

TWO NEW SPECIES OF *DICHANTHELIUM* (POACEAE) FROM THE MOUNTAINS AND PIEDMONT OF VIRGINIA, ONE WITH AN OUTLIER IN PENNSYLVANIA

Richard J. LeBlond

UNC-Chapel Hill Herbarium (NCU)
Campus Box 3280
North Carolina Botanical Garden
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina 27599-3280, U.S.A.
richardleblond@charter.net

John F. Townsend

Virginia Department of Conservation
and Recreation
Division of Natural Heritage
600 E. Main Street
Richmond, Virginia 23219, U.S.A.
john.townsend@dcr.virginia.gov

J. Christopher Ludwig

Seedbox Consulting LLC
19444 Running Cedar Lane
Maidens, Virginia 23102, U.S.A.
ludwigia.jc@gmail.com

ABSTRACT

Two new species of *Dichanthelium* are described: ***Dichanthelium appalachiense*** from shale woodlands in the mountains of Virginia, with a historical population from Pennsylvania; and ***Dichanthelium harvillii*** from a mafic region in the Piedmont of Virginia.

RESUMEN

Se describen dos especies nuevas de *Dichanthelium*: ***Dichanthelium appalachiense*** de bosques de lutita en las montañas de Virginia, con una población histórica de Pennsylvania; y ***Dichanthelium harvillii*** de una región máfica en el piedemonte de Virginia.

INTRODUCTION

Fieldwork in the Ridge and Valley and Piedmont provinces of Virginia by state Natural Heritage botanists has uncovered two new and rare species of witchgrasses: *Dichanthelium appalachiense* Townsend & LeBlond and *Dichanthelium harvillii* Ludwig & LeBlond. Both novelties are aligned with the large-spikelet taxa in *Dichanthelium* section *Macrocarpa*, particularly with *D. boscii* (Poirot) Gould & C.A. Clark. *Dichanthelium appalachiense* is found on shale and siltstone formations on forested ridges in Bath Co., Virginia, with a historical disjunct location in a region of sandstones and shales in Berks Co., Pennsylvania. *Dichanthelium harvillii* is restricted to an area once dominated by hardwood-pine forests on mafic rock formations in Halifax Co., Virginia, a site with several rare and endemic taxa. The two new species may be most closely related to each other, though they are well-distinguished by macromorphology, ecology, and range.

***Dichanthelium appalachiense* Townsend & LeBlond, sp. nov. (Figs. 1, 2, 3).** TYPE: U.S.A. VIRGINIA: Bath Co.: dry shale woodlands on steep eastern slope of Beards Mountain W of Nimrod Hall and Cowpasture River, 27 Jun 2013, Townsend 4485B, Ballard, & Wieboldt (HOLOTYPE: US; ISOTYPES: BRIT [Townsend 4480C, Ballard, & Wieboldt]; MO [Townsend 4485C, Ballard, & Wieboldt]; NCU [Wieboldt 12898, Townsend, & Ballard, Wieboldt 12906A, Townsend, & Ballard]; NY [Townsend 4485A, Ballard, & Wieboldt]; PH [Townsend 4480A, Ballard, & Wieboldt]; VPI [Townsend 4480B, Ballard, & Wieboldt]; WILLI [Wieboldt 12906B, Townsend, & Ballard].

Note.—According to the International Code of Nomenclature (Turland et al. 2018), “Field numbers, collecting numbers, accession numbers, or specimen identifiers alone do not necessarily denote different gatherings.” Since all of these collections were made from the same population on the same date, they qualify as the primary type collection of holotype and isotypes.

Plants 1–few culms together, cespitose to short-rhizomatous; culms to 50 cm long; few winter rosette leaf blades seen, similar to but mostly smaller than lower culm blades, 1.5–2.25 cm long × 3–5.5 mm wide; lower internodes puberulent (-glabrate), mid- and upper internodes becoming moderately to densely puberulent to spreading short-pubescent on peduncle, panicle rachis, and branches; lower nodes densely retrorsely pubescent with hairs 3–5 mm long, or hairs ascending on upper nodes. **Sheaths** of lower culm leaves shorter than internodes, mid- and upper culm sheaths equaling to exceeding internodes; sheaths glandular-papillose, more densely pubescent near the long-ciliate margins with hairs to 5 mm long, usually also with shorter hairs, the

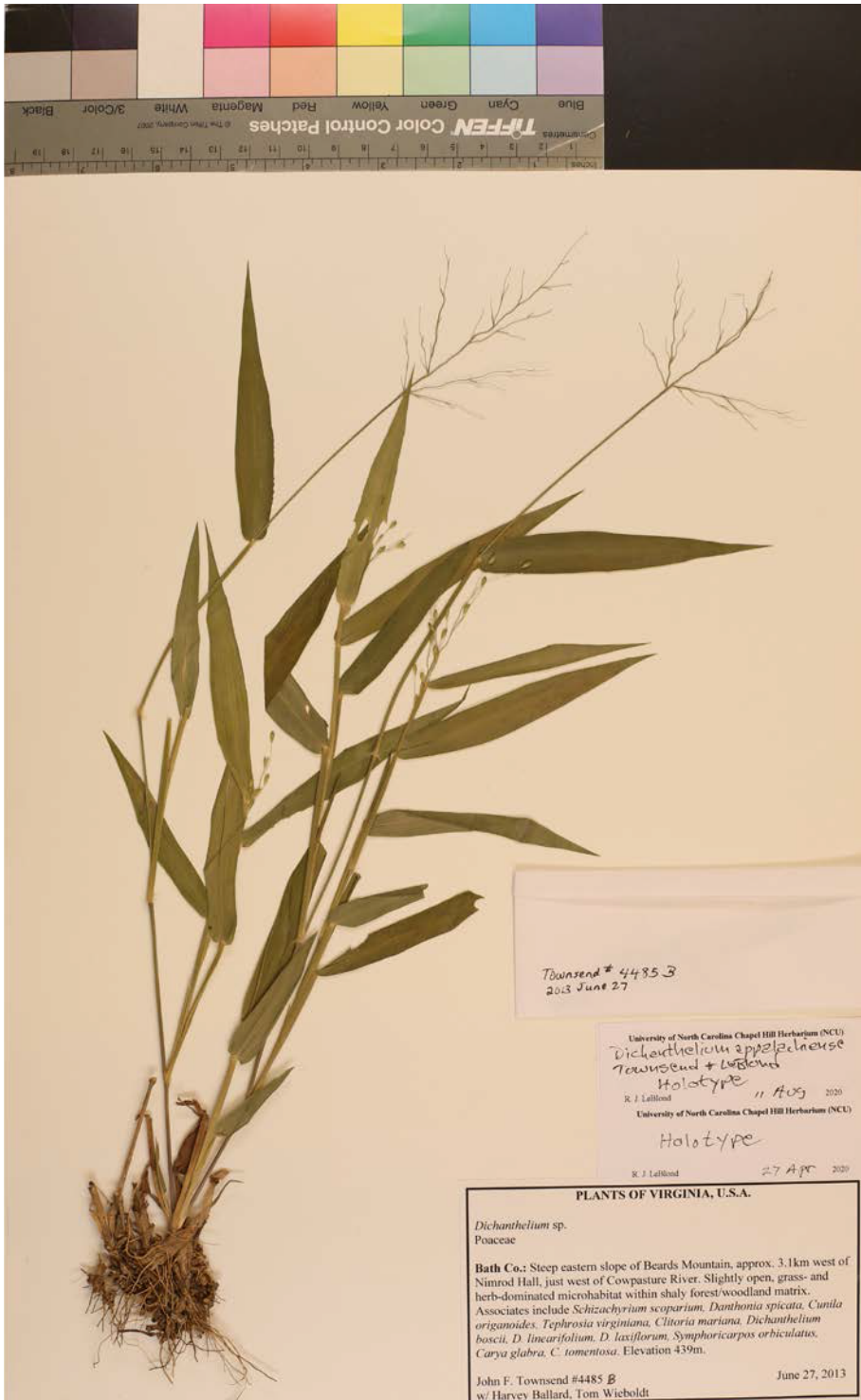


Fig. 1. Holotype of *Dichanthelium appalachense* from Bath County, Virginia (Townsend 4485B et al., US).



Fig. 2. Autumnal form, *Dichantherium appalachense* from Bath County, Virginia (Townsend 4585, DUKE).



FIG. 3. Autumnal inflorescence, *Dichanthelium appalachense*. Photo by John F. Townsend, 2013.

longer hairs often spreading (especially on sheaths at mid- and upper culm), or a mix of ascending, spreading, and retrorse hairs; individual sheath margins more densely ciliate distally, with near-margin pubescence also increasing distally. **Ligules** moderately to densely ciliate with hairs 0.5–1.2 mm, the membranous basal portion nearly obsolete to 0.1 mm. **Blades:** lower culm blades lance-attenuate, widest at sub-rounded base, 2–6.5 cm long \times 3–7 mm wide at broadest point; mid and upper culm blades 5–11.5 cm \times 4.5–13 mm, averaging about 9 \times as long as wide, widest proximally or sometimes medially, basally narrowly rounded to subcordate, lanceolate to narrowly lance-ovate, long acuminate; most blades ciliate in the proximal half, becoming less ciliate to eciliate distally, or ciliate only basally; blade margins scabrous, at least one margin with a whitish-cartilaginous portion about 0.1 mm wide; adaxial surface glabrous or appressed-puberulent, strongly scabrous; abaxial surface glabrous (-appressed-puberulent), slightly scabrous, a paler green. **Vernal panicles** 4.5–11 cm long, 1.5–6.5 cm wide, $\frac{1}{3}$ – $\frac{3}{4}$ as wide as long, branches ascending or the lower spreading; rachis and branches densely short-pubescent with appressed and spreading hairs 0.1–0.3 mm long; pedicels sparsely pubescent or scabrous, 3–10 mm long, appressed to spreading-ascending. Spikelets mostly < 30 per vernal panicle, 3.3–4.0 mm long, 1.2–1.7 mm wide, blunt to acute, moderately to moderately-densely pubescent with spreading hairs 0.2–0.3 mm long; surface and some hairs with glandular nodules; lower glumes 1.3–1.7 mm long (to 1.9 mm on some autumnal spikelets), 0.7–1.0 mm wide, $\frac{1}{3}$ – $\frac{1}{2}$ as long as spikelet, broadly ovate, apex rounded to blunt (-subacute); upper glume and lower lemma subequal, barely exceeding upper lemma; upper lemma puberulent at apex, surface sometimes glandular. **Primary (aestival) branches** develop during maturation of vernal panicles in late spring and early summer, emerging progressively from upper to lower nodes; primary branch leaves similar in size to vernal leaves; bases of primary branch terminal panicles included in the sheath of the distal-most leaf; primary branch panicles 2–7 \times 0.5–2(–6) cm, usually < $\frac{1}{2}$ as wide as long, with 10–20 spikelets. **Secondary (autumnal) branches** develop later in summer from primary branches;

blades somewhat smaller, to 8 cm × 7 mm; panicles mostly included in the subtending sheaths with only 2–5 spikelets visible; spikelets with first glumes to 1.9 mm long.

Etymology.—All of the currently known populations of *Dichantherium appalachiense* are in the Appalachian Mountains.

Additional specimens examined (paratypes). **USA. PENNSYLVANIA. Berks Co.**: dry soil on roadside bank, northeast of Plowville, 22 Jul 1944, *Brumbach 3793* (VPI). **VIRGINIA. Bath Co.**: grassy opening on SE-facing slope W of Nimrod Hall, 9 Jul 2013, *Wieboldt 12919* (VPI); dry shale woodlands on steep eastern slope of Beards Mountain W of Nimrod Hall and Cowpasture River, 22 Aug 2013, *Townsend 4544* (also a topotype) (NCSC); S-facing slope near ridgeline of Beards Mountain, NE of Douthat Lake, 24 Sep 2013, *Townsend 4582* (VPI), 4585 (DUKE); ridgetop W of Mil boro, 26 Sep 2013, *Townsend 4595* (GMUF); small canopy gap on ridgeline of Rough Mountain E of Nimrod Hall, 18 Jun 2020, *Townsend 6842* (herb.pers.); SE-facing grassy opening along John Bolar Draft, E of West Virginia border, 24 Jun 2020, *Townsend 6845* (herb. pers.).

Dichantherium appalachiense was first collected in Virginia from a geographically restricted shale woodlands community by the second author and others on 27 June 2013. During that visit, the unknown plant was collected several times from the same population and given separate collection numbers.

The five Virginia populations are found on three ridges in the Ridge and Valley province of the Appalachian Mountains. One population is on a steep, east-facing slope, two are on south-facing slopes, and two more are in topographic saddles on ridge tops. All five habitats are found on shale bedrock, and are characterized by grass- and herb-dominated partial openings in species-rich forest and woodlands. Frequent microhabitat herbs are *Schizachyrium scoparium* (Michx.) Nash, *Danthonia spicata* (L.) P. Beauv. ex Roemer & Schultes, *Dichantherium boscii*, and *D. linearifolium* (Scribn.) Gould. A few globally rare taxa are known from adjacent habitats, including *Boechera serotina* (E.S. Steele) Windham & Al-Shehbaz and *Clematis viticaulis* E.S. Steele. An undescribed *Viola* is in preparation for publication as a new species.

One of the Virginia populations is located in Douthat State Park, managed by the Virginia Department of Conservation and Recreation (DCR), Division of State Parks, with rare species management input from the DCR Division of Natural Heritage. Two populations are located in the George Washington and Jefferson National Forest, one of them in habitat designated as a Special Biological Area. Another is located on Gathright Wildlife Management Area, managed by Virginia's Department of Wildlife Resources. A single population is located on private land, and does not currently have formal protection.

The 1944 specimen of *Dichantherium appalachiense* from Berks Co., Pennsylvania, was collected from “dry soil on a roadside bank” near Plowville (from specimen label at VPI). The microhabitat is not known, but the site is located in a region of Triassic sandstones and shales. It was originally identified as *Panicum boscii* Poiret × *Panicum ashei* Pearson ex Ashe.

Dichantherium harvillii Ludwig & LeBlond, **sp. nov.** (Fig. 4, 5, 6). TYPE: U.S.A. VIRGINIA: Halifax Co.: Difficult Creek Natural Area Preserve, in pine-hardwood woodland N of Dryburg, 22 May 2018, *Townsend 6053* (HOLOTYPE: US; ISOTYPES: MO, NY, PH).

Plants 1–few culms together, caespitose to short-rhizomatous; culms 30–45 (–55) cm long; few winter rosette blades seen, linear to linear-lanceolate, 1.8–2.5 cm × 3 mm; lowest elongate internode pale purple, often glandular-papillose, moderately to densely pubescent with spreading to ascending hairs to 2 mm long; middle internodes usually sparsely pubescent, the upper becoming more densely so, the peduncle, panicle axis, and branches densely puberulent to spreading short-pubescent; at least lower nodes retrorsely bearded with longer hairs 2–3 mm, or hairs ascending on upper nodes. **Sheaths** shorter than internodes, pubescent with hairs to 5 mm long, especially basally and increasing distally near margins, some sheaths glandular-punctate; mid- and upper sheaths becoming glabrate except near margins; collar densely puberulent. **Ligules** 0.3–1.0 mm long, ciliate, the basal membrane absent to 0.1 mm. **Blades**: lower culm blades 5.5–9 cm long × 3–6 mm wide, becoming senescent as primary branching develops; mid- and upper culm blades (6.5–)8.5–14 cm × 5–11 mm, averaging about 14 × as long as wide, narrowly lanceolate, long-acuminate, narrowed to the sub-rounded base; blades usually ciliate basally or in the proximal ¼, sometimes beyond middle, becoming eciliate in distal portions of the plant; margins scabrous, a whitish-cartilaginous portion, if present, less than 0.05 mm wide;

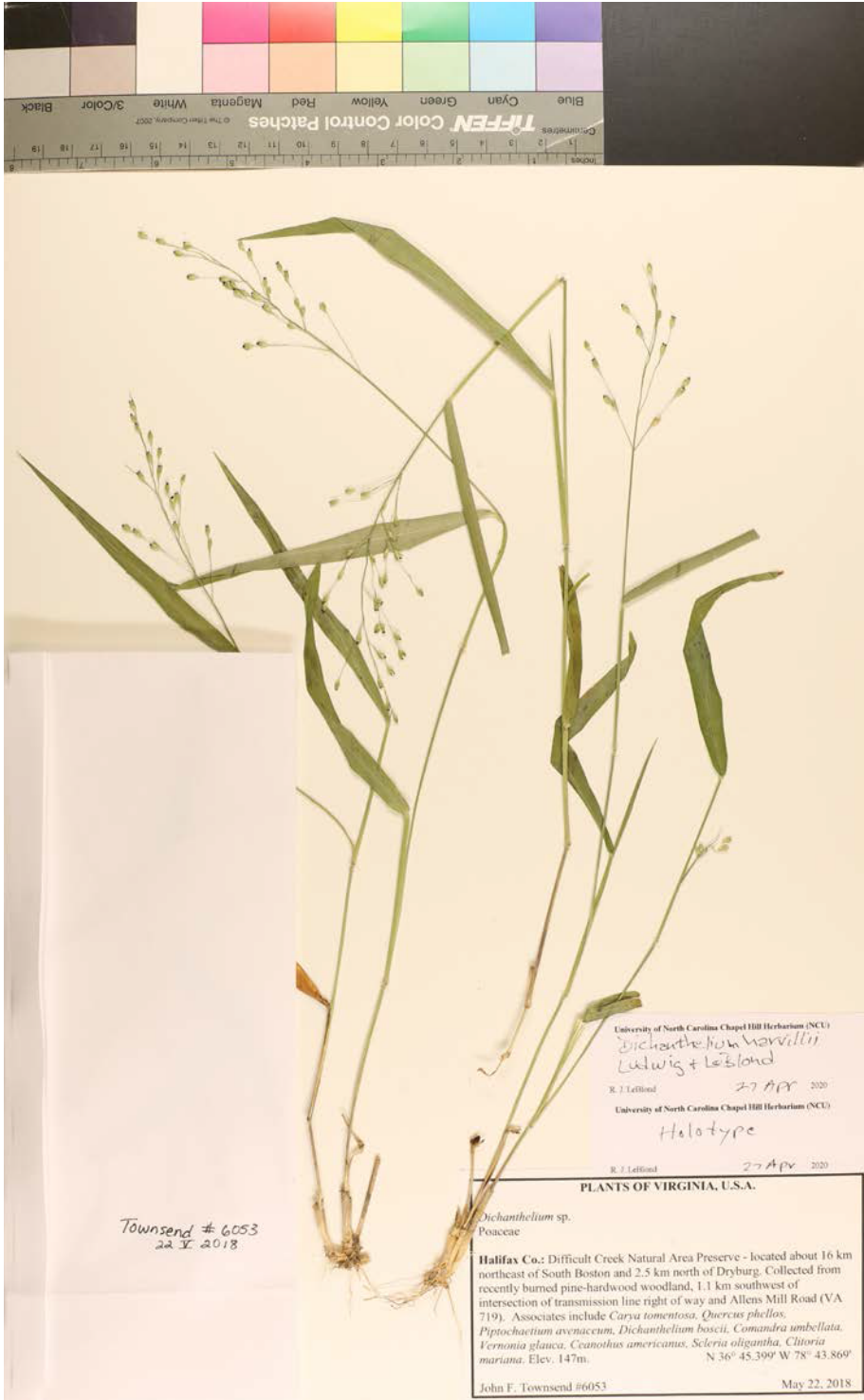


Fig. 4. Holotype of *Dichanthelium harvillii* from Halifax County, Virginia (Townsend 6053, US).



FIG. 5. Autumnal form, *Dichantheium harvillii* from Halifax County, Virginia (Townsend 4744 & Ludwig, VPI).



FIG. 6. Autumnal inflorescence, *Dichantherium harvillii*. Photo by John F. Townsend, 2014.

adaxial surface glabrous or appressed-puberulent, strongly scabrous; abaxial surface usually glabrous (-appressed-puberulent), slightly scabrous, a paler green. **Vernal panicle** 5.5–9 cm × 2–6 cm, $\frac{1}{4}$ – $\frac{2}{3}$ as wide as long; spikelets ellipsoid, beaked, 3.5–4.2 (–4.5) cm × 1.4–1.9 mm, mostly < 30 per vernal panicle, surface and some hairs with glandular nodules; lower glumes 1.2–1.9 mm × 0.7–1.0 mm, ovate to narrowly triangular, blunt to subacute; upper glume and lower lemma subequal, strongly nerved, pubescent with spreading hairs 0.1–0.2 mm long, exceeding upper lemma by 0.2–0.5 mm; upper lemma smooth at 10×, often minutely glandular and/or pubescent at apex. **Primary (aestival) branching** from upper (especially) and middle nodes, their blades similar to those of the culm, the uppermost branches often overtopping the senescent vernal panicle; primary branch panicles 4–6.5 cm × 0.5–3.5 cm, with 6–12 spikelets. **Secondary (autumnal) branching** blades smaller, 3–7 cm × 2–5 mm; secondary branch panicles 1.5–2 cm × 0.4–0.7 cm; primary and secondary branching panicles often hidden among leaf fascicles.

Etymology.—This new witchgrass is named in honor of noted Virginia botanist Alton M. Harvill, Jr., who made important contributions to the genus. He and his wife Barbara Harvill were the first to discover the ecological significance of the Difficult Creek Natural Area Preserve, where the new species is found.

Additional specimens examined (paratypes): **UNITED STATES. VIRGINIA. Halifax Co.**: mafic powerline corridor, Difficult Creek Natural Area Preserve, 15 Jun 1995, *Ludwig* 2431A (VPI); same, *Ludwig* 2431B (WILLI); same, *Ludwig* 2431C (GMUF); open, burned pine plantation with hardpan soils, Difficult Creek Natural Area Preserve, 9 Jul 2014, *Ludwig* s.n. (NCU); same, 10 Jul 2014, *Ludwig* s.n.A (DUKE); same, 10 Jul 2014, *Ludwig* s.n.B (NCSC); same, 10 Jul 2014, *Ludwig* s.n.C (BRIT); young, thinned loblolly pine woodland with diverse herbaceous understory, Difficult Creek Natural Area Preserve, *Townsend* 4723 *et al.* (VPI); thinned and burned loblolly pine woodland, Difficult Creek Natural Area Preserve, 21 Aug 2014, *Townsend* 4744 & *Ludwig* (VPI).

Dichantherium harvillii is known only from the 819-acre Difficult Creek Natural Area Preserve near the city of South Boston in Halifax Co. The population consists of widely scattered individuals and small clumps of no more than three plants. The site is noted for the number of rare plant species that occur there, including the

globally rare *Marshallia legrandii* Weakley, *Echinacea laevigata* (C.L. Boynton & Beadle) S.F. Blake, and *Pycnanthemum torreyi* Benth., as well as ten additional, state-rare species. As noted on specimen labels from Harvill and Harvill collections from the 1960s, this area had been dominated by a thin hardwood-pine canopy prior to conversion to loblolly pine plantations in the early 1980s. The area was acquired by the state of Virginia in 2001 and has since been managed for protection and restoration of natural structure, composition, and processes. Remnant canopy and midstory will become more dominant as loblolly pine harvests continue. Important species in this category include *Quercus stellata* Wangenh., *Q. alba* L., *Q. phellos* L., *Q. marilandica* Muenchhausen var. *marilandica*, *Q. velutina* Lam., *Carya glabra* (Miller) Sweet, *C. tomentosa* (Lam. ex Poir.) Nutt., *Ulmus alata* Michx., and *Pinus echinata* P. Miller. *Piptochaetium avenaceum* (L.) Parodi, *Scleria oligantha* Michx., *Danthonia spicata* (L.) P. Beauv. ex Roemer & Schultes, *D. sericea* Nutt. and *Schizachyrium scoparium* (Michx.) Nash are common in the ground layer, along with a diversity of forbs associated with open-canopy habitats, including a high diversity of legumes and composites. Remarkably, 25 species of *Dichantherium* have been found at the Difficult Creek site. The more common include *D. boscii*, *D. sphaerocarpon* (Elliott) Gould, *D. laxiflorum* (Lam.) Gould, *D. acuminatum* (Swartz) Gould & C.A. Clark var. *fasciculatum* (Torrey) Freckmann, and *D. depauperatum* (Muhl.) Gould. The area is underlain by mafic metavolcanic rocks of the Virgilina Formation, a melange of rock types.

DISCUSSION

Dichantherium appalachiense and *D. harvillii* appear to be most similar to each other, and to *Dichantherium boscii* in section *Macrocarpa*. All three species have retrorse bearding on at least the lower nodes, large spikelets, short ciliate ligules, and moderately densely to densely ciliate sheath margins, with the density occurring proximally as well as distally. In other large-spikelet species in sections *Macrocarpa*, *Clandestina*, and *Oligosantha*, sheath margins are densely ciliate only at the summit, the margins below the summit sparsely ciliate or eciliate. Though possibly closely related, the three species are readily separated by several macromorphological characters. In Weakley (2020), the three key together with *Dichantherium ravenelii* (Scribner & Merrill) Gould (section *Oligosantha*) based on spikelet size, node bearding, and ciliate ligules, as follows.

1. Ligules 2–5 mm long; blades 8–17 cm long × 8–20 mm wide, the abaxial surface velvety; lower glumes 1.8–2.5 mm long _____ **D. ravenelii**
1. Ligules 0.3–1.3 mm long; blades 5–14 cm long and either 12–40 mm or 5–13 mm wide, the abaxial surface glabrous to puberulent, but not velvety; lower glumes 1.2–2.2 mm long.
 2. Blades 12–40 mm wide, broadly ovate-lanceolate, averaging < 5 × as long as wide, bases cordate; blades ciliate only at base; blade adaxial surface smooth except near apex; vernal panicles 4–12 cm wide, about as wide as long when mature; spikelets 3.8–5.2 mm long and 1.7–2.2 mm wide; lower glumes 1.5–2.2 mm long; upper glumes shorter than upper lemmas _____ **D. boscii**
 2. Blades 5–13 mm wide, narrowly lanceolate, lanceolate, or narrowly lance-ovate, averaging 9–14 × as long as wide, bases narrowed to sub-rounded; blade cilia often extending above base; blade adaxial surface scabrous throughout; vernal panicles 1.5–6.5 cm wide, usually $\frac{1}{3}$ – $\frac{2}{3}$ as wide as long when mature; spikelets 3.3–4.5 mm long and 1.2–1.9 mm wide; lower glumes 1.2–1.9 mm long; upper glumes equaling to 0.5 mm longer than upper lemmas.
 3. Lower internodes puberulent to glabrous; longer node hairs 3–5 mm; lower sheaths shorter than internodes, upper equaling to longer; lower culm blades 2–6.5 cm long, mid- and upper culm blades 5–11.5 cm long, lanceolate to narrowly lance-ovate, about 9 × as long as wide; spikelets 1.2–1.7 mm wide, narrowly ellipsoid, blunt to acute; lower glumes broadly ovate; upper glumes exceeding upper lemmas by 0–0.2 mm _____ **D. appalachiense**
 3. Lower internodes papillose-pubescent with spreading-ascending hairs to 2 mm long; longer node hairs 2–3 mm; all sheaths shorter than internodes; lower culm blades 5.5–9 cm long, mid- and upper culm blades 8.5–14 cm long, narrowly lanceolate, about 14 × as long as wide; spikelets 1.4–1.9 mm wide, ellipsoid, beaked; lower glumes narrowly triangular to ovate; upper glumes exceeding upper lemmas by 0.2–0.5 mm _____ **D. harvillii**

It has been speculated that hybridization has played a role in the evolution of one or both new species, with *Dichantherium boscii* as a possible parent. But *D. appalachiense* and *D. harvillii* appear to be reproducing independently of *D. boscii*, and only genetic studies can tell us who might be the parent of whom.

During the investigation, it was noted that the bearding hairs on upper nodes in both new species were often appressed-ascending, likely the result of recent exposure from leaf sheath envelopment. This condition may happen in other species that have node hairs enveloped by sheaths.

ACKNOWLEDGMENTS

We are grateful to Carol Ann McCormick and her staff at the NCU herbarium for preparation of the type collections, and to Gregory Sollom for specimen photography. We are also indebted to John Boggan of US for assistance in determining which specimens qualified as isotypes for *Dichantheium appalachiense*. Field research greatly benefited from the support of the Virginia Department of Conservation and Recreation, Division of Natural Heritage. We greatly appreciate reviews of Robert Freckmann and Joseph K. Wipff.

REFERENCES

- TURLAND, N.J., J.H. WIERSEMA, F.R. BARRIE, W. GREUTER, D.L. HAWKSWORTH, P.S. HERENDEEN, S. KNAPP, W.-H. KUSBER, W.-H., D.-Z. LI, K. MARHOLD, T.W. MAY, J. MCNEILL, A.M. MONRO, J. PRADO, M.J. PRICE, & G.F. SMITH (EDS.). 2018. International code of nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Veg. 159. Glashütten: Koeltz Botanical Books, Germany. DOI <https://doi.org/10.12705/Code.2018>
- WEAKLEY, A.S. 2020. Flora of the southern and mid-Atlantic states. Working draft of June 2020. University of North Carolina Herbarium, North Carolina Botanical Garden, Chapel Hill, U.S.A.