CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. LXXXVII

(*Continued from p. 57.*)

IV. THE COMPLEX BROMUS CILIATUS

M. L. Fernald

(Plate 196)

Bromus **Dudleyi**, n. sp. (Tab. 196, figs. 1–3). Planta noncaespitosa vel plus minusve caespitosa 0.4–1.2 m. alta; culmis erectis glabris nodis sparse breviterque pilosis; foliis caulinis plerumque 6 late linearibus utrinque glabris vel paginis superioribus villosis, vaginis glabris vel rare villosis, laminis mediis 1–2.5 dm. longis 4–12 mm. latis; paniculis lanceolatis vel ovatis laxe ramosis 0.6–2 dm. longis, ramis filiformibus scabris remotis adscendentibus vel patentibus vix pendulis; spiculis lanceolato-oblongis vel anguste ellipticis 2–2.5 cm. longis 5–9 mm. latis 4–7-floris; glumis planiusculis vix conduplicatis submembranaceis, marginibus scariosis purpureo- vel aeneo-tinctis; gluma inferiore lanceolata acuta vel attenuata late costata, costa laevi vel scabra; gluma superiore oblongo-lanceolata obtusa vel subacuta plerumque breviter aristata valde lateque 3 (rarissime 5)-costata, costis brunneis vel purpurascentibus; lemmatibus planiusculis submembranaceis anguste oblongis aristis exceptis 1–1.2 cm. longis 2.3–3 mm. latis purpurascentibus aeneis vel rare virescentibus obtusis vel subacutis apice aristatis arista scabra 2–4 mm. longa, paginis dorsalibus 3–5-nervatis in parte extra nervos laterales valde villoso-hirsutis ad vel supra medium; palea plana oblonga quam lemma breviore, marginibus infra apicem plerumque scariosis 0.5–0.7 mm. latis integris, nervis ciliolatis infra a marginibus et a medio subaequidistantibus ad apicem versus marginalibus; antheris 1–2 mm. longis; caryopsibus oblongo-lanceolatis 8 mm. longis 1.6 mm. latis, latere ventrali valde costato.—Newfoundland to British Columbia, south to Nova Scotia, northern and western New England, New

York, Michigan, Minnesota and Montana. Newfoundland: bushy swale along Deer Brook, Bonne Bay, August 26, 1929, *Fernald, Long & Fogg*, no. 1223 (type in Gray Herb.); boggy thickets, Birchy Cove (Curling), *Fernald, Wiegand & Kittredge*, no. 2624 (in part); gravelly railroad embankment, Grand Falls, *Fernald, Wiegand & Darlington*, no. 4679; gravelly thickets along Harry's River, *Fernald & Wiegand*, no. 2617; wet runs and boggy spots in limestone barrens, Table Mountain, Port à Port Bay, *Fernald, Wiegand & Kittredge*, no. 2619. Quebec: wet thicket, Ile du Havre, Mingan, *St. John*, no. 90,166; alluvial thickets, Dartmouth River, August 26 & 27, 1904, *Collins, Fernald & Pease;* gravel of River Ste. Anne des Monts, August 3–17 1905, *Collins & Fernald;* alluvial islands at the mouth of Bonaventure River, August 4, 1904, *Collins, Fernald & Pease:* alluvial thickets and low wooded river-banks, Little Cascapedia River, July 29 & 30, 1904, *Collins, Fernald & Pease;* Kondiaronk, Lac Saint-Jean, *Victorin*, nos. 15,265, 15,266; Lac Noir, Co. Megantic, *Victorin*, no. 11,369. Prince Edward Island: damp thicket, Indian River, *Fernald, Long & St. John*, no. 6931. Nova Scotia: gravelly thicket, Uniacke Lake, *Fernald, Bartram & Long*, no. 23,335. Maine: dry field, outlet, Pleasant Pond, *Collins & Chamberlain;* moist soil, Beddington, September 2, 1924, *Knowlton;* wet place, Rockland, *C. A. E. Long*, no. 660; river-thickets, Sydney, *Fernald & Long*, no. 12,718. New Hampshire: boggy meadow, Clarkesville, *Fernald & Pease*, no. 17,050; moist woods, Glen Ellis, Pinkham Notch, July 23, 1921, *Knowlton;* damp woods, Melvin Village, August 23, 1904, *M. A. Day.* Vermont: damp place, Townshend, July 25, 1903, *Blanchard.* Massachusetts: edge of woods, Sherborn, *M. L. Loomis*, no. 1360; roadside, Princeton, August 9, 1894, *J. F. Collins;* Ashfield, August 3, 1909, *E. F. Williams* (type of *B. ciliatus*, forma *denudatus*); Heath, July 17, 1909, *E. F. Williams;* roadside thicket, Tolland, *F. C. Seymour*, no. 335; open bog, Lanesboro, August 4, 1920, *R. Hoffmann.* Connecticut: Hampton, August 11, 1888, *Chas. Wright* (with comment: "lower glume with faint lateral nerves"); dry bank, Lisbon, August 26, 1902, *C. B. Graves.* New York: open sedgy bog, Round Marshes, Cortland, *Eames & MacDaniels*, no. 159; boggy meadow near headwaters of Beaver Brook, Cortland, *F. P. Metcalf*, no. 5814 (distributed as *B. ciliatus*, var. "Very characteristic bog form"); open moor of Lowery's Pond, Junius, *Metcalf*, nos. 1727 and 5815 ("Swamp variety"); Ontario: Leamington, *J. Macoun*, no. 26,058. Michigan: swamps, Keweenaw Co., *Farwell*, no. 562a (with note: "hairs of glumes *spreading*, not *appressed*"). Minnesota: Muskoda, Red River Valley, *Ballard*, no. 3075. Saskatchewan: margins of lakes and streams, Moose Mountain Lake, August 5, 1883, *J. Macoun.* Montana: East Gallatin swamps, *Rydberg*, no. 3170. British Columbia: Mile 81, Pacific Great Eastern Ry., *J. M. Macoun*, no. 94,021.

Bromus Dudleyi has been confused with and usually distributed as

B. ciliatus L.; but *B. ciliatus*, the commonest species of thickets and borders of woods in eastern Canada and the northeastern States has, when well developed, a larger and greener panicle with more pendulous branches. Its well developed spikelets (FIGS. 4 and 5) are so open as plainly to show the slender rhachilla, while in *B. Dudleyi* the lemmas are so approximate that the short internodes of the rhachilla are difficult to see. *B. Dudleyi* matures early. Of the 60 sheets before me not one has young or freshly flowering spikelets; all are in fruit or so mature that the spikelets are disintegrating and nearly all were collected at dates ranging from July 17 through August, with only four (overripe) collections in the first half of September. *B. ciliatus*, on the other hand, as shown by a very extensive series, especially from Newfoundland and eastern Canada and New England, is rarely in anthesis before the middle of July, when *B. Dudleyi* is becoming mature. The large representation of *B. ciliatus* before me shows that in New England, eastern Canada and Newfoundland it is in flower (the spikelets not readily disintegrating) from mid-July into September, and that the fruiting material had been collected from August 11 through September.

In habitat *Bromus Dudleyi* shows a marked preference for (though not restriction to) limy or neutral bogs and wet thickets, being specially characteristic of the calcareous regions of Newfoundland, the Mingan Islands, the Gaspé Peninsula, western New England, central New York, etc. It is the plant which the late W. R. Dudley specially designated in his Cayuga Flora, as

> 1256. **B. ciliatus**, L. var. ——, approaching some of the Rocky Mt. forms (according to Dr. Vasey,) occurs in our sphagnum bogs or wet meadows. The plants are low, light-green; the panicle peculiarly chaffy in appearance, light-colored, and the flowering glumes smooth on the back but strongly ciliate. It is abundant, in Round Marshes, along Locke Pond and elsewhere.[1]

Its occurrence in the calcareous bogs of central New York was again emphasized by Wiegand, who mistook the bog-plant for *Bromus ciliatus:* "In central New York *B. ciliatus* is generally an inhabitant of marl springs and calcareous boggy places. In other portions of its range it does not seem to be confined to boggy places or even to calcareous situations, yet no structural difference is apparent between the New York material and that from elsewhere."[2] And later, Wiegand & Eames referred to this early-maturing plant of wet habitats as growing

[1] Dudley, Cayuga Fl. 129 (1886).
[2] Wiegand, RHODORA, XXIV. 91 (1922).

in the Cayuga Basin in "Boggy meadows and springy places, in marl or strongly calcareous soils; frequent. July–Aug."[1]

When he published *Bromus ciliatus*, forma *denudatus* Wiegand, Rhodora. xxiv. 91 (1922), Wiegand merely distinguished from *B. ciliatus* with sheaths villous the plants with sheaths glabrous and he separated off in the Gray Herbarium two covers full of such specimens (most of them with all the spikelet-characters of *B. ciliatus*), stating that the smooth-sheathed form occurs "Throughout the range of the typical form"; but he specially designated as the type a single specimen "Ashfield, Massachusetts, 1909, *E. F. Williams.*" The type-specimen was an unfortunate selection, for it is an over-ripe specimen with the spikelets completely disintegrated. It was collected on August 3d and the fragments seem to indicate that the type of forma *denudatus* belongs to *B. Dudleyi.* Somewhat later, still not understanding the differences in the spikelets which separate *B. Dudleyi* and *B. ciliatus*, but conscious that glabrous-sheathed plants are more general in the North than are those with villous sheaths, I elevated the form to varietal rank as *B. ciliatus*, var. *denudatus* (Wiegand) Fernald, Rhodora, xxviii. 20 (1926). Since the conceptions back of *B. ciliatus*, forma *denudatus* and var. *denudatus* were mixed, since their technical type is a specimen with badly shattered panicle and since forms with villous or with glabrous (denudate) sheaths occur in our other species of the group (*B. ciliatus, B. Richardsoni, B. altissimus, B. purgans*, etc.) it would be unwise further to elevate the name. The International Rules of Nomenclature make no requirement that a name appropriate in one category shall necessarily be retained when the rank is changed, particularly if it is a *nomen confusum.* It seems right, therefore, to give this belated recognition to the acumen of the late William Russell Dudley, who nearly half a century ago clearly recognized the distinctness of the plant here proposed as *B. Dudleyi*, and to designate as a type a numbered specimen of unquestioned identity.

The specific distinctions between *Bromus Dudleyi* and *B. ciliatus* are briefly stated below:

B. ciliatus. Panicles (except in dwarf plants) 1–3 dm. long, with more or less nodding branches: spikelets green or greenish, rarely purple- or bronze-tinged, at maturity loose, displaying the rachilla: glumes strongly conduplicate; the 2d narrowly lance-attenuate, 3-nerved, the greenish nerves very slender: lemmas subcoriaceous, conduplicate or involute, lance-attenuate, with very delicate nerves; the marginal band appressed-pilose to sericeous or glabrous: palea linear, usually closely embraced by

[1] Wiegand & Eames, Fl. Cayuga L. Basin, 61 (1926).

the strongly folded lemma; the green and ciliate ribs marginal their entire length, the hyaline border abruptly folded toward the middle of the palea: caryopsis linear-lanceolate.

B. DUDLEYI. Panicles 0.6–2 dm. long, their branches scarcely nodding: spikelets mostly purple- or bronze-tinged, rarely green, with crowded lemmas; the rachilla usually hidden: glumes flattish or merely dorsally rounded; the 2d with coarse colored nerves: lemmas flattish, submembranaceous, oblong, obtuse to subacute, strongly nerved; the marginal band conspicuously villous-hirsute especially below the middle: palea oblong, flat, scarcely embraced by the lemma; the ciliolate nerves midway between the entire margin and the middle except at the tip where they become marginal: caryopsis oblong-lanceolate.

These contrasts are brought out in the plate, for which I am indebted to Dr. H. M. Raup and Mr. A. N. Steward, showing spikelets of *B. ciliatus* (FIG. 4) and its variety (to be discussed in succeeding paragraphs) (FIG. 5) and a panicle (FIG. 1), spikelet (FIG. 2) and palea (FIG. 3) of *B. Dudleyi* from the type-collection of that species. For comparison, spikelets of *B. Kalmii* (FIG. 7), *B. Porteri* (FIG. 6) and *B. ramosus* (FIG. 8) are also shown.

Bromus Dudleyi (FIGS. 1–3), as Dudley (quoting Vasey) stated, is nearer related to some Rocky Mountain plants than to true *B. ciliatus* (FIGS. 4 and 5). It occurs itself in British Columbia and Montana and doubtless elsewhere in the Rocky Mountains, where its nearest relative is *B. Porteri* (Coult.) Nash (FIG. 6), but that species has the panicle much looser and the lemmas densely pubescent over their entire surfaces, much as in *B. Kalmii* Gray (FIG. 7) of usually dry soils of the eastern United States. The western specimens of *B. Dudleyi* have been called *B. Richardsoni* Link, but that species closely simulates *B. ciliatus* in its strongly folded or conduplicate and silky-margined lemmas. In habit, early flowering, short cauline leaves, flattish lemmas and flat-margined paleas *B. Dudleyi* is equally close to *B. Kalmii* (FIG. 7), but the latter species of mostly dry habitats from southwestern Maine southward and westward is at once distinguished by the extreme pubescence of its spikelets, shorter and broader lemmas, with shorter awns and more numerous and more prolonged nerves, and narrower paleas with pilose or almost villous nerves.

The original locality of *Bromus canadensis* Michx. Fl. Bor.-Am. i. 65 (1803), recorded on the label as Lake St. John, and Michaux's characters, "foliis rariter pilosis: . . . florum valva exteriore . . . versus margines villosa," suggest that *B. Dudleyi* might be *B. canadensis*. Michaux, however, apparently collected the latter late in the season, long after *B. Dudleyi* is mature ("Le 12 Septembre

. . . arrivé . . . au Poste du lac St Jean . . . Le 13 j'ay herborisé aux environs du Lac."—Journ. André Michaux, ed. Sargent, 85, 86). The other characters given by Michaux might belong to either *B. ciliatus* or *B. Dudleyi* but, fortunately, in the series of fragments of types accumulated by Professor Hitchcock at Washington there is a spikelet of the type of *B. canadensis.* This spikelet, most kindly loaned me for study by Dr. Jason R. Swallen, is not only young but thoroughly characteristic of the late-flowering plant generally accepted as *B. ciliatus.*

Bromus ciliatus L. When I took up[1] *Bromus ciliatus,* forma *denudatus* Wiegand[2] as var. *denudatus,* I pointed out that the plant with glabrous or nearly glabrous median and upper sheaths is far more abundant northward and far less abundant southward than the plant with densely retrorse-villous sheaths. After the removal from the former series of *B. Dudleyi* it becomes important again to note the relative abundance of the two extremes left in *B. ciliatus.* The material before me (in the Gray Herbarium and the herbarium of the New England Botanical Club) shows the following contrasts in relative abundance.

	Labrador Peninsula (Straits of Belle Isle and Cote Nord to James Bay)	Anticosti I. and Gaspé Peninsula	Newfoundland	New Brunswick	Nova Scotia	Southwestern Quebec (Temiscouata Co. to Eastern Townships)	Maine	New Hampshire	Vermont	Massachusetts	Connecticut	New York
Middle and upper sheaths glabrous or only remotely and sparsely pilose	6	30	31	6	8	3	33	14	8	8	0	0
Sheaths densely pilose or villous	0	0	3	3	3	5	45	27	14	16	8	6

Besides being generally more northern, the plant with glabrous or nearly glabrous sheaths shows a strong subalpine tendancy, occurring on the high escarpments of western Newfoundland, on the subalpine meadows (alt. 900–1125 m.) of the Shickshock Mts. of Gaspé, on the Fan of Huntington's Ravine (alt. 1372 m.) on Mt. Washington, New Hampshire, and on the famous cold and subalpine slides of Willoughby, Vermont; it also occurs at the summit of Roan Mt. (alt. 1917 m.),

[1] Fernald, Rhodora, xxviii. 20 (1926).
[2] Wiegand, Rhodora, xxiv. 91 (1922).

North Carolina. Contrasted with this strong subalpine tendency of the smoother plant is the fact that, of the plant with densely villous or pilose upper sheaths not a single specimen from Newfoundland to Ontario and Connecticut has been collected at any appreciable altitude. Furthermore, while the marginal pubescence of the lemmas in the plant with villous upper sheaths is delicate and appressed-sericeous, the pubescence of the lemma in the more boreal glabrous-sheathed extreme is more variable, sometimes appressed-sericeous but more often coarsely pilose. The characteristically pilose-margined lemma and the smooth sheaths are well brought out in the illustration of *B. ciliatus* in Shear, Revis. N. A. Sp. Bromus, fig. 16.[1] Shear did not attempt to differentiate the two extremes of *B. ciliatus*, but Wiegand, in breaking up the species defined his conception of typical *B. ciliatus* as having "Sheaths villous; blades usually hairy," while his forma *denudatus* has "Sheaths glabrous or the lowermost slightly villous; blades usually glabrous."[2] Wiegand's interpretation was accepted unquestioned when I elevated his forma *denudatus* to var. *denudatus*.[3] But, as already pointed out, the designated type of forma or var. *denudatus* is not conspecific with the bulk of the material with glabrous upper sheaths; consequently it is necessary to look anew into the proper names for the varieties of *B. ciliatus*.

The original description of *Bromus ciliatus* L. was as follows:

> *ciliatus*. 4. BROMUS panicula nutante, foliis utrinque vaginisque subpilosis, glumis ciliatis.
> *Habitat in* Canada; *ex semine. D. Kalm.*
> *Culmi tenues. Folia utrinque & vaginae vix manifeste pubescentes. Panicula valde nutans, non crispis pedunculis. Spiculae oblongae, compressae, petalorum marginibus (non dorso) valde pilosis, qua nota facile distingvitur. Flosculi 8, sub apice aristati; calyces nudi. Glumae corollae lanceolatae.*[4]

According to Hitchcock[5] there is nothing in the Linnean herbarium which has the glumes glabrous on the back ("petalorum marginibus (non dorso) valde pilosis") and which can, therefore, be considered a "type." He consequently concluded that we should retain the name *B. ciliatus* for the plant as treated in Shear's monograph. This seems the proper course; and since Shear, in monographing the genus, specially illustrated the plant with glabrous sheaths and pilose-

[1] U. S. Dept. Agric. Div. Agrost. Bull. No. 23: 32. fig. 16 (1900).
[2] Wiegand, Rhodora, xxiv. 90 (1922).
[3] Fernald, Rhodora, xxviii. 20 (1926).
[4] L. Sp. Pl. i. 76, 77 (1753).
[5] Hitchcock, Contrib. U. S. Nat. Herb. xii. 122 (1908).

margined lemmas, this extreme should be taken to stand as true *B. ciliatus*. Fortunately, this is the commoner variety in Canada, whence Kalm secured the seed; and the emphatic statements of Linnaeus that the "sheaths are scarcely manifestly pubescent (vaginae vix manifeste pubescentes)" and that "the margins of the lemmas are conspicuously pilose (petalorum marginibus (non dorso) valde pilosis, qua nota facile distingvitur)" make it reasonably clear that Shear's illustration truly embodies[1] the important characters of the Linnean plant. This interpretation, that Linnaeus had the common plant of northeastern Canada with scarcely pubescent sheaths gains support from the fact that, in the *Species Plantarum*, *B. ciliatus* with "vaginae vix manifeste pubescentes" came immediately after Linnaeus's other American species, *B. purgans*, in which the sheaths are rarely so pubescent as in the villous-sheathed extreme of *B. ciliatus*. Yet Linnaeus described *B. purgans* as having "*Vaginae foliorum retrorsum pilosae.*" *B. canadensis* Michx. seems to have been based on small specimens of true *B. ciliatus*.

For the less boreal plant with villous sheaths I find no published name. I am therefore designating the two varieties as follows:

Bromus ciliatus L., var. **genuinus.** *B. ciliatus* L. Sp. Pl. i. 76 (1753). *B. canadensis* Michx. Fl. Bor.-Am. i. 65 (1803). *B. ciliatus* Shear, U. S. Dept. Agr. Div. Agrost. Bull. No. 23, fig. 16 (1900). *B. ciliatus*, forma *denudatus* Wiegand, Rhodora, xxiv. 90 (1922), in large part but not as to type. *B. ciliatus*, var. *denudatus* (Wieg.) Fern. Rhodora, xxviii. 20 (1926), in large part but not as to type.—Middle and upper sheaths glabrous or nearly so: margin of lemma pilose to sericeous.—Newfoundland and southern Labrador Peninsula to Manitoba, south to Nova Scotia, Massachusetts, northern Ohio, Michigan, Wisconsin and North Dakota, often ascending to subalpine areas; Roan Mt., North Carolina.

Var. **intonsus**, n. var., vaginis mediis superioribusque villosissimis vel valde retrorse-pilosis; lemmatis marginibus sericeis.—Newfoundland and southern Quebec to southern Ontario, south at low altitudes to Pennsylvania and Michigan. Type: Ashfield, Massachusetts, August 4, 1909, *E. F. Williams* (in Gray Herb.).

All the older sheets of *B. ciliatus* var. *intonsus* in the Gray Herbarium were labeled in the hand of William Boott or of Asa Gray *B. asper;* and this variety formed the basis of the entry in Gray's Manual, ed. 5, of *B. asper* from "Bethel, Maine, in fields along the river-bank, *W. Boott.* (Nat. from Eu.)"[2] and the more ample range in

[1] Except for the superabundance of lemmas.

[2] Gray, Man. ed. 5: 635 (1867).

ed. 6: "N. Brunswick to Mich. and Ky. (Nat. from Eu.)."[1] The record was taken over by Britton & Brown and in their Illustrated Flora, ed. 2, is entered as "In waste places, New Brunswick to Michigan and Kentucky. Naturalized from Europe."[2] That William Boott and Asa Gray were not quite convinced that the plant they called *B. asper* was really an introduction is shown by the penciled memoranda in Gray's hand, obviously inspired by the field knowledge of Boott, on some of the labels: "native"; nevertheless this pertinent and most important item did not find an entry into the Manual. In his monographic study of the genus in North America, Shear, taking up for *B. asper* Murr. (1770) the earlier name *B. ramosus* Huds. (1762), said: "A species introduced from Europe. It is said in Britton and Brown's 'Illustrated Flora' to be distributed from New Brunswick to Michigan and Kentucky. We have no American specimens in the National Herbarium."[3] Had he realized the sources of Gray's and Britton & Brown's records, Shear could have added that there were no American specimens of *B. ramosus* (*B. asper*) extant and that the original identification was an error; for *B. ramosus* of Europe (FIG. 8) differs from the American plant mistaken for it in its pubescent culms, narrower and much prolonged panicle, more remote and longer lemmas with longer awns, and anthers very much longer (4 mm. long).

EXPLANATION OF PLATE 196

(Figures × 1¾)

FIG. 1, panicle of BROMUS DUDLEYI (from type-number); FIG. 2, spikelet of B. DUDLEYI; FIG. 3, inner face of lemma, showing flat palea; FIG. 4, spikelet of B. CILIATUS, var. GENUINUS from Table-top Mountain, Quebec (*Fernald & Collins*, no. 169); FIG. 5, spikelet of B. CILIATUS, var. INTONSUS from the type; FIG. 6, B. PORTERI from type-locality, Twin Lakes, Colorado (*Wolfe*, no. 807); FIG. 7, B. KALMII from the assumed type, Troy, New York, *Asa Gray;* FIG. 8, B. RAMOSUS (*B. asper*) from Bavaria (*Fl. Exsicc. Bav.* no. 597).

V. SOME VARIETIES OF THE AMPHIGEAN SPECIES OF OSMUNDA

M. L. FERNALD

THREE species of Osmunda are found on both of the northern continental masses, Eurasia and North America. One of them extends into tropical South America, another into subtropical and tropical

[1] Wats. & Coult. in Gray, Man. ed. 6: 670 (1890).
[2] Britton & Brown, Ill. Fl. ed. 2, i. 275 (1913).
[3] Shear, U. S. Dept. Agric. Div. Agrost. Bull no. 23: 30 (1900).

Photo. by H. M. Raup and A. N. Steward.

BROMUS: FIGS. 1–3, B. DUDLEYI; FIG. 4, B. CILIATUS, var. GENUINUS; FIG. 5, B. CILIATUS, var. INTONSUS; FIG. 6, B. PORTERI; FIG. 7, B. KALMII; FIG. 8, B. RAMOSUS; all × 1¾.