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AN EMENDED DESCRIPTION AND POSSIBLE ORIGIN OF *LYCOPODIELLA SUBAPPRESSA* (LYCOPODIACEAE)

Lycopodiella Holub is a small, but difficult, genus of wetland clubmosses. Contributing to the complexity of the group is the presence of three different ploidy levels—diploid, triploid, and tetraploid. Bruce (1975) first noted the presence of two tetraploid *Lycopodiella* and abortive-spored triploid hybrids in North America. He informally named the two tetraploid species "northern appressum" and "appressed inundatum". He attributed Michigan and Nova Scotia to "northern appressum" and Michigan and New England to "appressed inundatum". These two species were formally described by Bruce *et al.* (1991) as *L. subappressa* ("northern appressum") and *L. margueritae* ("appressed inundatum"). Both Bruce *et al.* (1991) and Wagner and Beitel (1993) considered both species restricted to Michigan. No statements were provided to refute the earlier reports of either species in northeastern North America.

Based on the description (Bruce et al. 1991), *Lycopodiella subappressa* should be morphologically very similar to *L. appressa* (Chapman) Cranfill (Figure 1) in many important morphological features, resembling a smaller *L. appressa* with a single upright shoot. However, examination of material from the Great Lakes region reveals that *L. subappressa* is easily distinguished from *L. appressa* in several features, including strobilus width, sporophyll length, margin, and orientation, and number of upright shoots per horizontal shoot segment. In fact, images of pressed specimens provided by Bruce et al. (1991; Figure 1, page 5) clearly show inconsistencies with the collected plants and the written description (e.g., the sporophylls and upright shoot trophophylls are not appressed as stated in the text and identification key). Table 1 compares critical morphological features for *L. appressa*, *L. subappressa* (both original and emended descriptions), and *L.* ×*copelandii* (Eiger) Cranfill.

Figure 1. *Lycopodiella appressa*, a distinctive species of the Atlantic coastal plain.

	***L. subappressa* as described**	***L. appressa***	***L. subappressa* emended description**	***L. ×copelandii***
Horizontal shoot thickness	1–1.5 mm	1.2–3.5 mm	1–1.5(–1.7) mm	2–2.8 mm
Distance to first roots	not reported	1.5–4.8 cm	(2–)3.5–7.5 cm	(1.8–)3.5–10.5(–15.0) cm
Upright shoot height	4–17 cm	(8.5–)12–37.5 cm	8–16 cm	11.5–20 cm
Number of upright shoots	1	2–6	1 (rarely 2)	(1–)2–5
Strobilus (proportion of shoot height)	20–33(–50)%	6–41%	13–37%	11–30%
Width of strobilus	4–5 mm	4–6 mm	6–9(–10) mm	7–11(–12) mm
Sporophyll length	3–4 mm	2.9–5(5.2) mm	4.9–6.7 mm	(4.7–)5.4–7 mm
Sporophyll margin	entire	usually either entire or with a low, broad tooth on one or both margins	with 0–2 slender teeth per margin at (at least some sporophylls toothed)	with 0–2 slender teeth per margin (at least some sporophylls toothed)
Sporophyll orientation	appressed	appressed	loosely appressed to ascending	ascending
Trophophylls of horizontal shoots	4–6 × 0.8–1 mm, entire	3.3–6.2(–6.5) × 0.6–1 mm, with (0–)1–5(–7) teeth per margin	4–6.8 × 0.7–1 mm, with (0–)2–5(–6) teeth per margin	5–6.5 × 0.5–0.8, with 0–2(–3) teeth per margin

Table 1. Morphological comparison of *Lycopodiella* taxa. Measurements of *L. appressa* and *L. ×copelandii* are from New England material (Haines 2003b and unpublished data).

Based on available descriptions (Bruce 1975, Bruce et al. 1991), it appears that Bruce intended to use the name *Lycopodiella subappressa* for a smaller, northern form of *L. appressa*. However, the type specimen of *L. subappressa* (*Wagner 70508* MICH!) does not resemble a small form of *L. appressa*, rather, it is most similar to *L. ×copelandii* of the Atlantic coastal plain. *Lycopodiella* collections matching many features of the published description of *L. subappressa* can be found in Newfoundland and Nova Scotia (collections at GH! and MT!). The specimens are immature and spore measurements are not possible; however, measurements of stomates indicate that these plants are likely diploid (Arthur Haines, unpublished).

As mentioned previously, Bruce (1975) reported both species of tetraploid clubmosses from northeastern North America—*Lycopodiella margueritae* from New England and *L. supappressa* from Nova Scotia. I have been unable to find any specimens annotated by Bruce as "appressed inundatum" (or its apparent herbarium name *L. crawfordii*) or "northern appressum" from these areas (these names would have been used by Bruce as the plants had not yet been formally described). However, Bruce did provide penciled annotations on several specimens at GH suggesting that abortive-spored specimens were the product of diploid and tetraploid crosses. It appears that Bruce used the presence of abortive-spored specimens as indirect evidence for the occurrence of tetraploid species in the northeast. Most of those specimens thought to be triploid hybrids are referable to *Lycopodiella ×gilmanii* A. Haines and *L. appressa* (as evidenced by their morphology and smaller spore size). The reason for the production of abortive spores in those plants has not yet been determined.

No hypotheses have been published concerning the possible origin of *Lycodiella subapressa*. Morphology suggests that this species may be derived from *L. ×copelandii* (= *L. alopecuroides* × *L. appressa*; Figure 2). These two taxa are similar in many respects, including overall plant outline, sporophyll length, margin, and orientation, strobilus width, and horizontal shoot trophophyll margins (i.e., the trophophylls are toothed to some degree). Differences in plant height, horizontal shoot thickness, and number of upright shoots can be explained by climate—bog clubmosses from northern and/or interior locations produce fewer, shorter, and thinner shoots than do individuals from southern and coastal locations (Haines 2003a). In the absence of

geographic data, and without resorting to measurements of spore and stomate size, *L.* ×*copelandii* and *L. subappressa* can be confidently identified only by horizontal shoot thickness and sometimes upright shoot number (e.g., when more than two upright shoots per horizontal shoot segment are produced in *L.* ×*copelandii*).

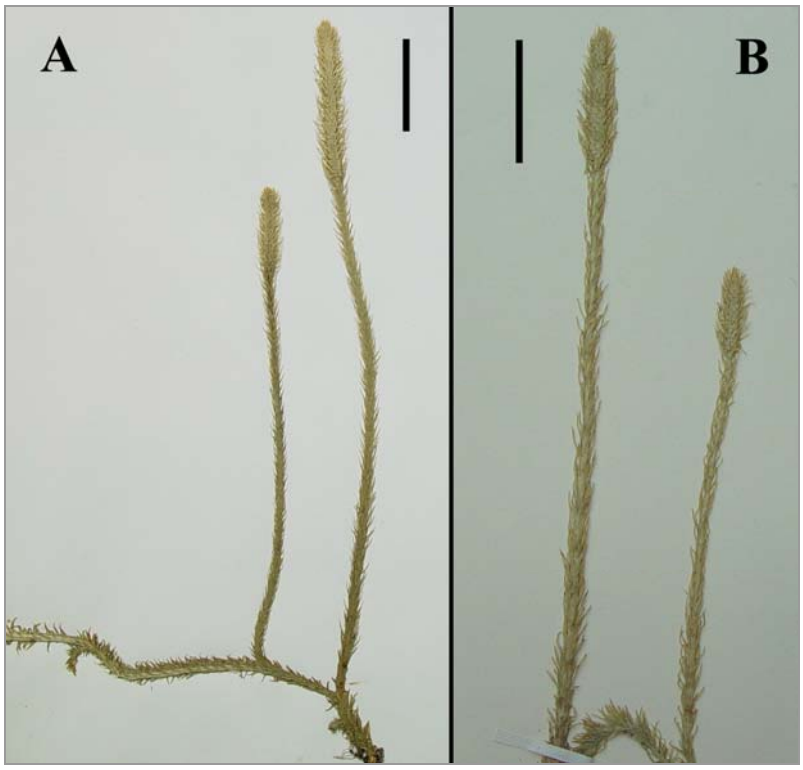

Figure 2. Comparison of *Lycopodiella* specimens, scale bars=30 mm. A—*L.* ×*copelandii*; 27 Sep 1940, *Eames s.n.* (CONN). B—*L. subappressa*; *Reznicek*, *Case*, *& Case 8923* (MICH).

Emended Description of *Lycopodiella subappressa* Bruce, Wagner, & Beitel

Plants deciduous, overwintering by a thickened tip of stem. **Horizontal shoots** rooting (2–)3.5–7.5 cm distal to the proximal-most upright shoot, 7–17 cm long, 1–1.5(–1.7) mm thick exclusive of the trophophylls, producing 1 or rarely 2 upright shoots. **Upright shoots** 8–16.5 cm tall, 1–1.8 mm thick, with appressed-ascending trophophylls. **Trophophylls of horizontal shoots** 4–6.8(–7.8) × 0.7–1 mm, with (0–)2–5(–6) teeth per margin. **Trophophylls of upright shoots** varying from entire to toothed, usually those near the base of the shoot with abundant teeth, gradually becoming few-toothed or even entire upward on shoot. **Strobili** 14–49 × 6–9(–10) mm, representing 13–37% of the total upright shoot height. **Sporophylls** (4.6–)4.9–6.7 mm long, loosely appressed to ascending, with 0–2(–3) teeth per margin. **Spores** 53.4–53.6 µm (based on 2 measurements by Anton Reznicek, University of Michigan).

Specimens Examined

USA. Michigan. Allagen County. E of US 23, south side of Clyde Twp., N of 112 St., acidic, sandy, shrubby habitat, Clyde, 30 Aug 1998, *Wagner 98046* (CONN). Mackinac County. Growing in seasonally wet sandy soil along old pipeline corridor, colony of 30–40 plants, NE ¼ section 14 T41N R5W, ca. 2 mi. S of E end of Brevoort Lake, 15 Sep 1989, *Henson 2996* (MICH). Midland County. At US highway 10, Michigan highway 30, near power metal high tension tower in NE area of borrow pit, also along W edge of pit near access road, 5 Sep 1972, *Bruce 72-078* (MICH). Ottawa County. Borrow pit on E side of US 31, north of Grand River, 14 Nov 1970, *Wagner 70508* (MICH; holotype). Van Buren County. Moist, sandy, bare soil near powerline access road, under large powerline, Extensive patch on one area, plants greenish, E side of 75th St., N of 28th Ave., SE ¼ section of 3, T2S R17W, ca. 2 mi N of Covert, 26 Jul 1999, *Reznicek & Hendrix 10950* (MICH). Wayne County. Moist and very diverse prairie-savanna complex on sandy, undulating terrain, NE ¼ sect. 8, T4S R10E,

SW corner of Sibley and Telegraph Rds., outskirts of Woodhaven, 19 Sep 1991, *Reznicek*, *Case*, *& Case 8923* (MICH).
Ohio. Lucas County. Moist sand pit dominated by *Rhychospora capitellata*, *Polytrichum* sp., and *Lycopodiella*, frequent in large colonies, Oak Openings Preserve Metropark, "Monclova Sand Pits", S side of Monclova Rd., just E of Wilkins Rd., 28 Sep 1993, *Reznicek*, *Case*, *Case*, *Oldham*, *& McLeod 9752* (MICH).

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REASSESSMENT OF THE TAXONOMY OF *RANUNCULUS HISPIDUS*

Ranunculus hispidus Michx. is a frequent crowfoot over much of eastern North America. It has traditionally been treated as a complex that contains three taxa. These taxa have been recognized as separate species (Fernald 1950) or, more recently, as varieties (Duncan 1980, Whittemore 1997). The differing treatments are, in part, due to differences in interpretation of taxonomic ranks. This note presents justification for treatment of these taxa at the species level.

Ranunculus hispidus sensu Duncan (1980) is made up of three varieties—variety *hispidus* (Figure 1), variety *caricetorum* (Greene) T. Duncan (Figure 2), and variety *nitidus* (Chapman) T. Duncan. The species is recognized by leaves generally with three separate, petioluled leaflets, clavate receptacles, flabellate nectary scales, and styles stigmatic near the apex and persistent as a beak on the smooth achenes. Duncan (1980) performed relatively detailed research and incorporated multiple lines of evidence for justification of the taxa he recognized. However, examination of the ranks he used shows that he applied the rank of variety to infraspecific taxa regardless of the morphological variation they displayed (i.e., some varieties are separated by several reliable characters, while others possess only one consistent difference). Further, some of the varieties recognized by Duncan have different chromosome numbers and/or are completely allopatric. These comments point to an arbitrary definition of the rank of variety (as used by Duncan). Nesom (1993) has also provided criticism of Duncan's use of ranks in the *R. hispidus* and *R. petiolaris* Kunth *ex* DC. complexes, arguing that the species may be more complex than Duncan presents and that some varieties appear to warrant species status.

Figure 1. *Ranunculus hispidus* var. *hispidus* from western Connecticut.

Figure 2. *Ranunculus hispidus* var. *caricetorum* from northern Maine.

Nesom (1993) argued for recognition of *Ranunculus hispidus* var. *nitidus* as a distinct species. Treating this taxon as a species is sensible considering that it is distinct in floral, fruiting, and vegetative morphology from the other two infraspecific taxa (*sensu* Duncan) of *R. hispidus*. Variety *nitidus* has sepals that are conspicuously reflexed from a well defined, transverse fold ca. 1 mm above the sepal base, achenes with a pronounced, corky rib 0.4–1.2 mm wide that encircles the achene body, and the plants typically demonstrate repent shoots that root at the nodes during fruiting (and often prior). Both varieties *hispidus* and *caricetorum* have sepals that are spreading or rarely reflexed, but then from the very base of the sepals, achenes with a narrow rib 0.1–0.2 mm wide that encircles the achene body, and the plants demonstrate upright or decumbent shoots during fruiting (sometimes rooting at the nodes). Further, var. *nitidus* tends to have shorter sepals and petals that show less apical dilation than the other varieties. Based on these differences, *R. hispidus* var. *nitidus* is sufficiently distinct to be regarded as a species. The earliest name at the rank of species appears to be *R. septentrionalis* Poir. *in* Lam., a name frequently misapplied to *R. hispidus* var. *caricetorum*.

***Ranunculus septentrionalis* Poir. *in* Lam.**

Basionym: *Ranunculus septentrionalis* Poir. *in* Lam.; Encyclopedie Methodique Botanique 6: 125. 1804.

Holotype: "Cette plante croît dans l'Amerique septentrionale … in herb Lamarck." (P-LAM).

Synonyms: *Ranunculus carolinianus* DC; *Ranunculus nitidus* Ell.; *Ranunculus septentrionalis* Poir. *in* Lam. var. *nitidus* (Ell.) Chapman; *Ranunculus hispidus* var. *nitidus* (Ell.) T. Duncan.

This leaves two taxa for discussion—*Ranunculus hispidus* var. *hispidus* and *R. hispidus* var. *caricetorum*. These two varieties can be reliably separated by ecology and vegetative morphology. Variety *hispidus* is a plant of mesic to dry-mesic, upland woodlands and forests with upright stems 14–45(–60) cm tall at fruiting. Variety *caricetorum* is a plant of hydric soils (e.g., swamps, marshes, ditches) with eventually spreading to decumbent stems 50–80(–91) cm long at fruiting (Figure 3).

Figure 3. Decumbent stems of *Ranunculus hispidus* var. *caricetorum*.

Although var. *hispidus* and var. *caricetorum* show some difference in geographical range (var. *hispidus* is more southern than var. *caricetorum*), they are sympatric over a broad swath from southern New England west to southern Missouri. An important factor in this discussion is that the two taxa differ in ploidy level. Variety *hispidus* is tetraploid with 2n=32, whereas variety *caricetorum* is octoploid with 2n=64. Duncan (1980) stated that the ploidy level difference prohibits interbreeding when variety *caricetorum* comes into contact with tetraploid members of the complex. Based on differences in chromosome number, strong ecological separation, and weak geographic separation, *R. hispidus* var. *hispidus* and *R. hispidus* var. *caricetorum* are effectively isolated from one another. I have not seen intermediate material, nor am I aware of records that report such. Therefore, given that these two taxa are morphologically and ecologically distinct, possess different chromosome numbers, and appear to be reproductively isolated, I advocate recognizing *R. hispidus* var. *caricetorum* at the rank of species. At this rank, a name is already available—*R. caricetorum*.

***Ranunculus caricetorum* Greene**

Basionym: *Ranunculus caricetorum* Greene; Pittonia 5: 194. 1903.

Lectotype: USA. Wisconsin. Near Dodgeville, 20 Jun 1898, *Greene s.n.* (NDG).

Synonyms: *Ranunculus intermedius* Eat; *Ranunculus septentrionalis* Poir. *in* Lam. var. *caricetorum* (Greene) Fern.

In summary, sufficient distinctions, including morphology, ecology, chromosome number, and/or distribution differences, warrant recognizing the members of the *Ranunculus hispidus* complex (varieties *sensu* Duncan) as species: *R. caricetorum*, *R. hispidus*, and *R. septentrionalis*.

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