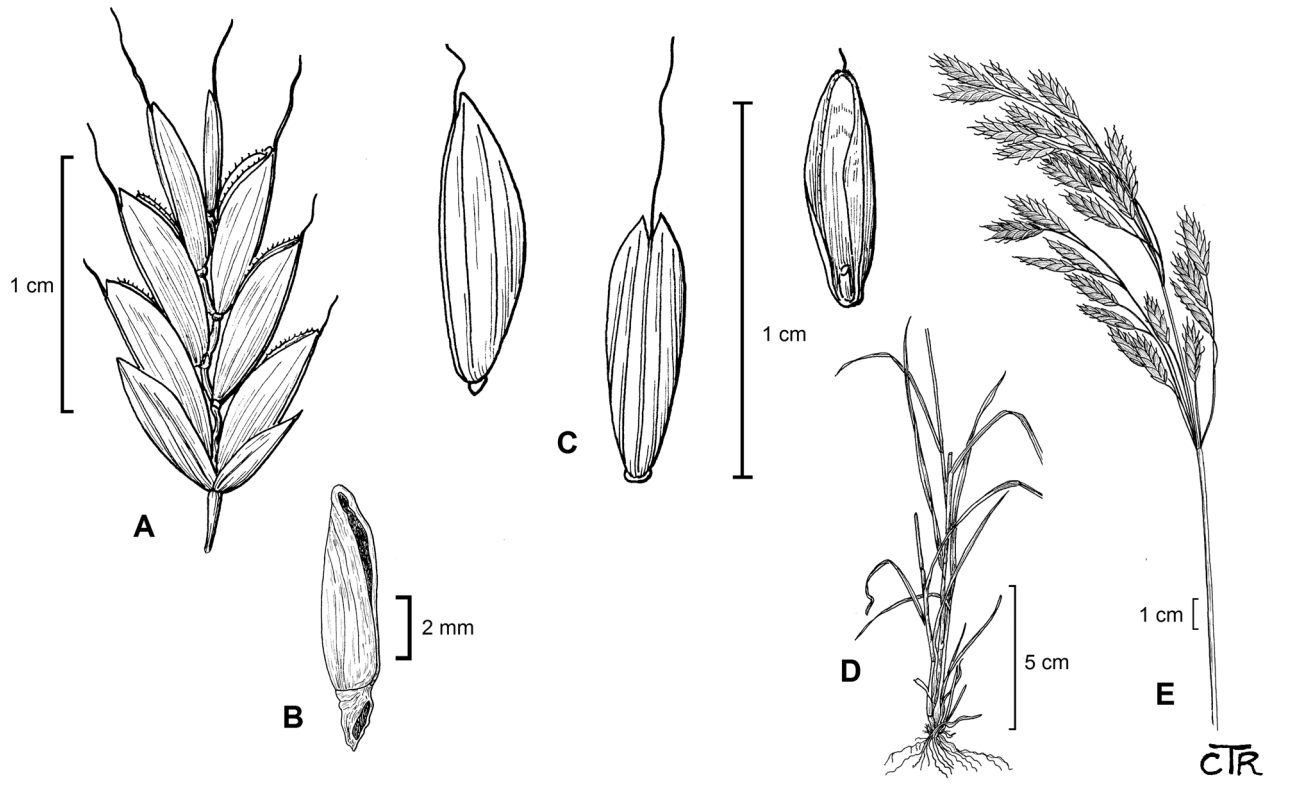


**FIGURE 67.** *Bromus secalinus.* A. Spikelet. B. Caryopsis. C. Lemmas. D. Habit. E. Inflorescence. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:**—Introduced. *Bromus secalinus* is known in México from two collections from Veracruz (Fig. 68); Beetle (1987) noted that the species is not established in Veracruz. Its current status in México is unknown. *Bromus secalinus* is native to Europe. In North America north of México it occurs throughout the U.S.A. and southern Canada (Pavlick & Anderton 2007).

**Ecology:—**Waste places and fields. Elevation: 2100–2135 m.

**Common Names:**—cheat, cheat chess, cheat grass, chess, chess brome, ryebrome, rye brome (English).

**Specimens Examined:**—**MÉXICO**. **Veracruz:** La Joya, 19.56667°N, 96.5°W, 2100 m, 9 September 1980, *M.T. Mejía Saulés M-212* (ARIZ-233857, MEXU-1098058); Mpio. Rafael Ramirez, Toxtlacuayan, 2135 m, 19.6167°N, 97.07°W, 16 September 1982, *T. Mejía S. 949* (MEXU).


**FIGURE 68.** Geographical distribution of *Bromus secalinus* in México.

22. ***Bromus tectorum*** Linnaeus (1753: 77). Figs. 69, 70.

*Schedonorus tectorum* (L.) Fries (1843: 131). *Genea tectorum* (L.) Dumortier (1868: 67). *Zerna tectorum* (L.) Lindman (1918: 101). *Anisantha tectorum* (L.) Nevski (1934: 20, 22). Type:—EUROPE. Anon. (lectotype LINN- 93.23!, designated by Smith 1985: 500).

*Bromus setaceus* Buckley (1862: 98). Type:—UNITED STATES OF AMERICA. Texas: *Buckley s.n.* (holotype PH-01065439!, isotype US-865474! fragm. ex PH). Pavlick *et al.* (2003: 185) indicated the specimen fragment at US to be the lectotype, and noted "lectotype designated by Hitchcock, Man. Grass. U.S. 817 (1935), but without citing a specific sheet in a specific herbarium." Buckley's original material is in PH and the specimen there is the holotype; the US specimen fragment is an isotype.

Plants annual. Culms 5–80 cm tall, 0.7–2.5 mm wide at base, solitary or loosely tufted, erect or ascending, weakly to moderately pubescent below inflorescences; nodes 2–4, glabrous or minutely pubescent. Leaf sheaths glabrous or variously pubescent, hairs stiff and up to 0.5 mm, or soft, wavy and up to 1 mm long, longer hairs up to 2 mm long sometimes present towards sheath apex; auricles absent; ligules (1–)2–3 mm long, glabrous, erose-lacerate; blades 1.3–14 cm × 1–5 mm, flat, adaxial surface sparsely to densely pubescent, hairs stiff hairs and up to 0.3 mm long, abaxial surface puberulent, hairs appressed and ca. 0.1 mm long, sometimes denser towards blade apex, margins smooth or with hairs like adaxial leaf surface. Panicles 4–22 cm × 1–13.5 cm, condensed and erect when young, becoming lax and nodding, sometimes reduced to a few spikelets, branches spreading to drooping, 0.4–4 cm long, usually longer than spikelets, usually one-sided, often sinuous, scabrous to densely pubescent, 1–14 spikelets per branch. Spikelets 1.5–2(–2.5) cm long (2.5–3.5 cm including awns), 3–6(–8)-flowered, linear-elliptic to cuneate, sometimes broadening at maturity, moderately laterally compressed, rachillas sometimes visible at maturity; glumes glabrous or minutely to densely pubescent with short, appressed hairs, with occasional long, soft hairs up to 1 mm long, these sometimes occurring in a line just inside margins, margins hyaline, midnerves glabrous or scabrous, apices ± bifid, the cleft 0.1–0.5 mm deep; lower glumes 4–9 mm long, linear-lanceolate, 1(–3)-nerved, green to purplish-green along and between the nerves, occasionally minutely awned, awn to 1.1 mm long; upper glumes 7–13.5 mm long, elliptic-lanceolate, 3(–5)-nerved, green to purplish-green along and between the nerves; lemmas 9–13.8 mm × (0.6–)0.9–1.5 mm, lanceolate, rounded over the backs, apices bifid, the teeth 1–3

mm long, 7-nerved, green to purplish-green along and between the nerves, backs glabrous, scabrous, or pubescent with long, soft hairs up to 1 mm long, hairs sometimes denser along margins and sometimes present only on upper two thirds, nerves smooth or scabrous; awns 8–18 mm long, arising 1.1–2.7 mm below lemma apex, straight; paleas 7–8.7 mm long, shorter and narrower than the lemmas, backs glabrous, translucent, keels ciliate, cilia up to 0.6 mm long; anthers 0.5–0.9 mm long; caryopses 7−8 mm long. $2n = 14$ (Sharma & Sharma 1979, Ward 1983, Lövkvist & Hultgård 1999).

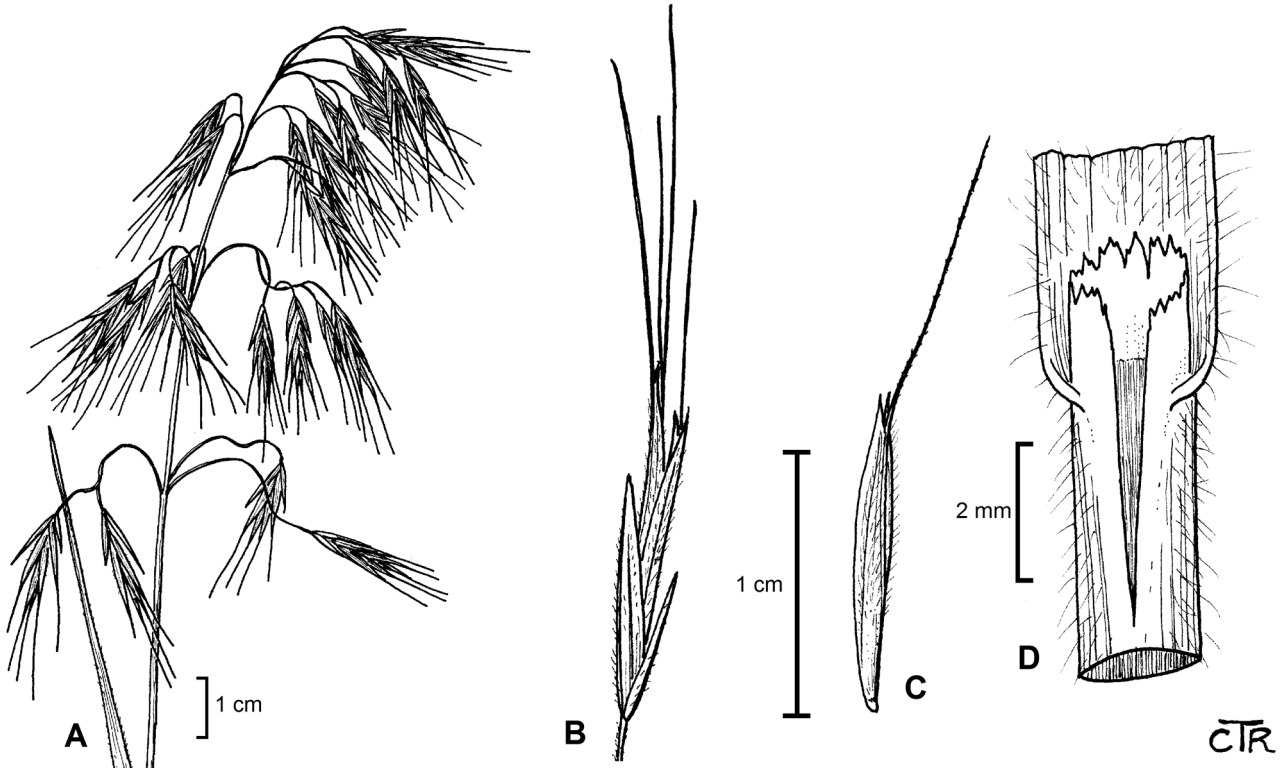


**FIGURE 69**. *Bromus tectorum*. A. Inflorescence. B. Spikelet. C. Lemma. D. Ligule. Illustration by C.T. Roché, reproduced from Barkworth *et al.* (2007) with permission.

**Distribution:**—Introduced. In México, *B. tectorum* occurs in northern Baja California (Fig. 71). Collections have also been made in Chihuahua and Coahuila, but it is not known if the species persists in these areas.

**Ecology:**—*Bromus tectorum* is found on slopes, arroyos and meadows; associated with *Pinus jeffreyi*, *Abies concolor*, *Arctostaphylos patula*, *A. pringlei*, *Holodiscus dumosus*, *Symphoricarpos oreophilus* and *Populus tremuloides*. Elevation: 930–2830 m.

**Common Names:**—cheatgrass, cheat grass, downy brome, drooping brome, early chess, military grass, thatch bromegrass (English).

**Comments:**—Glabrous plants are sometimes recognized as *B. tectorum* var. *glabratus* Spenner (1825: 152) (Gould & Moran 1981, Beetle 1987). *Bromus tectorum* is a serious invasive weed. In North America north of México the first specimen was collected in 1859 in Pennsylvania, and the first report in western North America is from Spence's Bridge, British Columbia, where the species was collected in 1889 (Mack 1981). A collection from Guadalupe Island, Baja California, in 1875 (*Palmer 99*, NY!) is the earliest report in North America (Novak & Mack 2001). Multiple introductions of *B. tectorum* into North America have been documented with genetic data (e.g., Mack 1981, Novak *et al.* 1991, Novak & Mack 1993, Novak & Mack 2001, Bartlett *et al.* 2002, Valliant *et al.* 2007, Schachner *et al.* 2008). The species is used as fodder (Saulés & Dávila Aranda 1992). *Bromus tectorum* was not reported for Mexico by Soderstrom & Beaman (1968).


**FIGURE 70.** *Bromus tectorum*. *Moran 30981* (SD-127299).

**Specimens Examined:**—**MÉXICO. Baja California:** Guadalupe Island, [29.04°N, 118.28°W], 1875, *E. Palmer 99* (NY, mixed sheet with *B. berteroanus*); 0–3 mi beyond end of road into N end of high Sierra San Pedro Mártir, [31.0372°N, 115.4542°W], 7200–7700 ft [2195–2347 m], 6 July 1962, *J.D. Olmsted 4589* (RSA-POM-170824); 1 km W of El Retiro and 11 km SSW of La Rumorosa, 32.4583°N, 116.1°W, 1275 m, 9 May 1982, *R. Moran 30660* (SD-111159); 2.5 km S of El Condor, 32.4417°N, 116.1583°W, 1300 m, 26 May 1979, *R. Moran 27335* (SD-103403); 4 km SE of San Valentín, E of Tecate, 32.5458°N, 116.425°W, 940 m, 11 May 1980, *R. Moran 28530* (SD-105869); 5 km S of Los Gavilanes, 32.2°N, 116.0042°W, 1675 m, 28 May 1979, *R. Moran 27502* (SD-104027); 6 km SE of San Pedro, 32.1417°N, 115.9375°W, 1680 m, 28 May 1979, *R. Moran 27510* (SD-104029); arroyo bed just S of Rancho San Faustino, 32.2167°N, 116.1667°W, 1290 m, 27 June 1981, *R. Moran 29637* (SD-108489); Cerro La Parra, 31.7667°N, 115.7833°W, 1775 m, 31 July 1976, *R. Moran 23660* (SD-94644); edge of Río San Rafael, NW end of Sierra San Pedro Mártir, [31.15°N, 115.45°W], 4500 ft [1372 m], 6 August 1962, *J.D. Olmsted 4664* (RSA-POM-170690); El Rayo, sobre la brecha a la Laguna de Hanson, al ENE de Ensenada, [32.0542°N, 115.075°W], 1 May 1981, *R. Guzmán 1330* (MEXU); Ensenada, [31.87°N, 116.59°W], 27 May 1993, *Jaramillo V., Villegas G., Domínguez O. et al. 81* (MEXU); Ex-Misión San Pedro Mártir, 30.8°N, 115.45°W, 1475 m, 1 June 1975, *R. Moran 22124* (SD-91433); in meadow NW of Rancho Pantalones, 4 km NNW of Laguna Hanson, 32.1042°N, 115.9208°W, 1650 m, 24 June 1979, *R. Moran 27693* (SD-103013); La Grulla, 30.8917°N, 115.4833°W, 2050 m, 8 June 1982, *R. Moran 30916* (SD-111214); Metamorphics 4 km SE of El Topo, 32.2167°N, 115.95°W, 1690 m, 16 May 1982, *R. Moran 30759* (SD-110998); Mpio. Ensenada, Ahuaje El Sapo Ejido Sierra de Juárez, 2531 pies, [32.29°N, 115.86°W], 13 May 1997, *A. Miranda S. 1151* (MEXU); Mpio. Ensenada, Rancho San Faustino, [32.22°N, 116.17°W], 3 May 1981, *R. Guzmán M. 1373* (MEXU-1098061); Mpio. Ensenada, Sierra de Juárez aserradero cerca de la Laguna Hanson en el Parque Nacional Constitución de 1917, [31.97°N, 115.84°W], 1500 m, 30 April 1994, *V. Jaramillo V., G. Villegas & A. Miranda 953* (MEXU); Mpio. Ensenada, Rancho La Concepción, 33 km al SW de el Observatorio San Pedro Mártir, 31.05°N, 115.6167°W, 1300 m, 30 April 1987, *P. Tenorio L. & C. Romero T. 13183* (MEXU-995769, MEXU-1098042); Mpio. Mexicali, Ejido Jacumé km 78 carretera Mexicali-Tijuana, [32.47°N, 116.18°W], 1260 m, 12 May 1997, *M.A. Vergara B. 82* (MEXU-1098070); Mpio. Tecate, Santa Verónica, [32.46°N, 116.36°W], 930 m, 26 May 1993, *Jaramillo V., Villegas G. & Domínguez O. 17* (MEXU-1098067); Mpio. Tijuana, La Rumorosa, [32.535°N, 116.05°W], 1220 m, 17 May 1987, *P. Tenorio L. & C. Romero de T. 13459* (MEXU); near summit of Cerro de la Cupula (= C.2828), 31.0333°N, 115.45°W, 2800 m, 2 July 1982, *R. Moran 30981* (SD-127299); near summit of Cerro de la Cupula (C. 2828), 31.0333°N, 115.45°W, 2700 m, 27 July 1970, *R. Moran 17893* (SD-76453); Parque Nacional Constitución, Laguna Hanson, [32.0542°N, 115.075°W], 1 May 1981, *A.A. Beetle & R. Alcarez M-6641* (ANSM, MICH-119287, MEXU-1098069); Parque Nacional Constitución, Laguna Hanson, Sierra de Juárez, [32.07°N, 115.89°W], ca. 1610 m, 15 September 1983, *R.F. Thorne, K. Kubitzki, P. Peterson & C. Annable 57061* (RSA-POM-332659); Parque Nacional Constitución, Laguna Hanson, Sierra de Juárez, [31.97°N, 115.84°W], 1610–1625 m, 28 May 1983, *R.F. Thorne, W. Wisura, W. Steinmetz et al. 55773* (RSA-POM-310447, SD-123838); S of El Condor, 0.5–2.3 mi S, [32.45°N, 115.95°W], 1300 m, 9 May 1985, *R.F. Thorne & W. Wisura 60554* (RSA-POM-342697); W shore of Laguna Hanson, 32.0542°N, 115.075°W, 1610 m, 21 June 1980, *R. Moran 28865* (SD-105484); Sierra San Pedro Mártir, Rancho Meling, [31.0372°N, 115.4542°W], 940 m, 27 May 1993, *Jaramillo V., Villegas G., O. Domínguez et al. 65* (MEXU); Sierra San Pedro Mártir, above Yerba Buena, 31.0333°N, 115.45°W, 2750 m, 30 May 1977, *Reid Moran 24206* (MEXU-726456); Sierra San Pedro Mártir, Corral Meadow, 7.5 km NW of the observatory, 31.1125°N, 115.4972°W, 2520 m, 26 June 1988, *A.C. Sanders, R. Minnich, E. Franco & M. Salazar 7922* (RSA-POM-474990, SD-125856); Sierra San Pedro Mártir, La Concepción, 31.0167°N, 115.6167°W, 1600 m, 31 May 1968, *R. Moran 15003* (SD-69303, US); Sierra San Pedro Mártir, La Concepcion, 31.0167°N, 115.6167°W, 1600 m, 31 May 1968, *R. Moran 15004* (SD-69302); Sierra San Pedro Mártir, Oak Pasture, 30.9583°N, 115.6°W, 1710 m, 8 May 1978, *R. Moran 25688* (SD-100727); Sierra San Pedro Mártir, S of Vallecitos near Cerro la Botella Azul, [30.9556°N, 115.4239°W], 2440 m, 27 June 1998, *J. Rebman & A. Russell 5389* (ASU-0010744, RSA-POM-642764, SD-145344); Sierra San Pedro Mártir, Yerba Buena, [31.0333°N, 115.3°W], 2450 m, 16 August 1967, *R. Moran & R.F. Thorne 14235* (RSA-POM-222143); Sierra San Pedro Mártir, Vallecitos, [30.9556°N, 115.4239°W], 17 October 1982, *M. del Real M. 301* (MEXU-1098065); Parque Nacional San Pedro Mártir, 5.1 km E of W park entrance, [31.0372°N, 115.4542°W], 2470 m, 27 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R.D. Noyes 5106* (CAN, US); Sierra San Pedro Mártir, [31.0372°N, 115.4542°W], 7 May 1991, *O. Paullin & M. Montoya 265* (MEXU-1098064); Sierra San Pedro Mártir, Cerro Observatorio, [31.0372°N,

115.4542°W], 2830 m, 28 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R.D. Noyes 05246* (US); Sierra San Pedro Mártir, 55 mi SE of Hwy. 1 on road towards Villecentos at Arroyo Los Alamillos, 31.0112°N, 115.54°W, 2270 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15184* (US); Sierra San Pedro Mártir, Vallecitos Meadow, 16.6 km E of W park entrance, [31.0372°N, 115.4542°W], 2485 m, 27 August 1988, *P.M. Peterson, C.R. Annable, R.F. Thorne & R.D. Noyes 5112* (CAN, US); Sierra San Pedro Mártir, camp site at Vallecitos, [31.0333°N, 115.3°W], 8300 ft [2530 m], 19 September 1983, *P.M. Peterson, C.R. Annable, R.F. Thorne & K. Kubitzki 1932* (US); Sierra San Pedro Mártir, 56 mi SE of Hwy. 1 on road towards Villecentos, 31.0157°N, 115.53°W, 2210 m, 24 September 2000, *P.M. Peterson & J. Cayouette 15192* (US); upper (E) end of Vallecitos Meadow, 31°N, 115.45°W, 2350 m, 6 September 1976, *R. Moran 23735* (SD-94746); Vallecitos, near road to observatory and campground, [31.0333°N, 115.3°W], 2430 m, 18 June 1985, *R.F. Thorne, R. Dahlgren, S. Boyd & D. Charlton 60840* (RSA-POM-346117); 10.5 mi W of La Rumorosa, along Hwy. 2, [32.51°N, 116.13°W], 1310 m, 8 May 1985, *R.F. Thorne & W. Wisura 60425* (RSA-POM-342669); Yerba Buena, 31°N, 115.45°W, 2450 m, 16 August 1967, *R. Moran & R.F. Thorne 14235* (SD-76628); Yerba Buena, 31.0333°N, 115.45°W, 2750 m, 30 May 1977, *R. Moran 24206* (SD-98077). **Chihuahua:** Maleza en Jardín de observacion en La Campana, [28.63°N, 106.08°W], 12 April 1975, *J. Valdés-Reyna VR877* (ANSM). **Coahuila:** Buenavista, 25.4333°N, 101.1°W, 1600 m, *s.d.*, *A. de los Reyes s.n.* (ANSM). **Sonora:** El Papalote, 18 km on MEX Hwy. 2, W of Sonoyta, [31.1675°N, 112.9933°W], 9 April 1986, *R.S. Felger & R. Valenzuela López 86-133* (ARIZ-263959).


**FIGURE 71.** Geographical distribution of *Bromus tectorum* in México.

## Excluded Taxa

***Bromus arenarius*** Labillardière (1804[1805]: 23, pl. 28)
Wiggins (1980) reported *B. arenarius* from northern Baja California. Gould & Moran (1981) noted that they did not see specimens of this species and did not treat it, whereas Beetle (1987) later treated it for Baja California. We have not seen any specimens of this species from México.

***Bromus ciliatus*** L.
See comments under *B. richardsonii*.

***Bromus commutatus*** Schrader (1806: 353)
Beetle (1987) noted that *B. commutatus* has been collected in Chihuahua, but is not established there. His report may be based on MEXU-243518 collected 26 August 1978 at Rancho Experimental La Campana (there is no

collector given on the specimen label) and originally determined as *B. commutatus*; the specimen is *B. japonicus*. This species was again reported recently from the same experimental station by Royo Márquez & Melgoza Castillo (2012), likely based on the same mis-identified specimen.

***Bromus grandis*** (Shear 1900: 243) Hitchcock in Jepson (1912: 175)
Wiggins (1980) reported this taxon from N Sierra Juárez, Baja California. Gould & Moran (1981) noted that they did not see specimens of this taxon and did not treat it. We have not seen specimens of this taxon from Baja California or elsewhere in México.

***Bromus orcuttianus*** Vasey (1885a: 223)
Wiggins (1980: 912) reported this taxon from "northernmost Baja California". Gould & Moran (1981) noted that they did not see specimens of this taxon and did not treat it. We have not seen specimens of this taxon from Baja California or elsewhere in México. A specimen determined originally as *B. orcuttianus* from southwestern Chihuahua (Aug–November 1883, *Palmer 233*, NY!) is a species of *Brachypodium*. Another specimen from Chihuahua (*Jones s.n.*, RSA-POM), incorrectly determined as *B. orcuttianus*, is *B. carinatus* var. *marginatus*.

***Bromus porteri*** (Coulter 1885: 425) Nash (1895: 512)
See comments under *B. anomalus*.

***Bromus sterilis*** Linnaeus (1753: 77)
Espejo-Serna *et al.* (2000) reported *B. sterilis* from Baja California. This report may be based on *Paulin & Morales 218* (MEXU-1098059) and MEXU-109768, both collected in Baja California and originally determined as *B. sterilis*; the former specimen is *B. carinatus*, the latter is *B. madritensis*.

***Bromus texensis*** (Shear 1900: 41) Hitchcock (1913: 381)
Reported from México by Hitchcock (1913), on the basis of a specimen in US (*Pringle 2052*). Wagnon (1952) noted that this specimen is *B. anomalus*, a determination with which we agree.

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