FLORISTICS AND BIOGEOGRAPHY OF THE BRYOPHYTE FLORA IN THE BIG THICKET NATIONAL PRESERVE, SOUTHEAST TEXAS

A Thesis

by

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ABSTRACT

The Big Thicket National Preserve in southeast Texas, U.S.A has been the subject of numerous vascular plant surveys. However, there has not been a comprehensive survey of non-vascular plants (bryophytes) since its founding in 1974. A survey of the bryophytes was conducted between 2008 and 2011. This specimen and literature based inventory documents a total of 166 species of mosses, liverworts, and hornworts in 55 families, 97 genera. This total represents a 41% increase over previously documented species in the preserve. Nine new tentative state records are listed. Dichotomous keys for the identification of all extant groups, genera, and species are included. The bryophyte flora of the Big Thicket National Preserve is primarily composed of Widespread (28%), Holarctic (26%), Eastern North American (21%), and Tropical (17%) species.

DEDICATION

In the first century B.C., Publilius Syrus in his *Sententiae,* espoused the view "*a rolling stone gathers no moss.*" However, in the ensuing 2000 or so years, it seems further research now suggests that in fact "*moss grows fat on a rollin' stone*" (Don McLean, American Pie, 1971).

The study of bryophytes in the "Lone Star State" has been intermittent at best, while vascular plants have taken a much greater prominence in our pursuit of botany. This thesis is dedicated to all of those who preceded me in the pursuit of these most interesting, but overlooked residents of our state. Borrowing a phrase from A.C. Crundwell "*the trouble with mosses is that they are the wrong size, and there is no money in them*" suggests (tongue in cheek) that they are of little value. I beg to differ, and as Bernard Goffinet and Jon Shaw so aptly expressed it *"although the angiosperms are impressively diverse in numbers and structure, they are, we now know from phylogenetic insights into plant evolution, just glorified bryophytes."* Despite all of this trouble with mosses, each of my predecessors has contributed to the foundation upon which to stand, as I hope to advance bryology in Texas a bit further.

ACKNOWLEDGEMENTS

During the course of this project I spent many, maybe too many, hours away from home. Therefore, my most sincere thank you, and deepest appreciation, goes to my wife Maggie, who steadfastly supported me in the pursuit of my obsession. To my parents Rodger and Lillie, who always taught me to never give up, and that anything worth having does not come easy. The completion of this degree and my accomplishements in life thus far, are based on these principals.

My committee members, Stephan L. Hatch, William E. Rogers, David M. Cairns, and Paul G. Davison have all been very patient in this process, offered constructive criticism, and guidance along the way.

The staff at the Big Thicket National Preserve provided assistance and logistical support while I was in the field. The Big Thicket Association generously made the Field Research Station my “home away from home” while I was making collections in the Big Thicket.

A special thanks goes to Paul V. Roling who spent countless with me hours in the field collecting bryophytes, and even more hours making identifications as part of this inventory. His companionship and efforts were essential to this project.

Over the years, as I collected specimens and data, three students (Jessica Dyer, Makell Garlick, Andrea Wiley) assisted me in getting voluminous amounts of specimen data from those tiny paper collecting bags, and countless label images, into digital files. Jene’t Ardoin graciously offered her time to create the figures in this thesis and helped with formatting some of the content.

I would be remiss if I failed to acknowledge the outstanding financial support I received in the course of this project. The Western National Parks Association, in addition to the Big

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CHAPTER I

INTRODUCTION

What are Bryophytes?

Bryology, as defined by Webster's dictionary, is a branch of botany that deals with the [study of] bryophytes. The term "bryophyte" originated from the Greek language and refers to "plants that swell upon hydration" (Vanderpoorten & Goffinet 2009). This ability to swell when wetted certainly hints at the capability of these organisms to resume their former stature following desiccation, a key feature in the physiological ecology of bryophytes. Frequently viewed as "poor relatives" of the more flashy angiosperms (Goffinet & Shaw 2009) or as the "lower plants" (Proctor 2000), these characterizations no doubt allude to their early evolutionary emergence. Bryophytes are often lumped into a loose collection of organisms referred to as cryptogams. The cryptogams (*kryptos*, meaning hidden and *gameein*, meaning to marry) are a disparate assemblage of organisms such as algae, lichens, fungi, and ferns, most of which are at best remotely related to the other members of the artificial group. As such, this term is largely obsolete in contemporary plant systematics, although it does illustrate the overlooked status of these organisms.

Bryophytes, in the traditional sense, include the Bryophyta (mosses), Marchantiophyta (liverworts), and Anthocerotophyta (hornworts). All of these groups are non-vascular plants with similar habits, and which frequently occupy the same habitats. Although regularly consolidated into a single group, based on an overall lack of complexity and similar life cycle strategies, these groups have very little in common (Steere 1969) and likely reflect differing ancestral lineages (Goffinet 2000). As non-vascular plants, bryophytes are generally thought of as the first land plants. Mishler et al. (1994) concluded the Charophyceae, one of four basal algal lineages, are the ancestor of all extant land plants to include the bryophytes and tracheophytes. However, the placement of the bryophyte groups within this basal lineage has not yet reached a final consensus. Summarizing relationships among the bryophytes relative to their ancestors (charophytes) and their descendants (tracheophytes), Goffinet (2000) suggests the convergence of hypotheses place the hornworts as the most basal group, with the mosses and liverworts in a monophyletic group sister to the tracheophytes.

Bryophytes as a group consist of between 15,000 (Gradstein et al. 2001) and 25,000 (Crum 2001) species worldwide and are the second largest group of plants. They occur on every continent, and in every habitat, where vascular plants reside (Glime 2007). In fact, bryophytes are the dominant plants, in species diversity and biomass, in a number of regions in the world. On the continent of Antarctica, only three species of vascular plants are known to persist, *Deschampsia antarctica* Desvaux (Antarctic hairgrass), *Poa annua* Linnaeus (annual bluegrass), and *Colobanthus quitensis* (Kunth) Bartling (Antarctic pearlwort), the remaining flora consists of mosses and liverworts (Bednarek-Ochyra et al. 2000; Ochyra et al. 2008). In the higher latitudes of arctic tundra ecosystems, species richness declines in both vascular and non-vascular plants. However the decrease in the bryophytes is much less than that of vascular plants which leads to an increase in the relative abundance of bryophytes (Jägerbrand et al. 2011). Longton (1982) suggested bryophytes are highly significant in terms of cover, richness, biomass, and production in polar ecosystems; and Rozzi et al. (2008) demonstrate an inversion between vascular and non-vascular plant diversity in the sub-Antarctic Magellanic region of southwestern South America. Clearly this distinction does not apply in any ecoregion in Texas. However, only minimal investigation into the diversity and ecology of bryophytes in the state, and region, has been completed (Whitehouse 1954; Slack & Stark 2011).

Uses and Values of Bryophytes

Along with a diminished phylogenetic perception, bryophytes have often been relegated by many to occupy a position of low value in terms of their economic use and ecological values. This perspective could be neatly summed up, as indicated by Ando and Matsuo (1984), in that the usefulness of mosses has been limited to packing, plugging, stuffing, decorating, and soil conditioning. Most of these uses are utilitarian in nature; however, a number of significant ecological values are identifiable such as: erosion control, aiding nitrogen fixation, nutrient and water cycling, and carbon sequestration (Glime & Saxena 1991; Porley & Hodgetts 2005; Crandall-Stotler & Bartholomew-Began 2007; Tuba et al. 2011). These values continue to elevate the usefulness of bryophytes as valuable members of natural systems. In recent decades, bryophytes have experienced a notable rise in popularity in academic circles (Goffinet & Shaw 2009). Tuba et al. (2011) in their recent volume *Bryophyte Ecology and Climate Change* demonstrate an intuitive, yet potentially overlooked value of bryophytes as possible early indicators of climate change. Bryophytes have also been used as model organisms in genetic research for many decades. In the 1930's the liverwort genus *Sphaerocarpos* Boehmer, was utilized to demonstrate the presence of sex chromosomes in plants, and more importantly that DNA was the molecular basis of heredity (Porley & Hodgetts 2005). Recent advances in genetic research, phylogenetic and biotechnological, have further utilized mosses. The acrocarpous moss, *Aphanorhegma patens* (Hedwig) Lindberg, (*Physcomitrella patens* (Hedwig) Bruch & Schimper) has proven useful in reconstructing early land plant evolution (Rensing et al. 2008), in addition to the potential for cost effective manufacture of biopharmaceuticals (Gitzinger et al. 2008).

Bryophyte Morphology

As the earliest land plants, bryophytes successfully moved from an aquatic existence into a terrestrial environment and have evolved for millions of years independently of the vascular plants (Crum 2001). In contrast to the vascular plants, bryophytes possess attributes which effectively set them apart from their more advanced descendants. As non-vascular plants, bryophytes exhibit differences in morphology and physiology, in addition to reproductive and dispersal mechanisms, when compared to vascular plants. Characteristics such as a dominant gametophyte generation, non-lignified stems and leaves, and repeated desiccation tolerance are not shared by most vascular plants, nor the purported ancestor of the bryophytes, the charophycean algae. Having assumed a poikilohydric lifestyle, bryophytes are inherently responsive to changes in environmental conditions and have evolved complex mechanisms which allow them to tolerate repeated desiccation without apparent structural or physiological damage (Vanderpoorten & Goffinet 2009; Proctor 2011). At the same time, these attributes impose significant liabilities for life in an often challenging terrestrial environment and has resulted in the evolution of variants with rather narrowly defined habitat niches, and frequently relatively limited geographic distributions (Gignac 2001). Bryophytes utilize these attributes as mechanisms to effectively exploit numerous microhabitats in their terrestrial environment.

The three bryophyte lineages differ from one another in a number of characteristics, to the extent these can be used as field indicators for differentiating the groups from one another (Vanderpoorten & Goffinet 2009). One morphological character shared by all three bryophyte groups is the dominance of the gametophyte generation. The bryophyte gametophyte is typically perennial, free-living, and photosynthetic; while the sporophyte is short-lived and completes it entire life attached to the maternal gametophyte (Goffinet & Shaw 2009). Although not necessarily “parasitic” the sporophyte is nonetheless near-completely dependant on the gametophyte for its nutritional needs (Crum 2001; Crandall-Stotler & Bartholomew-Began 2007). This is the opposite of the tracheophytes where the sporophyte generation is dominant. Although there is much diversity in the observed form of the bryophyte gametophyte, there are two basic types or habits: leafy and thalloid.

The Bryophyta all possess leaves, of varying morphologies, and do not exhibit a thalloid growth form (Crum 2001). The Marchantiophyta exhibit both forms divided loosely into two classes; the Marchantiopsida or thalloid liverworts, and the Jungermanniopsida or leafy liverworts, with the leafy liverworts representing at least 85% of the species in the Marchantiophyta (Schuster 1984; Crandall-Stotler & Stotler 2000; Shaw & Goffinet 2000). The Anthocerotophyta are all thalloid (Crum 2001). Gametophytes in the mosses consist of branched or unbranched stems with alternately arranged leaves that are typically spirally imbricate, or distichous as in the genera *Fissidens* and *Schistostega*. Moss leaves are generally undivided and typically have one to several costa, and laminal cells that range from round or variously quadrately isodiametric, to short or long linear. Many species of mosses have leaves that are one cell thick, others have multiple layers. Regardless of the number of layers, leaf cells are exposed directly to the environment on both the abaxial and adaxial surfaces.

The leaves of leafy liverworts are in two or three rows with the largest leaves alternately arranged and distichous, and if present, reduced underleaves occur on the ventral side of the stem. The plants appear to have a distinct upper and lower surface. The leaves may or may not have variously shaped lobules. The unistratose leaves are ecostate and have cells that range from quadrate to variously multi-angled, often with one to numerous oil bodies and chloroplasts in each cell. Thalloid gametophyte growth forms in the liverworts are loosely subdivided into simple and complex forms. The complex thalloids typically have multiple layers of cells, dorsal air-pores, air chambers, and a ventral storage zone. Complex thalloids are often opaque and have a definite fleshy appearance. Simple thalloids consist of an unspecialized thallus with a thickened midrib and two lateral wings (Crandall-Stotler et al. 2009). Thus, simple thalloids although often multilayered, are thinner and have a more delicate translucent appearance.

Hornwort gametophytes are always thalloid, typically with a single large chloroplast in each cell, and without oil bodies. Thalli are typically in rosettes with or without lobed or divided margins. Hornworts also house endosymbiotic colonies of the cyanobacteria *Nostoc* in globular or channeled clusters (Vanderpoorten and Goffinet 2009).

Although the gametophytic generation is dominant, there are marked differences in sporophyte morphologies between the three groups. In brief, mosses possess an unbranched stalk (seta) which supports a single sporangium that is always terminal. Spores develop within a spore sac which surrounds a columella inside the capsule. The distal end of the developing capsule typically has an operculum and this is partially or wholly covered by, at least initially, a calyptra; derived from modification of the archegonium that is torn away during the elevation/extension of the seta. In some mosses a series of peristome teeth, and in some cases an annulus, is present between the urn and the operculum. These teeth, of differing number and morphologies, are hygroscopic and aid in spore dispersal (Crum 2001; Crandall-Stotler & Bartholomew-Began 2007; Vanderpoorten & Goffinet 2009).

Liverwort sporophytes are typically elevated on a seta (with some exceptions such as the genus *Riccia* which are setaless and have sporophytes imbedded in the thallus) with a single terminal sporangium that encloses a mass of spores and elaters (elongated, coiled cells that aid in spore dispersal). A columella is not present. Spore dispersal is facilitated by the splitting of the capsule along four medial lines to release the spores and elaters in a single event (Vanderpoorten & Goffinet 2009).

In the hornworts the sporophyte is long and linear. The sporophyte is composed entirely of the sporangium except for the basal foot and a meristematic zone just above the foot that gives rise to sporangial tissue (no seta is produced); the sporangium (capsule) elongates from its base. A columella extends through the center of the sporangium. Spores and pseudoelaters are dispersed by the longitudinal splitting of the capsule which releases the spores gradually, from the base to the apex, throughout the growing season (Renzaglia et al. 2009; Vanderpoorten & Goffinet 2009).

Site Description

The "big thicket" is an entity that is often as difficult to define, as it is to delimit. Throughout the recent history of southeast Texas, the big thicket as a region has taken on several configurations. The boundaries of these configurations, determined by the needs of the user, differ significantly in their final spatial delineation. MacRoberts and MacRoberts (2009) summarize five general delineations of the big thicket compiled from various sources. These five concepts include: 1) *broadest conception* (Diggs et al. 2006), 2) *biological survey* (Parks et al. 1938), 3) *ecological area* (McLeod 1971), 4) *traditional or hunter's thicket* (Diggs et al. 2006), and 5) *artificial delineation* (Diggs et al. 2006). Although not included as one of the concepts in the MacRoberts' list, the National Park Service's, Big Thicket National Preserve (BITH) is clearly located within the theoretical boundaries of each of these definitions.

The BITH is undoubtedly one of the more familiar concepts recognized by the general public, and is the only definition with discrete boundaries, albeit political in nature. As pointed out by numerous authors (Gunter 1993; Abbott et al. 1997; Watson 2006) the big thicket has long been referred to as a biological crossroads, where the flora and fauna of several differing eco-regions converge. It is this unique biodiversity that was the impetus for many decades of efforts to protect and conserve what remains of the original big thicket, however it is defined. Originally set aside in October of 1974 the BITH was designated the nation's first preserve (Owens 1978), as opposed to a national park or monument, with the expressed purpose "*to preserve the area of rich biological diversity where the eastern hardwood forests, the southern coastal wetlands, the western prairies, and the arid southwest converge*" (National Park Service 2013). As such, the sites selected for inclusion in the original BITH were chosen to be representative of the different habitats found in the broader region rather than one contiguous ecosystem (Owens 1978; Peacock 1994; Diggs et al. 2006).

The Big Thicket National Preserve is located in the extreme southeast corner of Texas and is composed of nine "land units" interconnected by a series of six, river or creek "water units." The land units are large (10,000 hectares) to small (222 hectares) contiguous tracts of land spread out across seven counties in the region. The "water units" are perennial creek, bayou, or river corridors that connect all but three of the units into a widespread, but more or less continuous, network of preserved lands. The Loblolly, Hickory Creek Savannah, and Beech Creek Units are not currently interconnected within this network. At present the BITH as a preserve is 40,468 hectares and is located in the east Texas Pineywoods ecoregion and within the West Gulf Coastal Plain of the United States (Figure 1). The dominant vegetation in the region is mixed pine-hardwood forests on the uplands and mixed hardwood forests in the bottomlands. In the southern portions of the region, near the Beaumont Unit, the typical coastal plain prairies become more evident. Annual precipitation in the region is between 122 and 142 cm, mean annual temperatures are between 19 and 21 degrees celsius (Hatch et al. 1990; Diggs et al. 2006). Additional details of BITH soils and geology can be found in Deshotels (1978) and Aronow (1981). Brief descriptions of the nine land units are provided below (Figure 2).

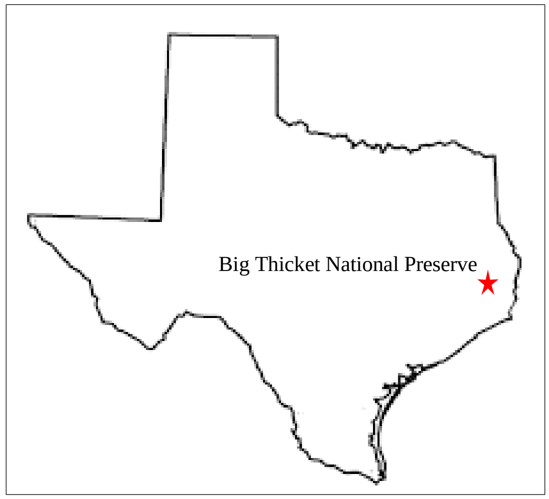

Figure 1: Location of the Big Thicket National Preserve.

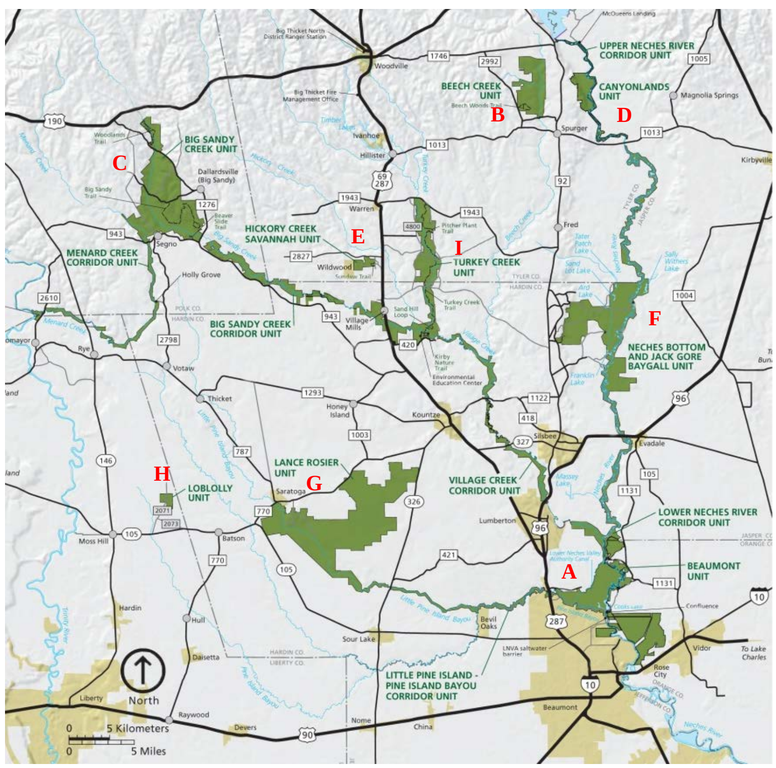

Figure 2: Map of the Big Thicket National Preserve, Southeast Texas. Modified from (National Park Service 2015).

The ***Beaumont Unit*** ("A" Fig. 2) is the southernmost unit in the BITH and is located in parts of Hardin, Jefferson, and Orange Counties with a geographic center near N 30˚ 07′ 44.77″ and W 94˚ 04′ 28.78″. Positioned just north and east of the city of Beaumont, the unit encompasses ca. 2516 hectares of largely bottomland hardwood forests along Little Pine Island Bayou, Village Creek, and the Neches River. The entire unit is essentially a maze of bayous and sloughs which effectively limit terrestrial access to much of the site. Topography is fairly constant as elevations range from 1.5 to 3.5 meters. Vegetation is largely *Taxodium-Nyssa* swamps in the bottomlands and *Quercus-Pinus* forest on ridges (Watson 2006).

The ***Beech Creek Unit*** ("B" Fig. 2) is located in western Tyler County with a geographic center near N 30˚ 44′ 29.42″ and W 94˚ 12′ 27.51″. The unit is ca. 2059 hectares and is relatively flat with poor drainage in most of the unit. Elevations range from 43 meters to 62 meters (Brown, et al. 2008a). Beech Creek and Little Beech Creek are the primary drainages and traverse the unit in a generally north-south line. The vegetation in the unit is dominated by lower slope hardwood-pine forest with lesser amounts of baygall, mid-slope oak-pine forest, floodplain hardwood-pine forest, floodplain hardwood forest (Marks and Harcombe 1981).

The ***Big Sandy Creek Unit*** ("C" Fig. 2) is located in extreme southeastern Polk County with a geographic center near N 30˚ 36′ 55.8″ and W 94˚ 40′ 46.33″. The unit is 5806 hectares and is dominated by upper and mid-slope pine-oak forests and lower slope hardwood-pine forests with lesser amounts of upland pine hardwood and floodplain hardwood forests, baygalls, cypress-tupelo swamps, and sandhill pine forest. Elevations range from 53 to 94 meters (Brown et al. 2006a). Big Sandy Creek is the primary drainage in the unit which runs in a general north-south line. Menard Creek and Double Branch of Big Sandy Creek drain the southwestern portions of the unit.

The ***Canyonlands Unit*** (“D” Fig. 2) is located in eastern Tyler County with a geographic center near N 30˚ 44′ 21.40″ and W 94˚ 08′ 23.91″. The unit is 597 hectares and is dominated by upland pine-oak, upper slope beech-magnolia-pine forests, and floodplain forests, baygalls and swamps. Elevations range from 18 to 61 meters (Haile & Hatch 2013). The Neches River is the primary drainage and forms the eastern boundary of the unit in a north-south line. To the west of the Neches River the upland terraces and bluffs that flank the river are eroded into numerous forested “canyons” which typically contain one to several springs that feed into the floodplain and produce lush vegetation.

The ***Hickory Creek Savannah Unit*** (“E” Fig. 2) is located in southwestern Tyler County with a geographic center near N 30˚ 32′ 44.53″ and W 94˚ 25′ 42.84″. The unit is 284 hectares and is dominated by open grasslands interspersed with longleaf pine savannah wetlands. The site has very little relief and elevations range from 35 to 42 meters. The crest of the Hickory Creek/Village Creek and Kimball Creek divide bisects the property and these drain the unit east and west respectively. Several pitcher plant bogs on the site contain several rare orchids and other carvivorous plants (MacRoberts et al. 2002; Watson 2006).

The ***Jack Gore Baygall*** and ***Neches Bottom Units*** (“F” Fig. 2) are located in extreme northeast Hardin, southeast Tyler, and western Jasper Counties with a geographic center near N 30° 29' 26.9" and W 94° 06' 32.9". The units encompass ca. 5379 hectares in total and are dominated by a mix of plant communities. Largely a floodplain forest along both sides of the Neches River, the units contain a upper- mid- and lower slope forests and include floodplain hardwood, wetland baygall, and cypress-tupelo swamps (Brown et al. 2010). Elevations range from 3 to 33 meters. The Neches River is the primary drainage, along with Black Creek and a spreading network of numerous sloughs and bayous that feed into the Neches River.

The ***Lance Rosier Unit*** (“G” Fig. 2) is the largest individual unit in the BITH and encompasses ca. 10,000 hectares in southern Hardin County, with a geographic center near N 30° 15' 06.4" and W 94° 26' 20.4". Largely a floodplain, the unit is relatively flat and thus poorly drained over much of the area. Vegetation is dominated by lower slope hardwood-pine forest and wetland pine savannah, with additional flatland hardwood forest, floodplain hardwood forest, and baygall thickets. Elevations range from 14 to 30 meters (Brown et al. 2006b). Little Pine Island Bayou is the primary drainage and crosses the western portion of the unit in a NW to SE direction.

The ***Loblolly Unit*** (“H” Fig. 2) is the smallest individual unit in the BITH and encompasses 222 hectares in eastern Liberty County. The geographic center of the property is near N 30° 17' 08.1" and W 94° 40' 24.4". The entire unit consists of either floodplain or flatland hardwood forest. The unit is essentially level and therefore drainage is very poor with standing water for long periods following rain events. Elevations are relatively constant at 33 meters. Once thought to be prairie, the site has converted to forest due to fire suppression efforts. In their inventory of the vascular plants Brown, et al. (2008b) found no prairie species or remnant prairie habitats.

The ***Turkey Creek Unit*** (“I” Fig. 2) is bisected by the Tyler and Hardin County line with a geographic center near N 30° 32' 49.5" and W 94° 20' 26.0". The unit encompasses 3150 hectares in an 18 kilometer by 4 kilometer narrow corridor along Turkey Creek. Elevations range from 15 to 45 meters (Brown et al. 2005). Vegetation is diverse and consists of 12 different plant communities to include arid sandyland, longleaf pine uplands, pine savannah, pine savannah wetlands, and floodplain beech-magnolia-cypress hummocks (Watson 2006). Turkey Creek is the dominant drainage in the unit oriented in a north-south direction which intersects with Village Creek in the very southern end of the unit.

CHAPTER II

METHODS

Objectives

1. Conduct an inventory of bryophytes within the land units of the Big Thicket National Preserve to create a current comprehensive checklist of extant species.
2. Construct a dichotomous key to aid in the identification of bryophytes found in the Big Thicket National Preserve.
3. Analyze the biogeographic affinities of the bryophyte flora in the Big Thicket National Preserve.

Field Collections

Numerous collecting trips were made to the BITH between 2008 and 2011. Sampling trips were conducted throughout the year, with an increased emphasis in the late fall and early spring to document taxa which are ephemeral in nature. These trips resulted in ca. 1765 individual samples. Unlike vascular plant collections, where each individual collection typically represents one species, bryophyte collections almost always consist of two, to several, different species in any given sample. Therefore, all species in each sample were identified, within reasonable constraints. Minor amounts of admixed material, too meager to identify, were not included. This total number of collections (samples) results in a far greater number of species identified within a given area. Field surveys were conducted in each of the nine land units: Beaumont, Beech Creek, Big Sandy Creek, Canyonlands, Hickory Creek Savannah, Jack Gore Baygall, Lance Rosier, Loblolly, and Turkey Creek. The corridor units were not included in this inventory because access to the units was very difficult since much of the adjacent property is private land, and traversing within the corridors was hazardous and very time consuming due to significant debris resulting from past hurricane damage. When corridor access was possible, collections were made as scheduling allowed.

While in the field, surveys were conducted utilizing a modified floristic habitat sampling method. This method, as described by Newmaster et al. (2005), focuses on a stratification of different mesohabitats into their component microhabitats and substrates when sampling bryophytes and was shown to produce a significant increase (>50%) in the number of taxa documented over the standard plot sampling method. Marks and Harcombe (1981) defined the vegetation types within the big thicket region of east Texas based generally on topographic position and the dominant over-story vegetation. Each of these is further subdivided into a number of communities: sandhill pine forest, upland pine forest, wetland pine savannah, upper slope pine-oak forest, wetland baygall shrub thicket, swamp cypress tupelo forest, etc. Within each of these communities, bryophytes inhabit a variety of substrates such as: soil and rock along stream banks, decaying or living tree bases, specialized soil types, specific tree species, etc. Sampling locations were spatially distributed to include a minimum of one location within each mesohabitat (sensu Marks & Harcombe 1981) and microhabitat encountered in each of the individual units. Within each microhabitat the various substrates were sampled for bryophytes.

Identification and Vouchering

Collections were transported to the S. M. Tracy Herbarium (TAES) for processing, identification, and vouchering. The primary references for identification were Briel (1970), and Schuster (1966, 1969, 1974, 1980, 1992, 1992a) for the Anthocerotophyta and Marchantiophyta; Crum and Anderson (1981), Flora of North America Editorial Committee (1993+), and Reese (1984) for the Bryophyta. Specimens are stored in archival bryophyte packets with an accompanying label containing all relevant collection information and accessioned into the S.M. Tracy Herbarium (TAES).

Herbarium Search

In addition to field collections, a survey of selected state and regional herbaria was conducted to locate historical BITH collections. Specimen data was obtained by searching on-line databases (DUKE, NY) and the Consortium of North American Bryophyte Herbaria Portal (CNALH 2014), e-mail correspondence (MO), and personal visits to herbaria by the author (ASTC, BRIT/SMU, SBSC, SHST, TAES/TAMU, TEX/LL). No records were retrieved from BAYLU (herbarium acronyms follow Thiers 2008). Specimen records were filtered by county and those that did not fall in a county where a BITH unit was located were eliminated. The remaining records were then individually examined and parsed to include only those records that were either stated as occurring in a unit of the BITH, or had sufficient location data that would reasonably place the collection site within a unit of the BITH. The resulting data set contained 294 documentable specimens from the BITH. Specimens from these records are cited in the species descriptions (i.e., BITH Distribution) when needed to complete a distribution for any given species.

Identification Keys

A key to groups (Anthocerotophyta, Bryophyta, Marchantiophyta), and keys to genera within each group, are provided in Chapter IV. A key to species, whenever a genus has more than one species, is also provided in Chapter IV, along with species descriptions for all extant species within the BITH. An index to species descriptions is provided in Appendix E.

Biogeographic Affinities

The BITH vascular plant biogeographic conclusions in MacRoberts and MacRoberts (2004, 2007) are based on both state and county level distribution records. Their analysis was greatly aided by the existence of numerous local, regional, and state checklists for vascular plants. Extant bryophyte collections in many regions of the United States are highly localized. This is especially true in Texas, where many counties have very few if any collections of bryophytes (Whitehouse 1954). Therefore, the biogeography of the BITH bryophyte flora was assessed based on distributions as derived from current literature on distributions within these groups.

CHAPTER III

THE BRYOPHYTE FLORA

Floristic Bryology in the Big Thicket Region

The earliest interest in the "biodiversity" of the big thicket region was undoubtedly from a utilitarian perspective, largely by Native Americans and early Spanish explorers. Unfortunately, neither left written records of their observations or perspectives in the region (Gunter 1993). Post-Spanish exploration in the region was also the focus of the timber and oil industries which continues to the present day. Early recorded accounts of the region's biodiversity focused on rather broad descriptions of the current land use, economic resources, principal vegetation, and topography. Several authors (Planck 1892; Gow 1904; Harper 1920) included various listings of the floral and faunal components observed in the region, although these were brief and woefully incomplete. Parks et al. (1938) and Parks (1938) assembled what could be the first inclusive listing of plant and animal species in the region. Contemporary research into the vascular flora is well presented in a series of reports focusing on a unit by unit inventory of the BITH (MacRoberts et al. 2002; Brown et al. 2005, 2006a, 2006b, 2008a, 2008b, 2009, 2010; Haile & Hatch 2013). However, one common theme in all previous reports is a complete lack of focus on the non-vascular plants (specifically bryophytes) found within the region.

Although Gow (1904), Harper (1920), and Planck (1892) make passing mention of the "mosses" or "*Sphagnum* bogs" each observed, and Parks et al. (1938) and Parks (1938) stress the need for inclusion of these groups, none provide any listing of bryophytes found in the region. A number of national and regional publications have lengthy lists of bryophytes, many of which are found in Texas (McAllister et al. 1932; Frye & Clark 1937, 1943, 1945, 1946, 1947; Grout

1928-1940; Whitehouse 1954; Whitehouse & McAllister 1954; Flora of North America Editorial Committee 1993+) although most of these only provide distribution data to the state or county level. In more recent decades reports of bryophytes for the region and the BITH are few, and consist of occasional reports of species as new to the state or region (Ellison 1963, 1964, 1964a, 1967; Mueller & Magill 1979). The first relatively comprehensive inventory of bryophytes in the BITH was initiated shortly after the establishment of the preserve. Mueller (undated) conducted a preliminary inventory of bryophytes as part of a non-flowering plant survey in 1976 and early 1977. In this survey, 70 species of bryophytes were identified within the preserve. Following this initial report, additional authors supplemented the known bryophyte flora of the BITH (Stoneburner & Wyatt 1979; Bazan 1980; Lodwick & Snider 1980; Wyatt et al. 1980).

Despite these published works, there has not been a comprehensive inventory of the bryophyte flora in the BITH since its establishment nearly 40 years ago. The potential for utilization of vascular plant diversity as a surrogate for non-vascular plant diversity has been examined by several authors (McCune & Antos 1981; Fensham & Streimann 1997; Pharo et al. 1999, 2000; Soderstrom 1981). However, the results have generally been inconclusive. This inventory of the bryophyte flora adds an additional layer of investigation into the overall diversity of the BITH.

Taxonomic Analysis of the Bryophyte Flora

A list of bryophytes reported in the BITH was compiled from the following literature references: Stoneburner and Wyatt (1979), Bazan (1980), Lodwick and Snider (1980), Wyatt et al. (1980). After removing species which were deterimed to be incorrectly identified (see Excluded Species on page 192) the total number of species reported prior to the current inventory was 98 (Appendix A). This historical list contains 3 hornworts, 43 mosses, and 52 liverworts. Following the completion of the current inventory, a total of 166 species are documented in the BITH based on extant collections and literature references. This new total represents an increase of 68 species (41%) over the historical list and contains 4 hornworts, 95 mosses, and 67 liverworts. These increases in species numbers are 25% (1 species), 55% (53 species), and 22% (15 species) for the hornworts, mosses, and liverworts respectively (Table 1).

Table 1: Summary and comparison of the historical and current Big Thicket National Preserve bryophyte flora.

Phylum	Families			Genera			Species		
	Historical List	New List	Change	Historical List	New List	Change	Historical List	New List	Change
Anthocerotophyta	1	2	50%	2	3	33%	3	4	25%
Bryophyta	24	32	25%	37	61	39%	43	95	55%
Marchantiophyta	20	21	5%	28	33	15%	52	67	22%
Totals	45	55	18%	67	98	32%	98	166	41%

Along with changes in total species numbers, noteworthy increases in families and genera within each group were observed. The historical list of mosses included 37 genera and the new list has 61 genera, and is an increase of ca. 39% in the number of moss genera. Increases in the liverwort genera are a modest 15% from 28 to 33. Changes in genera in the hornwort genera are 33%. Although this increase appears large, there are very few genera in the Anthocerotaceae worldwide, and only three in Texas. The greatest increase in families is in the mosses with eight new families reported. Table 2 lists these new families and genera for each group.

Table 2: New families and genera for the Big Thicket National Preserve.

Phylum	Families[1]	Genera
Anthocerotophyta	Notothyladaceae	*Notothylus*
Bryophyta	(Amblystegiaceae)	*Anacamptodon*
		Campyliadelphus
		Hygroamblystegium
	Bartramiaceae	*Philonotis*
	(Brachytheciaceae)	*Oxyrrhynchium*
	Bruchiaceae	*Bruchia*
	Bryaceae	*Ptychostomum*
	Climaceae	*Climacium*
	Ephemeraceae	*Ephemerum*
		Micromitrium
	Fabroniaceae	*Fabronia*
	(Hypnaceae)	*Ctenidium*
		Homomallium
		Hypnum
		Taxiphyllum
	Leskeaceae	*Haplocladium*
		Leskea
	(Mniaceae)	*Rhizomnium*
	Myrinaceae	*Schwetschkeopsis*
	(Pottiaceae)	*Barbula*
		Tortella
	Ptychomitriaceae	*Ptychomitrium*
	(Thuidaceae)	*Cyrto-hypnum*
Marchantiophyta	Marchantiaceae	*Dumortiera*

[1] Families in parenthesis are not new. These were included in order to place the new genera in the list.

The largest increases in species within a family/genus are the Fissidentaceae (*Fissidens*) with an increase of eight species. The Leskeaceae increased by five species (four of which are in the genus *Leskea*), and the Amblystegiaceae, Pottiaceae, Ricciaceae, and Sphagnaceae, each with four new species. Additional increases in families and genera within the Bryaceae, Ephemeraceae, Fabroniaceae, and Lekeaceae, are noted since none of these families/genera were been reported on the historical list (Table 3).

Table 3: Notable increases in species numbers between the historical and new species lists.

Family (Genus)	Historical Species List	New Species List	New Species	Percent Change
Amblystegiaceae	1	5	4	80
Bryaceae	0	2	2	100
Ephemeraceae	0	2	2	100
Fabroniaceae	0	2	2	100
Fissidentaceae (*Fissidens*)	1	9(9)	8	89(89)
Leskeaceae (*Leskea*)	0	5(4)	5	100(100)
Pottiaceae	2	6	4	67
Ricciaceae	3	7	4	57
Sphagnaceae	3	7	4	57

The largest families, in terms of the total number of species present in the BITH, are in listed in Table 4. Only those families with more than five species were included in the list (except for the Anthocerotaceae with two species in the genus *Aspiromitus*). The most speciose family is the Lejeuneaceae with a total of 16 species in six different genera. This dominance is not surprising considering the findings of Dauphin et al. (2011) where the tropical family Lejeuneaceae represent 34% of the total liverwort diversity in Florida. The next largest families are the Fissidentaceae with one genus (*Fissidens*) and nine species, and the Sphagnaceae with one genus (*Sphagnum*) and seven species. The remaining families in Table 4 have only five or six species.

Table 4: The largest families and genera in each phylum.

Phylum	Family	Genera	Species
Anthocerotophyta	Anthocerotaceae	2	2
Bryophyta	Amblystegiaceae	5	5
	Brachytheciaceae	5	5
	Fissidentaceae	1 (*Fissidens*)	9
	Funariaceae	2	6
	Hypnaceae	6	6
	Leskeaceae	2	5
	Pottiaceae	4	6
	Sphagnaceae	1 (*Sphagnum*)	7
Marchantiophyta	Jubulaceae	1 (*Frullania*)	6
	Lejeuneaceae	6	16
	Ricciaceae	2	6

Checklist of the Bryophyte Flora

All taxa in the following checklist were collected and identified by Dale A. Kruse or Paul V. Roling with the noted exceptions. Taxa reported by previous authors, and not collected in the current inventory, are indicated as follows: (1) Bazan (1980), (2) Mueller (undated), (3) Stoneburner and Wyatt (1979). Specimens located in herbaria, and not collected in the current inventory, are indicated using the appropriate herbarium acronym in parenthesis. NatureServe rankings follow species names. Tentative new state records are indicated by an asterisk (*).

ANTHOCEROTOPHYTA

ANTHOCEROTACEAE

Anthoceros laevis subsp. *carolinianus* (Linnaeus) Schuster;G5
Aspiromitus adscendens (Lehmannn & Lindenberg) R.M. Schuster(1);G3?
Aspiromitus punctatus (Linnaeus) Schljakov(1);G2G3

NOTOTHYLADACEAE

**Notothylas breutelii* (Gottsche) Gottsche;G4G5

BRYOPHYTA

AMBLYSTEGIACEAE

Amblystegium serpens (Hedwig) Schimper in Bruch, Schimper & Guembel;G5
Anacamptodon splachnoides (Fröelich ex Bridel) Bridel;G3G5
Campyliadelphus chrysophyllus (Bridel) Kanda;G5
Hygroamblystegium varium (Hedwig) Monkmeyer;GNR
Leptodictyum riparium (Hedwig) Warnstorf;G5

ANOMODONTACEAE

Anomodon attenuatus (Hedwig) Huebener;G5
Anomodon minor (Hedwig) Lindberg;G5

BARTRAMIACEAE

Philonotis longiseta (Michaux) E. Britton;G3G4

BRACHYTHECIACEAE

Brachythecium acuminatum (Hedwig) Austin[2][3];G5
Bryoandersonia illecebra (Hedwig) Robinson;G5
Clasmatodon parvulus (Hampe) Sullivant in A. Gray;G5
Oxyrrhynchium hians (Hedwig) Loeske;G5
Rhynchostegium serrulatum (Hedwig) A. Jaeger;G5

BRUCHIACEAE
Bruchia brevifolia Sullivant;G3G4
Bruchia drummondii Hampe ex E. Britton;G4
Trematodon longicollis Michaux;G5

BRYACEAE
Gemmabryum radiculosum (Bridel) J.R. Spence & H.P. Ramsay;G3G5
Ptychostomum pseudotriquetrum (Hedwig) J.R. Spence & H.P. Ramsay ex D.T. Holyoak and N. Pedersen;G5

CALYMPERACEAE
Syrrhopodon parasiticus (Bridel) Bescherelle;G5
Syrrhopodon texanus Sullivant;G5

CLIMACIACEAE
Climacium americanum Bridel;G5

CRYPHAEACEAE
Cryphaea glomerata Schimper ex Sullivant in A. Gray;G5

DICRANACEAE
Dicranella heteromalla (Hedwig) Schimper[2];G5?
Dicranella varia (Hedwig) Schimper[2];G5
Dicranum condensatum Hedwig[2];G5

DITRICHACEAE
Ceratodon purpureus (Hedwig) Bridel[2];G5
Ditrichum pallidum (Hedwig) Hampe;G5

ENTODONTACEAE
Entodon macropodus (Hedwig) Muller Halle;G5
Entodon seductrix (Hedwig) Muller Halle;G5

EPHEMERACEAE
Ephemerum spinulosum Bruch & Schimper;G4G5
**Micromitrium tenerum* (Bruch & Schimper) Crosby;G4G5

FABRONIACEAE
Fabronia ciliaris (Bridel) Bridel;G5

FISSIDENTACEAE
Fissidens adianthoides Hedwig;G5

Fissidens bryoides Hedwig;G5
Fissidens bushii (Cardot & Thériot) Cardot & Thériot;G5
Fissidens dubius P. Beauvois;G5
Fissidens elegans Bridel;G5
Fissidens fontanus (Bachelot de la Pylaie) Steudel;G5
Fissidens polypodioides Hedwig;G4G5
Fissidens subbasilaris Hedwig;G4G5
Fissidens taxifolius Hedwig;G5

FONTINALACEAE
Fontinalis novae-angliae Sullivant;G5
Fontinalis sullivantii Lindberg;G3G5

FUNARIACEAE
Funaria americana Lindberg(2);G3?
Funaria flavicans Michaux;G5
Funaria hygrometrica Hedwig;G5
Funaria serrata Bridel;G4
Physcomitrium immersum Sullivant;G4
Physcomitrium pyriforme (Hedwig) Hampe;G5

HYPNACEAE
Ctenidium molluscum (Hedwig) Mitten;G5
Homomallium adnatum (Hedwig) Brotherus in H.G.A. Engler and K. Prantl;G3G5
Hypnum lindbergii Mitten;G5
Isopterygium tenerum (Swartz) Mitten;G5
Platygyrium repens (Bridel) Schimper in Bruch and Schimper(2)(3);G5
Taxiphyllum taxirameum (Mitten) M. Fleischer;(SHST);G4G5

LEPTODONTACEAE
Forsstroemia trichomitria (Hedwig) Lindberg;G5

LESKEACEAE
Haplocladium microphyllum (Hedwig) Brotherus in H.G.A. Engler and K. Prantl;G5
Leskea australis Sharp;G4
Leskea gracilescens Hedwig;G5
Leskea obscura Hedwig;G5
Leskea polycarpa Hedwig;G4G5

LEUCOBRYACEAE
Leucobryum albidum (P. Beauvois) Lindberg;G5
Leucobryum glaucum (Hedwig) Ångström;G5

LEUCODONTACEAE
Leucodon julaceus (Hedwig) Sullivant;G5

MNIACEAE
Plagiomnium ciliare (Muller Halle) T. Koponen;G5

Plagiomnium ellipticum (Bridel) T. Koponen;G5
Rhizomnium punctatum (Hedwig) T. Koponen;G5

MYRINIACEAE
Schwetschkeopsis fabronia (Schwägrichen) Brotherus in H.G.A. Engler and K. Prantl;G5

ORTHOTRICHACEAE
Orthotrichum diaphanum Schrader ex Bridel(2);G5
Schlotheimia rugifolia (Hooker) Schwägrichen;G3G5

POLYTRICHACEAE
Atrichum angustatum (Bridel) Bruch & Schimper;G5
Pogonatum brachyphyllum (Michaux) P. Beauvois;G5
Pogonatum pensilvanicum (Hedwig) P. Beauvois;G5
Polytrichum commune Hedwig;G5

POTTIACEAE
Barbula indica (Hooker) Sprengel var. indica;G5?
Syntrichia fragilis (Taylor) Ochyra(2);G5
Syntrichia laevipila Bridel;G3G4
Tortella humilis (Hedwig) Jennings;G5
Weissia controversa Hedwig;G5
Weissia ludoviciana (Sullivant) W. D. Reese & B. A. E. Lemmon;G3G4

PTYCHOMITRIACEAE
Ptychomitrium drummondii (Wilson) Sullivant;G5

SEMATOPHYLLACEAE
Brotherella recurvans (Michaux) M. Fleisher(3);G5
Sematophyllum adnatum (Michaux) E. Britton;G5

SPHAGNACEAE
Sphagnum affine Renauld & Cardot;G5
Sphagnum henryense Warnstorf;G4?
Sphagnum lescurii Sullivant;G5
Sphagnum macrophyllum Bernhardi ex Bridel;G3G5
Sphagnum molle Sullivant;G4
Sphagnum palustre Linnaeus;G5
Sphagnum perichaetiale Hampe;G5

THELIACEAE
Thelia hirtella (Hedwig) Sullivant in A. Gray;G5
Thelia lescurii Sullivant in A. Gray;G5

THUIDACEAE
Cyrto-hypnum minutulum (Hedwig) W.R. Buck & H.A. Crum;G5
Thuidium alleniorum Austin;G3G5

Thuidium delicatulum (Hedwig) Schimper in Bruch, Schimper & Guembel;G5

MARCHANTIOPHYTA

ADELANTHACEAE

Odontoschisma denudatum (Nees) Dumortier[(1)];G5
Odontoschisma prostratum (Swartz) Trevisan;G4G5

ANEURACEAE

Aneura pinguis (Linnaeus) Dumortier;G5
**Riccardia* cf. *jugata* R.M. Schuster;G2
Riccardia latifrons (Lindberg) Lindberg[(1)];G4G5
**Riccardia multifida* (Linnaeus) A. Gray ssp. *synoica* R.M. Schuster;G5

AYTONIACEAE

Asterella tenella (Linnaeus) P. Beauvois[(2)];G5
Reboulia hemisphaerica (Linnaeus) Raddi;G5

CALYPOGEIACEAE

Calypogeia fissa (Linnaeus) Raddi;G5
Calypogeia sullivantii Austin;G4

CEPHALOZIACEAE

Cephalozia catenulata (Hübener) Lindberg;G5
Cephalozia connivens (Dickson) Lindberg;G5
Cephalozia lunulifolia (Dumortier) Dumortier;G5

CEPHALOZIELLACEAE

Cephaloziella hyalina Douin;G4
Cylindrocolea obliqua (Douin) R.M. Schuster;G1Q
Cylindrocolea rhizantha (Montagne) R.M. Schuster[(1)];G3?

FOSSOMBRONIACEAE

Fossombronia brasiliensis Stephani;G5
Petalophyllum ralfsii (Wilson) Nees & Gottsche ex Lehmannn[(2)];G3G5

GEOCALYCACEAE

Lophocolea heterophylla (Schrader) Dumortier;G5

JUBULACEAE

Frullania brittoniae Evans[(1)(2)];G4
Frullania eboracensis Gottsche;G5
Frullania ericoides (Nees) Nees;G3G5
Frullania inflata Gottsche;G5
Frullania kunzei (Lehmann & Lindenberg) Lehmann & Lindenberg;G4
Frullania obcordata (Lehmann & Lindenberg) Lehmann & Lindenberg;G4G5

JUNGERMANNIACEAE

**Jamesoniella autumnalis* (DeCandolle) Stephani;G5
Solenostoma gracillimum (Smith) Schuster[1];G5
Solenostoma hyalinum (Lyell in Hooker) Mitten[1];G5

LEJEUNEACEAE

Ceratolejeunea laetefusca (Austin) R.M. Schuster;G4
Cheilolejeunea rigidula (Montagne) R.M. Schuster;G5
Cololejeunea biddlecomiae (Austin) Evans[1];G5
Cololejeunea cardiocarpa (Montagne) R.M. Schuster;G4G5
**Cololejeunea contractiloba* Evans;G3G4
Cololejeunea minutissima (Smith) Schiffner;G5
Cololejeunea setiloba Evans;G2?
Lejeunea cladogyna Evans;G3?
Lejeunea flava (Swartz) Nees;G5
Lejeunea laetivirens Nees et Montagne;G5
**Lejeunea ulicina* (Taylor) Gottsche;G5
Leucolejeunea clypeata (Schweinitz) Evans;G4
Leucolejeunea conchifolia (Evans) Evans;G4
Leucolejeunea unciloba (Lindenberg) Evans;G4G5
Leucolejeunea xanthocarpa (Lehmann & Lindenberg) Evans[2];G5
Rectolejeunea maxonii Evans;G4

LEPIDOZIACEAE

Microlepidozia sylvatica (Evans) Jörgensen;G5
Telaranea nematodes (Gottsche ex Austin) Howe;G5

MARCHANTIACEAE

**Dumortiera hirsuta* (Swartz) Nees s.l.;G5

METZGERIACEAE

Metzgeria furcata (Linnaeus) Dumortier;G5
Metzgeria uncigera Evans[1];G3

PALLAVICINIACEAE

Pallavicinia lyellii (Hooker) Carruthers;G5

PLAGIOCHILACEAE

Plagiochila dubia Lindenberg et Gottsche[1];G4G5
Plagiochila ludoviciana Sullivant;G5
Plagiochila miradorensis Gottsche;G4

PORELLACEAE

Porella pinnata Linnaeus;G5
Porella platyphylla (Linnaeus) Pfeiffer;G5

RADULACEAE

Radula australis Austin;G3G4
Radula obconica Sullivant;G5

RICCIACEAE
Riccia curtisii (Austin) James[(1)];G5
Riccia fluitans Linnaeus[(2)];G5
Riccia huebeneriana subsp. *sullivantii* (Austin) R.M. Schuster;G4Q
Riccia membranacea Gottsche et Lindenberg;G3G5
Riccia sorocarpa Bischoff;G5
Riccia stenophylla Spruce;G3G5
Ricciocarpos natans (Linnaeus) Corda;G5

SCAPANIACEAE
Scapania nemorosa (Linnaeus) Dumortier;G5
Scapania nemorosa fo. *whitehouseae* R.M. Schuster;GNR

SPHAEROCARPACEAE
Sphaerocarpos texanus Austin;G5

Rare and Endangered Species

To assess the flora for rare and endangered bryophytes, a search of the NatureServe website (NatureServe 2015) was completed. NatureServe Conservation Status Rankings are based on a scale of one to five, with one being critically imperiled and five being demonstrably secure. The rankings G1, G2, and G3 are considered "at risk" species and are assigned the following definitions by NatureServe:

- G1 (Critically Imperiled): At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
- G2 (Imperiled): At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.
- G3 (Vulnerable): At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.

NatureServe also utilizes a "range rank" for some species to demonstrate the degree of uncertainty in the status of a species. In Table 5, 17 of the 26 species listed (65%) have a range rank which includes a G3, G4, or G5 ranking. In addition, all of the species in Table 5 have "incomplete distribution data" noted in their NatureServe profile, which likely impacts the ability to effectively assign a rank, or range rank. In Poole, et al. (2007) and Poole, et al. (2010) only one bryophyte, a moss, is listed as rare in Texas; *Donrichardsia macroneuron* (Grout) H.A. Crum & L.E. Anderson. However the worldwide distribution of this moss is limited to a single occurrence in Kimble County, Texas. Therefore, based on the uncertainty due to range ranks and incomplete distribution data, it is premature to suggest that any of the bryophytes in the BITH are truly endangered or threatened.

Table 5: Species including a G3 or lower NatureServe Conservation Status Ranking.

Taxon	Conservation Status Ranking				
	G1Q	G2/G2?	G2G3	G3/G3?	G3G4/G5
Anacamptodon splachnoides					x
Aspiromitus adscendens				x	
Aspiromitus punctatus			x		
Bruchia brevifolia					x
Cololejeunea contractiloba					x
Cololejeunea setiloba		x			
Cylindrocolea obliqua	x				
Cylindrocolea rhizantha				x	
Fontinalis sullivantii					x
Frullania ericoides					x
Funaria americana				x	
Gemmabryum radiculosum					x
Homomallium adnatum					x
Lejeunea cladogyna				x	
Metzgeria uncigera				x	
Petalophyllum ralfsii					x
Philonotis longiseta					x
Radula australis					x
Riccardia cf. *jugata*		x			
Riccia membranacea					x
Riccia stenophylla					x
Schlotheimia rugifolia					x
Sphagnum macrophyllum					x
Syntrichia laevipila					x
Thuidium alleniorum					x
Weissia ludoviciana					x

Tentative State Records

Eight new state records are tentatively reported from this inventory, one hornwort, one moss, and six liverworts. Several of these identifications will need further verification and distribution research, before being published as new state records.

ANTHOCEROTOPHYTA

Notothylas breutelii **-** The collection was made along Menard Creek, near the Birdwatcher's Trail, on sandy soil. The only previous records for the United States were from Audubon Park in New Orleans, Louisiana, and from greenhouses at Southeast Louisiana State University in Lafayette. The species is also known from Puerto Rico, the Virgin Islands, Mexico, and the Phillipines (Schuster 1992a).

BRYOPHYTA

Micromitrium tenerum was collected in the Menard Creek Unit at the Brid Watcher's Trail from a sandy soil. Bryan (2007) lists a distribution in North America in the eastern United States from Florida north to Quebec and west to Iowa, Indiana, Tennessee, to include Mississippi and Louisiana.

MARCHANTIOPHYTA

Cololejeunea contractiloba was collected from the base of a *Nyssa* sp. in the Turkey Creek Unit along the Kirby Nature Trail. Schuster (1980) lists a distribution on the outer coastal plain from Florida west to Mississippi, and possibly Louisiana (Briel 1970).

Dumortiera hirsuta s.l. - This specimen was collected in the upper part of the Canyonlands Unit from a soil substrate along a perennial to somewhat intermittent spring-fed stream. Schuster (1992) list two subspecies (subsp. *hirsuta* and subsp. *nepalensis*) although neither is reported from Texas. Subspecies *nepalensis* has a largely Applachian escarpment distribution in addition to a small population in central Florida and a single location in Louisiana. Subspecies *hirsuta* has a broader distribution in the southeastern United States from Florida north to Pennsylvania, then west to Illinois, Kentucky, Missouri, and Oklahoma. This distribution includes Arkansas and Louisiana.

Jamesoniella autumnalis was collected in the upper part of the Canyonlands Unit from a soil substrate. Schuster (1969) does not list the species for Texas. This species has a distribution that is eastern North American from Newfounland to Florida and west to Ohio, Indiana, Michigan, Minnesota, Wisconsin, Missouri, and Mississippi. The species is not reported from any state adjacent to Texas.

Lejeunea ulicina was collected as an epiphyte from the trunk of a *Magnolia grandiflora* Linnaeus in the Jack Gore Baygall Unit off of Timber Slough Road. Schuster (1980) lists two subspecies in North America (subsp. *ulcinia* and subsp. *bullata*) although neither is reported from Texas. The distribution for subsp. *bullata* is along the coastal plain from Florida north to Virginia and west to Mississippi and Louisiana. Subspecies *ulcina* is found in eastern North America from Nova Scotia south to northern South Carolina, Georgia, and Alabama.

Riccardia cf. ***jugata*** was collected from a tree trunk in the Jack Gore Baygall Unit in a depressional wetland off of Timber Slough Road. Schuster (1992) lists the species from Georgia and the Carolinas. If verified, this collection would represent a fairly disjunct distribution. The identification of this species (Kruse 1605, 1611) has been tentatively verified by Paul G. Davison (UNAF).

Riccardia multifida ssp. ***synoica*** was collected from a decaying stump in the Jack Gore Baygall Unit in a depressional wetland off of Timber Slough Road. The North American distribution of this species is largely in the southeastern coastal plain from North Carolina to Florida and then west to Mississippi (Schuster 1992). The identification of the four vouchers (Kruse 1669, 1670, 1671, 1672) has been verified by Paul G. Davison (UNAF).

Unit Inventory Status

The often stated goal of an inventory is to document the presence of every species from a specific group, in a given area. Clearly "every species" is a moving target, not to mention an exceedingly difficult goal to achieve, or confidently know if the goal has been achieved. Differences in the numbers of species in each unit are assumed to be a combination of one or more factors to include: physical access, diversity of habitats (vegetation type) within a given unit, microhabitat and substrate availability, collecting time and effort spent within each unit. The species from the checklist and their occurrence within each unit is in Appendix B.

Beaumont - 54
Beech Creek - 55
Big Sandy Creek - 73
Big Sandy Creek Corridor - 0
Canyonlands - 79
Hickory Creek Savannah - 33
Lance Rosier - 79
Little Pine Island Bayou Corridor - 34
Loblolly - 33
Lower Neches River Corridor - 20
Menard Creek Corridor - 77
Neches Bottom and Jack Gore Baygall - 64
Turkey Creek - 86
Upper Neches River Corridor - 7
Village Creek Corridor - 27

CHAPTER IV

KEYS TO THE IDENTIFICATION OF BRYOPHYTES AND SPECIES DESCRIPTIONS

Accurate identification of bryophytes is often a rather tedious task which requires the use of a compound microscope to observe micromorphology and a useable set of identification aids. At present, there is no single key for the identification of these plant groups in Texas. Briel (1970), Flora of North America Editorial Committee (1993+), Grout (1928-1936), Reese (1984), and Schuster (1966, 1969, 1974, 1980, 1992, 1992a) are each applicable in terms of geographic coverage; however, all of these sources include a varying number of species which do not, and many likely will not, occur in the region. The keys that follow will aid in the accurate identification of bryophytes of the BITH, and are a useful (although not comprehensive) resource not only for the BITH, but also for the broader region of east Texas.

The keys to groups, genera, and species are artificial, and do not represent or infer phylogenetic relationships among any of the taxa described. Parts of the following keys may be modified or adapted from one of the following works: Briel 1970, Crum and Anderson 1981, Flora of North America Editorial Committee (1993+), Hicks 1992, and Schuster 1966, 1969, 1974, 1980, 1992, 1992a. Although the keys are applicable to taxa outside the BITH, they are based on the genera and species collected in the course of this inventory and may not be workable for taxa encountered in the broader region. Species descriptions are ordered alphabetically by family, then genus and specific epithet within each group. When more than one species occurs in a genus, a key to the individual species follows the initial genus citation. The page location for each species description is included in Appendix D.

In addition to a description of the relevant morphological features, the following information is provided for each species. **Etymology** for genera and specific epithets is included with the genus citation and species descriptions. In most cases the meanings of the root word(s) were determined and include the stated or implied logic for the application of the name. However, in some cases the meaning and application of the terms was not found, or was not clear, in these instances the etymology was not included. Where available, etymology was taken from the following sources (Crum & Anderson 1981; Stern 1992; FNA 1993+; Schofield 2002; Lincoln 2008; Meagher 2008, 2011; Latdict 2015). **Synonyms** follow Schuster (1966, 1969, 1974, 1980, 1992, 1992a) for the Marchantiophyta and the Anthocerotophyta, and FNA (1993+) for the Bryophyta. **Common names** were compiled from several sources (Glime 1989, 1991, 1992, 1992a, 1993, 1993a, 1994, 1994a; Li & Glime 1989; Glime & Iwatsuki 1990; Glime & Zhang 1990; Wisconsin Bryophytes 2002; Atherton, et al. 2010; McKnight, et al. 2013) and follow any synonyms and are indicated by ALL CAPITAL letters. In a few cases common names were created by the author where the application of the name seemed intuitive (e.g. Breutel's Notothylas for *Notothylas breutelii* (Gottsche) Gottsche, and prostrate flapwort for *Odontoschisma prostratum* (Swartz) Trevisan). **Species descriptions** were compiled and adapted from several sources (Schuster 1966, 1969, 1974, 1980, 1992, 1992a; Briel 1970; Hicks 1992) for the Anthocerotophyta and Marchantiophyta, and (Crum & Anderson 1981; Reese 1984; Buck 1988; FNA 1993+; Gradstein, et al. 2001; Allen 2005, 2014; Anderson, et al. 2009) for the Bryophyta. **Substrate(s)** listed in the descriptions are from data obtained in the current inventory. In the event no substrate was indicated in the specimen data, substrate types were taken from Crum and Anderson (1981) or Schuster (1966, 1969, 1974, 1980, 1992, 1992a).

BITH Distribution: The following acronyms indicate individual units of the BITH where a species has a documented voucher or literature reference. Although not included in the original list of inventoried units, additional specimens are cited from the corridor units when a voucher was located in the herbarium search or through field collections.

Beaumont - BEAU
Beech Creek - BECR
Big Sandy Creek - BSCR
Canyonlands - CANY
Hickory Creek Savannah - HCRS
Lance Rosier - LARO
Little Pine Island Bayou Corridor - LPIB
Loblolly - LOBL
Lower Neches River Corridor - LNRC
Menard Creek - MECR
Neches Bottom - Jack Gore Baygall - NBJG
Turkey Creek - TKCR
Upper Neches River Corridor - UNRC
Village Creek Corridor - VCRC

Representative Specimens: Although multiple specimens of any given species were frequently collected, only one voucher is listed for each BITH unit surveyed. Collector names are abbreviated using the acronyms in the following list. Each collector is followed by a collection number(s) representing the voucher(s) for the species within the BITH. Unless otherwise noted, all vouchers are deposited at TAES/TAMU (in 2011 TAMU was incorporated into TAES). In the event a cited voucher was located at a different institution, collector number(s) are followed by the herbarium in parenthesis, where the voucher is currently housed.

Evangelina Bazan - EB
Lee Buderus - LB
Donna Dean - DD
B. J. Ertter - BJE
Charles Gardner - CG
Dale A. Kruse - DAK
David M. Lane - DML
Dale M. J. Mueller - DM
Alan J. Neumann - AJN
Paul V. Roling - PVR
Ronald A. Pursell - RP
William D. Reese - WDR
Ann F. Rogers - AFR
Gary C. Sartor - GCS
Ann Stoneburner - AS
Fred Wolf - FW
Robert Wyatt - RW

Keys to Groups, Genera, Species, and Species Descriptions

Key to Groups of Bryophytes

1.	Plants thalloid ………………………………………………................	2
1.	Plants leafy …………………………………………………............	3
2(1).	Thallus with a single, large chloroplast occupying the majority of the lumen in each cell ………………………..................................	Anthocerotophyta
2.	Thallus with multiple chloroplasts; or if with a single chloroplast, then individual chloroplasts small and not occupying the majority of the lumen in each cell …………..	Marchantiophyta
3 (1).	Leaves with one or more oil bodies present in most cells …............	Marchantiophyta
3.	Leaves without oil bodies ……………………….……………...........	4
4(3).	Leaves costate ………………………………………………...........	Bryophyta
4.	Leaves ecostate ………………………………………….................	5
5(4).	Leaves spirally arranged on stem …………………………..............	Bryophyta
5.	Leaves distichously arranged on stem …………………...................	Marchantiophyta

1.	Sporophytes horizontal, very shortly emerging from the enclosing basal sheath	*Notothylas*
1.	Sporophytes erect, long emergent beyond the enclosing basal sheath	2
2(1).	Thallus margins not divided, prostrate; spores yellow, small (38-50 µm)	*Anthoceros*
2.	Thallus margins divided, ascending; spores brown to black, large (75-95 µm)	*Aspiromitus*

ANTHOCEROTACEAE

Anthoceros R.M. Schuster, Sp. Pl. 1139. 1753. **Etymology**: *anthos* (flower) and *keras* (horn), in reference to the hornlike sporophyte.

Anthoceros laevis subsp. ***carolinianus*** (Linnaeus) Rappi, Comm., VIII Congr. Int. Bot. 14/16: 69. 1954.

Etymology: *laevis* (smooth) and *carolinianus* presumably for North (or South) Carolina where the type collection was made. **Synonym(s):** *Anthoceros bilobata* Turpin, *Anthoceros carolinianus* Michaux, *Anthoceros carolinianus* var. *occidentalis* Howe, *Anthoceros communis* Stephani, *Anthoceros incrassatus* Schiffn., *Anthoceros japonicas* Stephani, *Anthoceros koreanus* Stephani, *Anthoceros laciniatus* Schweinitz, *Anthoceros laevis* forma *tenuis* Nees, *Anthoceros laevis* var. *carolinianus* (Michaux) Lindberg, *Anthoceros laevis* var. *major* Austin, *Anthoceros* *laevis* var. *tenuis* Gottsche, Lindenberg, & Nees, *Anthoceros miyoshianus* Stephani, *Anthoceros moldavicus* Tarnavschi, *Anthoceros nordenskjöldii* Stephani, *Anthoceros reticulatus* Stephani, *Anthoceros subcostatus* Stephani, *Carpoceros carolinianus* Dumortier, *Phaeoceros carolinianus* (Michaux) Proskaur, *Phaeoceros laevis* fo. *carolinianu*s R.M. Schuster, *Phaeoceros laevis* subsp. *carolinianu*s Proskaur. CAROLINA HORNWORT.

Plants: thalloid, dark green mats or rosettes; the upper surface is smooth with deeply lobed, somewhat reflexed margins, the lower surface with rhizoids; antheridia in groups of 2-4 in cavities on upper surface; sporophytes tubular, somewhat flaring at base, 1.5-5.0 cm. long; spores yellow, 35-45 µm, densely pluripapillose. **Substrate:** mineral soil, decayed logs. **BITH Distribution:** CANY, MECR. **Representative Specimen(s):** PVR 381, 567.

Aspiromitus Stephani, Sp. Hepat. 5: 957. 1916. **Etymology**: *ad* and *spiro* (breathe) "gentle breath" in reference to spore dispersal.

Key to the Species of *Aspiromitus*

1. Spores large (55-100µm), surfaces neither alveolate or areolate, faces covered with low mammillate tubercles .... *A. adscendens*
1. Spores smaller (45-50µm), surfaces tetrahedral, outer faces echinate, inner surfaces differentiated from outer .... *A. punctatus*

Aspiromitus adscendens (Lehmann & Lindenberg) R.M. Schuster, Phytologia 63: 199. 1987.

Synonym(s): *Anthoceros adscendens* Lehmann & Lindenberg, *Anthoceros joorii* Austin, *Anthoceros lescurii* Austin, *Anthoceros megalosporus* Gottsche, *Anthoceros olneyi* Austin, *Anthoceros ravenelii* Austin, *Sphaerosporoceros adscendens* (Lehmann & Lindenberg) Hässel.

Plants: thalloid, in 3-8 mm green to dark green rosettes, dichotomously branched or lobed, dorsal surface with low ridges or lamellae; large internal cells forming cavities; cells with 1-2 large chloroplasts; short rhizoids on ventral surface; monoecious, spores 55-100 µm, external faces with low, blunt papillae, locally united into irregular ridges. **Substrate:** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 1093. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, as *Anthoceros adscendens* Lehmann & Lindenberg, however a voucher was not located.

Aspiromitus punctatus (Linnaeus) Schljakov, Novosti Sist. Nizsh. Rast. 13: 225. 1976.

Synonym(s): *Anthoceros agrestis* Paton, *Anthoceros caespiticius* De Notaris, *Anthoceros crispulus* Douin, *Anthoceros curnowii* Stephani, *Anthoceros fissa* Stephani, *Anthoceros husnotii* Stephani, *Anthoceros longicapsulus* Stephani, *Anthoceros moldavicus* Tarnavschi, *Anthoceros nagasakiensis* Stephani, *Anthoceros polymorphus* Raddi, *Anthoceros punctatus* fo. *stableri* Macvicar, *Anthoceros punctatus* Linnaeus, *Anthoceros punctatus* var. *crispulus* Montagne, *Anthoceros stableri* Stephani, *Aspiromitus husnotii* Stephani.

Plants: thalloid, dark green, rosettes 0.5-1.0 mm in diameter, in subradiately dissected oblong lobes, margins laciniate, dorsal surface smooth, to weakly lamellate; thalli lobes 8-30 cells high; gemmae absent; monoecious, spores fuscous, 45-50 µm in diameter, the outer surface with numerous sharp or bifid spines arising from anastomosing ridges forming a reticulate pattern. **Substrate:** mineral soil. **BITH Distribution:** TKCR. **Representative Specimens:** Bazan 1092. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, as *Anthoceros punctatus* Linnaeus, however a voucher was not located.

NOTOTHYLADACEAE

Notothylas Sullivant ex A. Gray**,** Amer. J. Sci. Arts 51: 74. 1846.

Notothylas breutelii (Gottsche) Gottsche, Bot. Zeitung (Berlin) 16(15): 21. 1858.

Etymology: Johann Christian Breutel (1788-1875) a German bishop and botanist at Herrnhut who collected from 1814 until 1875. His specimens were issued as the cryptogamic series of *Flora Germanica* exsiccata. **Synonym(s):** *Anthoceros breutelii* Gottsche, *Notothylas amazonica* Spruce, *Notothylas cubana* Stephani. BREUTEL'S NOTOTHYLAS.

Plants: thalloid, in partial or complete rosettes 20-30 mm in diameter, dichotomously branched with divisions rounded to truncate; margins incised or slightly so; involucres mostly submarginal and horizontal, from an obliquely ascending base; capsules with very short seta and a bulbous foot, 1.5-3.2 mm long; spores at maturity fuscous to nearly black, 42-47 mm in diameter, papillate-baculate. **Substrate:** soil on disturbed ground. **BITH Distribution:** MECR. **Representative Specimen(s):** PVR 189.

Keys and Species Descriptions - Bryophyta

1.	Plants very pale green to whitish when dry …………………......	2
1.	Plants in varying shades of green, brown, or yellow (*Leucobryum* is often very pale green) when dry …………......	3
2(1).	Leaves costate, with three or more layers of cells in cross-section; upper and lower layers hyaline; medial layer with green chlorophyllous cells ………………………...................	*Leucobryum*
2.	Leaves ecostate with one layer of cells in cross-section; leaves with two types of cells: large, empty, hyaline cells usually with spiral thickenings, bordered by rows of smaller green chlorophyllous cells ………………………………….............	*Sphagnum*
3(1).	Leaves distinctly distichous and conduplicate below…..............	*Fissidens*
3.	Leaves spirally arranged to somewhat flattened, but not clearly distichous; not conduplicate ...………………………..............	4
4(3).	Leaves with adaxial lamellae ………………………..................	Group A
4.	Leaves without adaxial lamellae ………………………...........	5
5(4).	Leaves with a distinct border of elongated hyaline cells; border present for all or most of the length of the leaf ……......	6
5.	Leaves not bordered with elongate hyaline cells ….……….…...	9
6(5).	Leaf cells linear to oblong but not isodiametric …………….....	7
6.	Leaf cells isodiametric ……………………………..................	8

7(6).	Rhizoidal tubers present	*Gemmabryum*
7.	Rhizoidal tubers absent	*Ptychostomum*
8(6).	Leaf margins entire ……………………………......................	*Rhizomnium*
8.	Leaf margins toothed ……………………………...................	*Plagiomnium*
9(5).	Plants pleurocarpous	10
9.	Plants acrocarpous	Group B
10(9).	Leaf cells papillose	Group C
10.	Leaf cells epapillose	11
11(10).	Leaves ecostate (*taxa variable in this character are keyed here and below*)	Group D
11.	Leaves costate	12
12(11).	Costa single and extending beyond mid-leaf	Group E
12.	Costa ending at or below mid-leaf, or costa short and double	Group F

Group A

1.	Protonema persistent; leaves few; individual plants very short and scattered	*Pogonatum*
1.	Protonema ephemeral; leaves several to many; plants larger and gregarious	2
2(1).	Costa narrow, < ¼ of leaf width; lamellae few (<10) often lax and wavy	*Atrichum*
2.	Costa broad, > ½ leaf width; lamellae numerous (>20) shorter and generally erect and closely compacted	*Polytrichum*

Group B

1	Plants pale green to whitish; lamina of leaves several layers thick in cross-section, with upper and lower layers hyaline and middle layer chlorophyllous	*Leucobryum*
1	Plants various shades of yellow, green, or brown; lamina of leaves, if more than one layer thick in cross-section, without upper and lower layers of hyaline cells	2
2(1).	Leaves bordered with one to several rows of hyaline cells extending from base to apex, or nearly so	*Syrrhopodon*
2	Leaves without a border of hyaline cells	3
3(2).	Leaves papillose (*taxa variable in this character are keyed here and below*)	4
3	Leaves epapillose	12
4(3).	Leaves strongly involute when wet	*Weissia*
4	Leaves weakly involute, plane, or revolute when wet	5
5(4).	Leaf apices broadly acute to rounded	6
5	Leaf apices narrowly acute to acuminate	8
6(5).	Leaf apices ending in a short to long excurrent awn	*Syntrichia* (in part)
6	Leaf apices ending in a short apiculus	7
7(6).	Costa with 2 stereid bands; plants dark green to blackish green	*Barbula*
7	Costa with 1 stereid band; plants yellow green to medium green	*Syntrichia* (in part)
8(5).	Leaf margins revolute	*Orthotrichum* (in part)

8	Leaf margins plane or somewhat involute	9
9(8).	Cells densely pluripapillose	*Tortella*
9	Cells unipapillose, or weakly to moderately pluripapilose	10
10(9).	Leaves generally > 3.0 mm long and strongly keeled	*Dicranum*
10	Leaves generally < 3.0 mm long and not keeled	11
11(10).	Costa weak especially near the base; leaves strongly toothed on margins, especially in the upper ½	*Ephemerum*
11	Costa strong throughout the leaf; margins entire to weakly toothed	*Ptychomitrium*
12(3).	Leaves with a broadly ovate base narrowing to a long subulate tip	13
12	Leaves lanceolate to narrowly ovate lanceolate	16
13(12).	Sporophytes immersed to emergent; capsule shortly ovate to obovate; calyptra mitrate	*Bruchia*
13	Sporophytes well-exserted; capsule ovate to narrowly obovate; calyptra cucullate	14
14(13).	Capsules with a slender neck, the neck longer than the urn	*Trematodon*
14	Capsules without a long slender neck, or with a neck much shorter than the urn	15
15(14).	Capsules erect to slightly inclined; seta 12-40 mm long	*Ditrichum*
15	Capsules inclined to distinctly curved; seta 5-14 mm long	*Dicranella*
16(12).	Costa absent, or costa weak especially in the lower portions of the leaf	17
16	Costa evident for all or most of the length of the leaf	18

17(16).	Leaves costate or with the costa present only in the upper portions of the leaf	*Ephemerum*
17	Leaves ecostate	*Micromitrium*
18(16).	Capsules inoperculate	*Physcomitrium*
18	Capsules operculate	19
19(18).	Leaf apices somewhat broadly acute to rounded	*Orthotrichum* (in part)
19	Leaf apices acute to acuminate	20
20(19).	Leaves keeled; strongly reflexed or revolute; margins irregularly notched to coarsely serrulate near the apex	*Ceratodon*
20	Leaves not keeled, or if somewhat keeled, then not strongly reflexed and coarsely notched near the apex	21
21(20).	Leaves oblong-ovate to obovate; capsules inclined to strongly inclined	*Funaria*
21	Leaves narrowly lanceolate to narrowly lanceolate; capsules erect to slightly inclined	22
22(21).	Alar cells differentiated; leaves 3-6 mm long; seta well exserted (13-22 mm long)	*Dicranum*
22	Alar cells not differentiated; leaves 1.5-2.2 mm long; seta shortly exserted (2-2.5 mm) long	*Ptychomitrium*

Group C

1.	Papilla projecting from upper cell ends	2
1.	Papilla over lumen of cells	3
2(1).	Costa percurrent to excurrent	*Philonotis*
2.	Costa short and double, or costa absent	*Schwetschkeopsis*

3(1).	Papilla only in the upper part of the leaves	*Ctenidium*
3.	Papilla throughout most of the leaves	4
4(3).	Cells pluripapillose	5
4.	Cells unipapillose	7
5(4).	Leaf apices rounded to ligulate; paraphyllia absent..................	*Anomodon*
5.	Leaf apices acute to acuminate; paraphyllia abundant	6
6(5).	Plants small, stem leaves less than 0.6 mm long; papilla minute, papilla on both leaf surfaces...	*Cyrto-hypnum*
6.	Plants larger, stem leaves 1.0-1.5 mm long; cells mostly unipapillose, papilla on abaxial leaf surface only......................	*Thuidium*
7(4).	Papilla prominent, long and straight, curved, or with apical branching; leaves with coarse ciliate margins	*Thelia*
7.	Papilla bulging to obscure; leaf margins entire to somewhat toothed but not long ciliate	8
8(6).	Paraphyllia few, linear to lanceolate	9
8.	Paraphyllia abundant, multiform, usually strongly papillose	*Thuidium*
9(8).	Stem and branch leaves similar; paraphyllia epapillose or prorulose	*Leskea*
9.	Stem and branch leaves differentiated (stem leaves larger than branch leaves); paraphyllia cell papillose	*Haplocladium*

Group D

1.	Plants aquatic (may be exposed due to changes in water levels)	*Fontinalis*
1.	Plants terrestrial, or in wet areas but not obviously aquatic	2

2(1).	Alar cells well-differentiated	3
2.	Alar cell not well-differentiated or absent	8
3(2).	Alar cells conspicuously inflated	4
3.	Alar cells not conspicuously inflated	5
4(3).	Leaves complanate and falcate secund	*Brotherella*
4.	Leaves plane and not falcate secund	*Sematophyllum*
5(3).	Alar cells numerous in well-differentiated groups extending upward along the leaf margins	6
5.	Alar cells fewer and not extending well up the leaf margins	*Isopterygium*
6(5).	Plants with clusters of leafy brood bodies in upper leaf axils	*Platygyrium*
6.	Plants without leafy brood bodies in leaf axils	7
7(6).	Leaves >1.2 mm long	*Forrstroemia*
7.	Leaves < 1.0 mm long	*Homomallium*
8(2).	Leaves serrulate all around; pseudoparaphyllia present (lanceolate)	*Taxiphyllum*
8.	Leaves entire; pseudoparaphyllia absent	9
9(8).	Stems somewhat flattened to strongly flattened	*Entodon*
9.	Stems julaceous	*Leucodon*

Group E

1	Primary stems rhizome-like with erect secondary stems	2
1.	Primary and secondary stems essentially all alike	3
2(1).	Plants dendroid; secondary stems tall and erect; leaf apices	

	coarsely toothed; plants terrestrial	*Climaceum*
2.	Plants not dendroid; secondary stems short (leaves often spirally twisted around the stem when dry); leaf apices with a stout apiculus; plants corticulous	*Schlotheimia*
3(1).	Leaves closely overlapping to imbricate	4
3.	Leaves distant to loosely overlapping	8
4(3).	Leaves broadly ovate to rounded; deeply concave; apices abruptly narrowed to a short apiculus	*Bryoandersonia*
4.	Leaves narrowly ovate to broadly lanceolate; plane or slightly concave; apices acute	5
5(4).	Leaves short, < 1.0 mm long	*Clasmatodon*
5.	Leaves longer, > 1.0 mm long	6
6(5).	Leaves plicate (especially in the lower ½ - ¾)	*Brachythecium*
6.	Leaves not, or only slightly, plicate	7
7(6).	Secondary stems irregularly and sparingly branched	*Cryphaea*
7.	Secondary stems subpinnately branched; tips often attenuate	*Forsstroemia*
8(3).	Leaves ovate; apices often falcate	*Campyliadelphus*
8.	Leaves lanceolate to broadly lanceolate-ovate; apices plane	9
9(8).	Costa strong; leaves serrate to serrulate, especially in the upper portions	10
9.	Costa weak to moderate; leaves entire to slightly denticulate	11

10(9).	Costa with an abaxial spine at the distal end; leaf apices plane	*Oxyrrhynchium*
10.	Costa not excurrent as an abaxial spine; leaf apices often twisted ¼ turn	*Rhynchostegium*
11(9).	Capsules erect; plants growing in crevices and knotholes well up on tree trunks	*Anacamptodon*
11.	Capsules horizontal to inclined; plants growing on tree bases and decaying logs	12
12(11).	Paraphyllia present; alar cells not or slightly differentiated; costa ending above mid-leaf and often curved above; plants largely aquatic to subaquatic	*Hygroamblystegium*
12.	Paraphyllia absent; alar cells somewhat to well differentiated; costa ending at mid-leaf to 3/4, straight; plants terrestrial	13
13(12).	Leaves short < 1.0 mm long; costa 10-30 µm at base	*Amblytegium*
13.	Leaves longer 2.0-6.0 mm long; costa > 40 µm at base	*Leptodictyum*

Group F

1	Leaf margins entire throughout	2
1.	Leaf margins with at least some serrations present	6
2(1).	Leaves strongly falcate secund	*Hypnum*
2.	Leaves plane, not falcate secund	3
3(2).	Plants with clusters of leafy brood bodies in upper leaf axils	*Platygyrium*
3.	Plants without leafy brood bodies in leaf axils	4
4(3).	Alar cells 4-6 and large and inflated “bubble cells”	*Sematophyllum*

4.	Alar cells numerous and quadrate	5
5(4).	Leaves > 1.2 mm long	*Forsstroemia*
5.	Leaves < 1.0 mm long	*Homomallium*
6(1).	Pseudoparaphyllia present	7
6.	Pseudoparaphyllia absent	9
7(6).	Pseudoparaphyllia filiform; leaf apeices entire to very slightly serrulate	*Isopterigium*
7.	Pseudoparaphyllia broader; leaf apices serrate to coarsely serrate	8
8(7).	Alar cells differentiated, large and inflated, often yellow at insertion	*Brotherella*
8.	Alar cells not differentiated	*Taxiphyllum*
9(6).	Leaf apices acuminate to aristate	*Fabronia*
9.	Leaf apices acute to broadly acute	*Entodon*

Keys to Species and Species Descriptions

AMBLYSTEGIACEAE

Amblystegium Schimper, Bryol. Eur. 6: 45 (fasc. 55–56. Mon. 1.). 1853. **Etymology:** *amblys* (blunt) and *stege* (roof), alluding to the obtuse operculum.

Amblystegium serpens (Hedwig) Schimper in Bruch, Schimper & Guembel. Bryol. Eur. 6: 53. pl. 564 (fasc. 55–56 Monogr. 9. pl. 3) 1853

Etymology: *serpens* (serpent or snake), referring to the creeping habit of the stems. **Synonym(s):** *Amblystegium juratzkanum* Schimper, *Amblystegium serpens* var. *juratzkanum* (Schimper) Rau & Hervey, *Hypnum serpens* Hedwig. CREEPING FEATHER-MOSS.

Plants: pleurocarpous, green to yellow-green; leaves remote to crowded, erect to widespreading (wet and dry), 0.45-0.9 mm long, lanceolate to ovate-lanceolate, acuminate, serrulate all around; costa single, slender, ½-⅔ leaf length; upper cells shortly oblong, lower cells subquadrate to oblong in the basal angles; sporophytes exserted, seta 9-23 mm long, capsules inclined to horizontal, cylindric; autoicous. **Substrate(s):** rock (headstone), tree bases, trunks, and stumps, soil (Crum and Anderson 1981). **BITH Distribution:** LARO, LPIB. **Representative Specimen(s):** DAK 2842; DM s.n.

Anacamptodon Bridel, Muscol. Recent. Suppl. 4: 136, pl. 2, f. 11. 1819. **Etymology:** *ana* (back), *kampos* (bent), and *odon* (tooth), alluding to the reflexed exostome teeth.

Anacamptodon splachnoides (Fröelich ex Bridel) Bridel, Muscol. Recent. Suppl. 4: 136. 1819.

Etymology: probably referring to the reflexed peristome teeth, although “splachnoides” clearly makes reference to a similarity to the genus *Splachnum*, however any such resemblance seems remote (Crum and Anderson 1981). **Synonym(s):** *Anacamptodon splachnoides* var. *americanus* Hampe, *Campylodontium hypnoides* Schwagrichen; *Orthotrichum splachnoides* Fröelich ex Bridel. KNOTHOLE MOSS.

Plants: pleurocarpous, dark green to yellowish; leaves crowded, erect and homomallous when dry, spreading to subsecund when wet, 0.7-1.0 mm long, ovate to oblong-ovate base, gradually acuminate apex, entire; costa single, ½-⅘ leaf length; upper cells oblong-rhombic to shortly oblong-rhomboidal, lower cells bulging; sporophytes exserted, seta 8-12 mm long, capsules erect when moist, recurved when dry, strongly constricted below the neck; autoicous. **Substrate(s):** knotholes and crevices (*Nyssa*) (*Acer*, *Betula*, *Fagus grandifolia*, FNA 2014). **BITH Distribution:** BSCR, LARO. **Representative Specimen(s):** DAK 1851, 3383.

Campyliadelphus (Kindberg) R.S. Chopra, Taxon. Indian Mosses 442. 1975. **Etymology:** *adelphos* (brother), alluding to similarity to *Campylium.*

Campyliadelphus chrysophyllus (Bridel) Kanda, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 15(2): 264. 1975.

Etymology: *chryso* (golden) and *phyll* (leaves), referring to the color of the leaves. **Synonym(s):** *Campylium chrysophyllum* (Bridel) Lange, *Campylium chrysophyllum* var. *brevifolium* (Renauld & Cardot) Grout, *Hypnum chrysophyllum* Bridel, *Hypnum chrysophyllum* var. *brevifolium* Renauld & Cardot. GOLDEN FEATHER MOSS, BRISTLE STAR MOSS.

Plants: pleurocarpous, green to yellow-green to brownish; leaves crowded, erect to spreading, 1.0 mm long, rounded-triangular or ovate to broadly ovate, abruptly narrowed to a channeled acumen, entire above, slightly sinuate or denticulate at base; costa single, ½-⅔ leaf length; upper cells oblong-linear, alar cells numerous quadrate to short oblong; sporophytes exserted, seta 10-27 mm long, capsule horizontal, curved, cylindric to short cylindric; dioicous.

Substrate(s): mineral soil, tree bases (*Magnolia grandiflora*). **BITH Distribution:** BECR, BSCR, CANY, LARO, NBJG. **Representative Specimen(s):** PVR 301, 379, 400, 541, 628. **Comments:**

Hygroamblystegium Loeske, Moosfl. Harz. 298-299. 1903. **Etymology:** *hygros* (wet), and the genus *Amblystegium*; referring to the aquatic to subaquatic nature of the species.

Hygroamblystegium varium (Hedwig) Mönkmeyer, Hedwigia 50(5/6): 275. 1911.

Etymology: *varians* (variable), referring to the high degree of variability in the species. **Synonym(s):** *Amblystegium varium* (Hedwig) Lindberg, *Leskea varia* Hedwig. WILLOW FEATHER-MOSS, TANGLED THREAD MOSS.

Plants: pleurocarpous, yellowish-brown to green; stem and branch leaves somewhat differentiated (stem leaves often longer and broader than branch leaves), adjacent to crowded, branch leaves loosely erect and slightly incurved when dry, spreading to erect-spreading when wet, 0.35-0.7 mm long, lanceolate to ovate-lanceolate, gradually acuminate, entire or slightly serrate; costa single, extending into the acumen; upper cells oblong-rhombic, lower cells oblong-hexagonal with a few in the basal angles subquadrate; sporophytes exserted, seta 12-22 mm long, capsules cylindrical, erect to horizontal; autoicous. **Substrate(s):** mineral soil, tree bases (*Fagus grandifolia, Quercus*), manmade substrates (concrete). **BITH Distribution:** BECR, CANY, MECR, TKCR. **Representative Specimen(s):** PVR 305, 404, 504, 524. **Comments:** This is an extremely variable entity which has been treated in various ways by different authors. Three subspecies, two of which are found in Texas, are currently described: *Hygroamblystegium* *varium* subsp. *varium* (Hedwig) Mönkemeyer and *Hygroamblystegium varium* subsp. *humile* (P. Beauvois) Vanderpoorten & Hedenäs (FNA 2014). The high degree of plasticity in leaf morphology and costa length, preclude the formal recognition of additional morphotypes exhibited by the complex.

Leptodictyum (Schimper) Warnstorf, Krypt.-Fl. Brandenburg, Laubm. 2(5): 867. 1906. **Etymology:** *leptos* (fine) alluding to the fine outline of the laminal cells.

Leptodictyum riparium (Hedwig) Warnstorf, Krypt.-Fl. Brandenburg, Laubm. 2(5): 878, 1906.

Etymology: *riparius* (freqenting banks of streams or rivers) referring to the river and stream valley habitat preference of the species. **Synonym(s):** *Amblystegium brevipes* Cardot & Theriot, *Amblystegium riparium* (Hedwig) Schimper, *Amblystegium riparium* var. *flaccidum* (Lesquereux & James) Renauld & Cardot, *Amblystegium riparium* var. *fluitans* (Lesquereux & James) Renauld & Cardot, *Amblystegium riparium* var. *longifolium* (Schultz) Schimper, *Brachythecium pennellii* E.B. Bartram, *Campylium polygamum* var. *longinerve* (Renauld & Cardot) Grout, *Hypnum riparium* Hedwig, *Leptodictyum brevipes* (Cardot & Theriot) Brotherus, *Leptodictyum laxirete* (Cardot & Theriot) Brotherus, *Leptodictyum riparium* var. *abbreviatum* (Schimper) Grout, *Leptodictyum riparium* var. *brachyphyllum* (Cardot & Theriot) Grout, *Leptodictyum riparium* var. *elongatum* (Schimper) Warnstorf, *Leptodictyum riparium* var. *flaccidum* (Lesquereux & James) Grout, *Leptodictyum sipho* (P. Beauvois) Brotherus, *Leptodictyum vacillans* (Sullivant) Brotherus, *Rhynchostegiella georgiana* Dixon & Grout (Schimper) Warnstorf. KNEIFF'S FEATHER MOSS, STREAMSIDE LEPTODICTYUM MOSS.

Plants: pleurocarpous, light green to yellow-green; leaves erect to wide spreading, often somewhat twisted when dry, 2.5-4.5 mm long, narrowly to broadly oblong-lanceolate, or ovate lanceolate, gradually long acuminate to acute apices, entire; costa single, thin, ½-¾ leaf length; upper leaf cells short rhomboidal to linear rhomboidal, lower cells short to long rectangular; sporophytes exserted, seta 10-30 mm long, capsules inclined to horizontal, cylindric; autoicous. **Substrate(s):** mineral soil, tree bases (*Nyssa*). **BITH Distribution:** BEAU, CANY, HCRS, LARO, NBJG, VCRC. **Representative Specimen(s):** DAK 1612, 2467; PVR 125, 732, 765, 802.

ANOMODONTACEAE

Anomodon Hooker & Taylor, Muscol. Brit. 79-80, pl. 3, 22. 1818. **Etymology:** *anomos* (anomalous, abnormal) and *odon* (tooth), alluding to the reduced peristome.

Key to the Species of *Anomodon*

1. Leaves narrowly ovate to ligulate, apices broadly rounded .... *A. minor*
1. Leaves ovate, with acute or apiculate apices .... *A. attenuatus*

Anomodon attenuatus (Hedwig) Huebener, Muscol. Germ. 562, 1833

Etymology: *attenuatus* (tapering), referring to the drooping, tapered, branches. **Synonym(s):** *Hypnum attenuatum* (Hedwig) Smith, *Leskea attenuata* Hedwig. POODLE MOSS.

Plants: pleurocarpous, dark green to yellowish-brown; leaves adjacent to crowded, loosely erect when dry and erect-spreading and complanate when wet, 1.2-2.0 mm long, broadly oblong-lanceolate from an ovate, broadly decurrent base, apices acute to rounded and ending in an apiculus, margins plane and pappilose-crenulate all around, sparsely serrulate near the apices; costa single, strong, ending a few cells before the apex; leaf cells hexagonal, densely pluripapillose (over lumen of cells), opaque; sporophytes exserted, seta 13-27 mm long, capsule erect, cylindrical; dioicous. **Substrate(s):** mineral soil, tree bases and trunks (*Carpinus caroliniana, Fagus grandifolia, Liquidambar styraciflua, Magnolia grandiflora, Nyssa sylvatica, Quercus phellos, Taxodium distichum*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, LARO, LNRC, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 2201, 3251, 3258, 1630a; PVR 279, 422, 529, 549, 591, 674, 720, 801.

Anomodon minor (Hedwig) Lindberg, Bot. Not. 1865(7): 196, 1865.

Etymology: *minor* (small, inferior, lesser), referring to the smaller size of the plants. **Synonym(s):** *Anomodon platyphyllus* Kindberg, *Neckera minor* (Hedwig) P. Beauvois, *Neckera viticulosa* var. *minor* Hedwig. ROUNDED TONGUE MOSS.

Plants: pleurocarpous, dark to glaucous green or yellowish-brown; leaves adjacent to crowded, erect or imbricate, not or slightly contorted when dry, somewhat spreading when wet, 1.5-2.3 mm long, broadly oblong from an ovate decurrent base, apices rounded or rounded obtuse, margins plane, papillose, crenulate, undulate; costa single, strong, ending below leaf apices; cells hexagonal, densely pluripapillose (over lumen of cells); sporophytes exserted, seta

6-12 mm long, capsules erect, ovoid. **Substrate(s):** tree bases (*Platanus occidentalis*). **BITH Distribution:** MECR. **Representative Specimen(s):** PVR 500.

BARTRAMIACEAE

Philonotis Bridel, Bryol. Univ. 2:15-28, pl. 6, f. 5. 1827. **Etymology:** *philo* (loving) and *notis* (moisture) alluding to the typically moist habitat.

Philonotis longiseta (Michaux) E. Britton, Bryologist 14(3): 44. 1911.

Etymology: *longus* (long) and *seta* (bristle) in reference to a long seta, a character which Crum and Anderson (1981) feel is of no significance. This would seem logical since *P. longiseta* has a seta that is generally in the middle, to lower, range of lengths when compared to the other North American species. **Synonym(s):** *Bartramia longiseta* Michaux.

Plants: pleurocarpous, green to yellow-green; leaves crowded, erect or secund when dry, erect-spreading when moist, 1.0-2.4 mm long, linear-lanceolate and slenderly acuminate, margins narrowly revolute, serrulate nearly all around; costa single, excurrent; leaf cells linear, unipapillose (papilla at upper cell ends); sporophytes exserted, seta 12-35 mm long, capsules suberect to inclined, globose; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, CANY, LARO. **Representative Specimen(s):** DAK 1832, 2830; PVR 783.

BRACHYTHECIACEAE

Brachythecium Schimper in P. Bruch and W.P. Schimper, Bryol. Eur. 6: 5 (fasc. 52-56. Mon. 1.). 1853. **Etymology:** *brachys* (short) and *theke* (case), referring to the capsule.

Brachythecium acuminatum (Hedwig) Austin, Musci Appalach. 310. 1870.

Etymology: *acuminatus* (tapering gradually) presumably in reference to the acuminate leaves. **Synonym(s):** *Brachythecium acuminatum* var. *cyrtophyllum* (Kindberg) Redfearn ex H.A. Crum, *Brachythecium biventrosum* (Muller Halle) A. Jaeger, *Brachythecium cyrtophyllum* Kindberg, *Chamberlainia acuminata* (Hedwig) Grout, *Chamberlainia biventrosa* (Muller Halle) Grout, *Chamberlainia cyrtophylla* (Kindberg) Grout, *Leskea acuminata* Hedwig. ERECT BRACHYTHECIUM

Plants: pleurocarpous, pale green to yellowish to whitish; leaves crowded, erect when dry, erect-spreading to spreading when moist, somewhat plicate, 1-2 mm long, ovate to ovate-lanceolate, gradually or abruptly acuminate, margins reflexed below, serrulate in the upper half; costa single, ⅔-¾ leaf length, often toothed abaxially; upper cells linear-rhomboidal, lower and alar cells subquadrate in several to numerous rows; sporophyte exserted, seta 7-25 mm long, capsules erect, cylindric; dioicous. **Substrate(s):** tree bases, decayed logs (Crum and Anderson 1981). **BITH Distribution:** LOBL. **Representative Specimen(s):** AS 1351.

Bryoandersonia H. Robinson, Bryologist 65(2): 137-139, f. 192-205. 1962. **Etymology:** *bryos* (moss) and Lewis Edward Anderson (1912-2007) American bryologist, who published in 1981 (in collaboration with Howard Crum) *Mosses of Eastern North America*.

Bryoandersonia illecebra (Hedwig) H. Robinson, Bryologist 65(2): 139. 1962.

Etymology: *illecebrosus* (attractive or alluring) presumably in reference to the appearance of the shiny, terete stems. **Synonym(s):** *Cirriphyllum boscii* (Schwagrichen) Grout, *Hypnum illecebrum* Hedwig. WORM MOSS, SPOON MOSS.

Plants: pleurocarpous, green to yellow-green to yellow-brown; leaves closely crowded to imbricate when dry, erect-spreading when wet, deeply concave-culcullate, 1.3-2.8 mm long, broadly ovate to rounded-ovate from a cordate base, apices abruptly narrowed to a short, broad flat acumen which is twisted when dry; costa single, slender, $^4/_5$ leaf length; upper cells oblong-linear, median cells shorter and strongly porose, alar cells subquadrate to shortly oblong, opaque; sporophytes exserted, seta 7-10 mm long, capsules inclined to horizontal, oblong, slightly curved; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, BSCR, CANY, LARO, LPIB, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1652, 2212, 2300, 2546; PVR 582, 605, 778, 793.

Clasmatodon (Hooker) Wilson, J. Bot. (Hooker) 4: 421-422, pl. 25, f. A. 1842. **Etymology:** *klasma* (fragment) and *odon* (tooth), referring to the irregularly bifid endostome.

Clasmatodon parvulus (Hampe) Sullivant in A. Gray, Manual (ed. 2) 660. 1856.

Etymology: *parvulus* (very small) presumably in reference to the very thin stems. **Synonym(s):** *Clasmatodon parvulus* var. *rupestris* Lesquereux & James, *Leskea parvula* Hampe.

Plants: pleurocarpous, green; leaves imbricate, erect and subsecund when dry, erect to wide-spreading when wet, 0.4-0.7 mm long, ovate-lanceolate to broadly ovate, narrowly to bluntly acute or rounded-obtuse, subentire to serrulate in the upper $^2/_3$, costa single, slender, $^1/_2$ - $^2/_3$ leaf length; upper cells rhombic or oblong-rhombic, basal cells subquadrate; sporophytes exserted, seta 3-5 mm long, capsules erect, oblong-cylindric; autoicous. **Substrate(s):** tree bases and trunks (*Acer, Betula nigra, Carpinus caroliniana, Carya, Crataegus viridis, Fagus grandifolia, Liquidambar styraciflua, Magnolia grandiflora, Magnolia virginiana, Nyssa sylvatica, Persea borbonia, Quercus alba, Quercus nigra, Quercus phellos, Taxodium distichum, Triadica sebifera, Ulmus americana*) woody vines (*Berchemia scandens*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LNRC, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1654; PVR 135, 156, 219, 304, 340, 430, 457, 561, 587, 672, 686, 763.

Oxyrrhynchium (Schimper) Warnstorf, Krypt.-Fl. Brandenburg, Laubm. 2(4): 781. 1905. **Etymology:** *oxys* (acute) and *rhynchos* (nose), referring to the beaked operculum.

Oxyrrhynchium hians (Hedwig) Loeske, Verh. Bot. Vereins Prov. Brandenburg 49(1): 59. 1907.

Etymology: *hians* (gaping), referring to the wide spreading nature of the leaves. **Synonym(s):** *Eurhynchium hians* (Hedwig) Sande Lacoste, *Hypnum hians* Hedwig, *Oxyrrhynchium* *hians* subsp. *rappii* (R.S. Williams) Wijk & Margadant, *Oxyrrhynchium rappii* R.S. Williams. SWARTZ'S FEATHER MOSS.

Plants: pleurocarpous, green to yellow green; stem and branch leaves somewhat differentiated, loose to loosely imbricate; stem leaves, erect to erecto-patent, 1.0-1.2 mm long, ovate to ovate-triangular, slenderly short acuminate, serrate to serrulate, costa single, broad, $^1/_2$ -$^3/_4$ leaf length, abaxial teeth present (often with additional teeth), laminal cells elongate, alar cells enlarged; branch leaves erect to erect-spreading, 0.8-1.2 mm long, ovate to ovate-lanceolate, acute, somewhat plicate, serrulate all around, costa single, $^3/_4$ leaf length, abaxial tooth present and strong; sporophytes exserted, seta 10-27 mm long, capsules inclined to horizontal, oblong-cylindrical; dioicous**. Substrate(s):** tree bases (*Carpinus caroliniana*) and mineral soil. **BITH Distribution:** BSCR, CANY, (LARO?). **Representative Specimen(s):** DAK 3250; PVR 759; RP 4496 (MO).

Rhynchostegium Schimper in P. Bruch and W.P. Schimper, Bryol. Eur. 5: 197 (fasc. 49-51. Mon. 1.). 1852. **Etymology:** *rhychos* (nose) and *stego* (cover), referring to the rostrate operculum.

Rhynchostegium serrulatum (Hedwig) A. Jaeger, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1876-77: 370. 1878.

Etymology: *serratus* (serrate, saw-edged with teeth pointing forward), presumably referring to the serrulate leaf margins. **Synonym(s):** *Brachythecium serrulatum* (Hedwig) H. Robinson, *Eurhynchium serrulatum* (Hedwig) Kindberg, *Hypnum serrulatum* Hedwig, *Steerecleus serrulatum* (Hedwig) H. Robinson. BEAKED COMB MOSS.

Plants: pleurocarpous, bright to yellow-green; leaves loose, wide-spreading to somewhat complanate both wet and dry, 1.3-2.0 mm long, oblong-ovate, slenderly acuminate, apices twisted, plane to erect, distinctly serrulate in upper $^{2}/_{3}$ or nearly to the bases; costa single, strong, $^{3}/_{4}$ leaf length, laminal cells linear-flexuose, alar cells not or weakly differentiated; sporophytes exserted, seta 10-30 mm long, capsules horizontal, oblong-cylindric, curved; autoicous**. Substrate(s):** mineral soil. **BITH Distribution**: BEAU, BECR, BSCR, CANY, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** CG 184; DAK 1858, 2838; DM 7159; AJN 847; PVR 363, 498, 618.

BRUCHIACEAE

Bruchia Schwägrichen, Sp. Musc. Frond. Suppl. 2(1, 2): 91. 1824. **Etymology:** Philipp Bruch (1781-1847), an apothecary and botanist in Zweibrücken who, with Wilhelm Schimper, wrote the multivolume *Bryologica Europaea*.

Key to the Species of *Bruchia*

1.	Spores pitted (27-34 µm); leaves 1-1.8 mm, abruptly narrowed to a short subula	*B. brevifolia*
1.	Spore reticulate (38-51 µm); leaves 1-2.6 mm, gradually long subulate	*B. drummondii*

Bruchia brevifolia Sullivant, Manual (ed. 2) 617. 1856.

Etymology: *brevi* (short) and *folius* (leaved) referring to the short leaves.

Plants: acrocarpous, yellowish or brownish, 1.0-1.5 mm high; leaves crowded, erect-flexuose when dry, 1.0-1.8 mm long, short subulate above an ovate to obovate base, apices acute and toothed, margins not or irregularly reflexed above the shoulders, costa single, percurrent or nearly so, not filling the subula; upper cells short-oblong to short-rectangular; sporophytes immersed to very shortly exserted, seta 0.7-1.3 mm long, capsules erect, pyriform; spores 27-34 µm, punctate-pitted (resembling a miniature golf ball); autoicous. **Substrate(s):** tree bases and trunks. **BITH Distribution:** BEAU. **Representative Specimen(s):** DAK 2215.

Bruchia drummondii Hampe ex E. Britton, Bull. Torrey Bot. Club 21: 361. 1894.

Etymology: Thomas Drummond (1793-1835) a Scottish botanical collector and the younger brother of the botanist James Drummond. He first became known to botanists by his distributed sets of mosses known as *Musci Scotici* (1824-1825). Drummond collected along the Brazos, Colorado and Guadalupe Rivers, spending almost two years collecting plants and birds in Texas.

Plants: acrocarpous, yellowish to brownish, 1.0-2.5 mm high; leaves crowded, 1.0-2.6 mm long, long subulate above an oblong-ovate base, apices acute, serrulate above or only at the apex; costa single, percurrent, nearly filling the smooth or slightly roughened subula; upper cells linear to linear-oblong; sporophytes immersed to slightly exserted, seta 0.6-1.0 mm long, capsules erect, broadly pyriform; spores (38-51 µm), reticulate; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** LARO. **Representative Specimen(s):** PVR 479.

Trematodon Michaux, Atti Reale Univ. Genova 1: 31. 1869. **Etymology:** *tremato* (perforated) and *odon* (tooth), alluding to the perforated peristome teeth.

Trematodon longicollis Michaux, Fl. Bor.-Amer. 2: 289. 1803.

Etymology: *longus* (long) and *collum* (neck), referring to the long neck of the capsule. **Synonym(s):** *Trematodon ambiguus* var. *longicollis* (Michaux) Arnott. BOW-BASE MOSS, COMMON LONG-CAPSULE MOSS.

Plants: acrocarpous, green to yellow-green, stems 5-8 mm high; leaves crowded, flexuose-spreading when wet, curled when dry, 2-3 mm long, clasping, oblong to oblong-ovate at the base and gradually narrowed to a long, linear-subulate apex, margins reflexed, entire, except for a few blunt teeth in the upper $^{1}/_{2}$ of the leaf; costa single, percurrent; upper cells short-oblong, lower cells oblong to rhomboidal; sporophytes long-exserted, seta 10-35 mm long, capsules cylindric with a neck that is about twice as long as the urn; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, CANY, LARO, MECR. **Representative Specimen(s):** DM 7138; PVR 312, 397, 567.

BRYACEAE

Gemmabryum J.R. Spence & H.P. Ramsay, Phytologia 87(2): 63–68. 2005. **Etymology:** *gemma* (a bud or propagule) and the genus *Bryum* (*bryon* or moss), from which it was separated. Referring to the importance of the three different types of asexual gemmae found in the genus.

Gemmabryum radiculosum (Bridel) J.R. Spence & H.P. Ramsay, Phytologia 87(2): 68. 2005.

Etymology: *radicula* (radicle, rhizoid in bryophytes) presumably in reference to the abundance of rhizoids. **Synonym(s):** *Bryum radiculosum* Bridel.

Plants: acrocarpous, green to yellow-green, stems up to 15 mm tall; leaves loose, erect to erect-spreading when wet, erect when dry, 1.0-2.5 mm long, triangular to lanceolate or ovate-lanceolate, acuminate, short pointed or awned, entire to somewhat denticulate near the apex, margins recurved throughout, indistinctly bordered; costa single, strong, excurrent, reddish below; median cells elongate-hexagonal, incrassate, those at the margin longer and narrower but only rarely forming a distinct border, lower cells shortly rectangular and sometimes quadrate; sporophytes long exserted, seta 1.0-2.5 cm long, capsules pendulous, cylindric to obpyriform; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** HCRS. **Representative Specimen(s):** PVR 565.

Ptychostomum Hornschuch, Syll. Pl. Nov. 1(3): 62-64. 1824. **Etymology:** *ptychos* (fold) and *stoma* (mouth), alluding to pleated appearance of capsule mouth.

Ptychostomum pseudotriquetrum (Hedwig) J.R. Spence & H.P. Ramsay ex D.T. Holyoak and N. Pedersen, J. Bryol. 29(2): 120. 2007.

Etymology: *pseudo* (false) and *tri* (three), falsely triangular, three-sided, or possibly three-ranked. **Synonym(s):** *Bryum pseudotriquetrum* (Hedwig) P. Gaertner, B. Meyer, & Scherbius, *Mnium pseudotriquetrum* Hedwig.

Plants: acrocarpous, green to red-green to yellow-green, 2-4 cm high, densely radiculose well up stem; leaves remote on lower stem and more crowded above, twisted and contorted when dry, erect-spreading when wet, 2.5-4.0 mm long, oblong-lanceolate to ovate-lanceolate, acute to acuminate or cuspidate, entire or serrulate near apices; costa single, strong, red below, percurrent to shortly excurrent; upper cells oblong-hexagonal, linear and thickened in several marginal rows forming a strong border, lower cells short to long, subquadrate to rectangular near the margins; sporophytes exserted, seta 25-40 mm long, capsules pendulous, elongate-ovate; dioicous or synoicous. **Substrate(s):** mineral soil**. BITH Distribution:** LARO. **Representative Specimen(s):** PVR 704.

CALYMPERACEAE

Syrrhopodon Schwägrichen, Sp. Musc. Frond., Suppl. 2 2: 110. 1824. **Etymology:** *syrrhopos* (close together) and *odon* (tooth) alluding to the connivent teeth of the peristome.

Key to the Species of *Syrrhopodon*

1. Propagules on the dorsal surface of the leaves along the costa .... *S. parasiticus*
1. Propagules at the apices of the leaves .... *S. texanus*

Syrrhopodon parasiticus (Bridel) Bescherelle, Ann. Sci. Nat., Bot., sér. 8, 1: 298. 1895.

Etymology: the species was first collected in Hispanola, where it was "parasitic" on branches of trees. **Synonym(s):** *Bryum parasiticum* Bridel, *Calymperes filigera* Austin, *Calymperopsis parasitica* (Bridel) Brotherus, *Syrrhopodon filigerus* (Austin) R. S. Williams.

Plants: acrocarpous, green to brownish-green, stems 3-15 mm tall; leaves appressed and slightly curved-secund when dry, wide-spreading when wet, 2-4 mm long, ligulate-lanceolate, acute or sometimes stoutly apiculate, margins erect or inflexed, entire; upper cells rounded-quadrate or hexagonal, mammilose on the upper surface, papillose on the lower surface; leaves often bordered with very narrow and often interrupted hyaline cells in the lower $^{1}/_{2}$-$^{3}/_{4}$ of the leaf, cancellinae ending in acute angles distally; costa single, strong, percurrent to excurrent; gemmae filamentous, smooth, abundant along dorsal surface of costa; sporophytes emergent to exserted, capsules cylindric; dioicous. **Substrate(s):** tree trunks (*Cyrilla racemiflora, Ilex opaca*). **BITH Distribution:** BSCR, CANY, LOBL. **Representative Specimen(s):** DAK 2828, 3085; PVR 724.

Syrrhopodon texanus Sullivant, Musci Hep. U.S. (repr.) 103. 1856.

Etymology: for the state of Texas, the type collection was made by Charles Wright near San Marcos in the central part of the state.

Plants: acrocarpous, dark green or brownish, stems 5-30 mm tall; leaves erect-spreading, moderately contorted when dry, 2.5-4.0 mm long, broadly ligulate or lingulate from an oblong or oblong-obovate base, broadly acute to obtuse, margins bordered nearly to apex with linear hyaline cells, coarsely toothed-ciliate at the shoulders and irregularly to the apex; costa single, strong, subpercurrent to excurrent; cells rounded-quadrate, pluripapillose on both surfaces; cancellinae rounded or obtuse at apex; gemmae clavate-fusiform, abundant in rounded globes at apices of leaves; sporophytes (very infrequent) exserted, seta 10-18 mm long, capsules narrowly cylindric. **Substrate(s):** tree trunks and bases (*Magnolia grandiflora, Magnolia virginiana, Nyssa, Persea borbonia, Pinus, Quercus nigra*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, LOBL, LPIB, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1607, 1840, 2815; PVR 138, 281, 584, 716, 740, 773.

CLIMACIACEAE

Climacium F. Weber & D. Mohr, Naturh. Reise Schweden 96. 1804. **Etymology:** *klimax* (staircase, ladder) alluding to the appearance of the processes of the inner peristome, the two halves of which are regularly united by projections between the perforations, giving somewhat the appearance of a ladder.

Climacium americanum Bridel, Muscol. Recent. Suppl. 2: 45-46. 1812.

Etymology: *americanum*, for the United States of America, the type was collected "*in sylvis Carolinae.*" **Synonym(s):** *Climacium americanum* subsp. *kindbergii* (Renauld & Cardot) Kindberg, *Climacium americanum* var. *kindbergii* Renauld & Cardot, *Climacium americanum* var. *pseudokindbergii* Cardot & Theriot, *Climacium kindbergii* (Renauld & Cardot) Grout. AMERICAN CLIMACIUM MOSS, TREE MOSS.

Plants: acrocarpous, dark or dirty-green, 3-7 cm tall; branch leaves sulcate, 1.8-2.5 mm long, ovate or ovate-lanceolate from a cordate base, auriculate, apices broadly acute to obtuse, coarsely and irregularly toothed, longitudinally undulate to plicate; upper leaf cells shortly oblong-rhomboidal, margins entire; stem leaves with apices broadly to sharply acute; costa single, subpercurrent; sporophytes exserted, seta 15-38 mm long, capsules erect, long-cylindric; dioicous. **Substrate(s):** mineral soil, tree bases (*Nyssa sylvatica, Quercus falcata, Taxodium distichum*), decayed logs. **BITH Distribution:** BEAU, BSCR, CANY, LARO, MECR, NBJG, VCRC. **Representative Specimen(s):** DAK 1606, 2832, 3255, 3384; PVR 262, 743, 768.

CRYPHAEACEAE

Cryphaea D. Mohr in F. Weber, Tab. Calyptr. Operc. [3]. 1813. **Etymology:** *krypha* (secret, hidden), a variant of *kryptos*, alluding to the immersed capsules, more or less hidden by the perichaetial leaves.

Cryphaea glomerata Schimper ex Sullivant in A. Gray, Manual (ed. 2) 656, pl. 5 [near upper right]. 1856.

Etymology: *glomeratus* (collected closely together into a head) presumably in reference to the clustering of the perichaetal leaves in a large and conspicuous infloresence.

Plants: pleurocarpous, dark green to brownish; leaves imbricate when dry, wide-spreading when moist, 1.1-1.3 mm long, ovate, acute or short-acuminate, entire, serrulate at the apices; costa single, $^{1}/_{2}$ leaf length or sometime extending into the acumen, often laterally spurred and bifid at the apex; upper cells rhombic to oblong-rhombic, bulging papillose on upper back; lower cells transversely short-oblong at the margins; sporophytes immersed, capsules erect, ovate to narrowly ovate; autoicous. **Substrate(s):** tree trunks and bases (*Acer, Carpinus* *caroliniana*, *Cornus florida*, *Crataegus viridis*, *Ilex opaca*, *Magnolia grandiflora*, *Platanus occidentalis*, *Triadica sebifera*), woody vines (*Vitis*). **BITH Distribution:** BEAU, BSCR, HCRS, LARO, LNRC, LOBL, LPIB, MECR, TKCR. **Representative Specimen(s):** PVR 222, 593, 599, 626, 644, 663, 677, 736, 745.

DICRANACEAE

Dicranella (Müller Halle) Schimper, Coroll. Bryol. Eur. 13. 1856. **Etymology:** the genus *Dicranum* and *ella* (little) meaning "little *Dicranum*."

Key to the Species of *Dicranella*

1. Seta yellow .... *D. heteromalla*
1. Seta red .... *D. varia*

Dicranella heteromalla (Hedwig) Schimper, Coroll. Bryol. Eur. 13. 1856.

Synonym(s): *Campylopus henrici* Renauld & Cardot, *Dicranella fitzgeraldii* Renauld & Cardot, *Dicranella heteromalla* var. *latinervis* Cardot & Thériot, *Dicranella heteromalla* var. *orthocarpa* (Hedwig) A. Jaeger & Sauerbeck, *Dicranum heteromallum* Hedwig, *Dicranum orthocarpum* Hedwig. SILKY FORKLET MOSS, FINE HAIR MOSS, FORK MOSS.

Plants: acrocarpous, yellow to dark green, up to 1 cm tall; leaves erect to falcate-secund, gradually narrowing from a lanceolate base to a subula largely occupied by the costa, 2-3 mm long, serrulate in the upper $^1/_2$; costa single, excurrent; median cells short-rectangular;

sporophytes exserted, seta 8-14 mm long, yellow, capsules inclined to horizontal, curved, cylindric; dioicous. **Substrate(s):** mineral soil (Crum and Anderson 1981). **BITH Distribution:** BSCR, TKCR. **Representative Specimen(s):** DM s.n.; CG 173.

Dicranella varia (Hedwig) Schimper, Coroll. Bryol. Eur. 13. 1856.

Etymology: *varia* (diverse, differing) in reference to the morphological variability found in the species. **Synonym(s):** *Anisothecium rubrum* Lindberg, *Anisothecium varium* (Hedwig) Mitten, *Dicranella howei* Renauld & Cardot, *Dicranella langloisii* Renauld & Cardot, *Dicranella rubra* Lindberg, *Dicranum varium* Hedwig. VARIABLE FORKLET MOSS.

Plants: acrocarpous, dirty green to light green to yellowish, 6-15 mm tall; leaves erect-spreading or somewhat falcate-secund, about 1 mm long lower on the stem and up to 2 mm long above, gradually narrowed from a lanceolate base into a linear-lanceolate, keeled limb; margins entire, recurved above, irregularly dentate toward the apex, bistratose; costa single, percurrent, median cells oblong-linear; sporophytes exserted, seta red, 5-8 mm long, capsules erect to inclined, short ovoid; dioicous**. Substrate(s):** mineral soil (Crum & Anderson 1981). **BITH Distribution:** MECR. **Representative Specimen(s):** DM s.n.

Dicranum Hedwig, Sp. Musc. Frond. 126. 1801. **Etymology:** *dikranon* (pitchfork) in reference to the divided or forked peristome teeth.

Dicranum condensatum Hedwig, Sp. Musc. Frond. 139. 34. f. 6-10. 1801.

Synonym(s): *Dicranum sabuletorum* Renauld & Cardot.

Plants: acrocarpous, yellowish-brown, 2-3 cm tall; leaves erect-spreading when wet, curved or crisped when dry, 2-3 mm long, broadly-lanceolate to a broadly short-acuminate to slenderly long-acuminate apices, keeled, entire below, serrulate in the upper $^1/_3$ or more; costa single, shortly excurrent to percurrent, densely serrulate and papillose on back to sometimes nearly smooth; upper cells irregular, more or less subquadrate or short-oblong; lower cells narrow and elongate, somewhat porose, alar cells usually strongly differentiated, 2-stratose, brownish, not extending to the costa; sporophytes exserted, seta 13-22 mm long, capsules inclined to horizontal, curved, cylindrical; pseudomonoecious (male plants on stem rhizoids of female plants). **Substrate(s):** mineral soil (Crum & Anderson 1981). **BITH Distribution:** LPIB. **Representative Specimen(s):** FW s.n. (MO).

DITRICHACEAE

Ceratodon Bridel, Bryol. Univ. 1: 480. 1826. **Etymology:** *keras* (horn) and *odon* (tooth), from the resemblance of the peristome teeth to the horns of a goat.

Ceratodon purpureus (Hedwig) Bridel, Bryol. Univ. 1: 480. 1826.

Etymology: *purpura* (purple), referring to the often reddish-purple coloration of the plants. **Synonym(s):** *Ceratodon purpurascens* (Hedwig) Jennings, *Ceratodon purpureus* var. *purpurascens*

(Hedwig) Bridel, *Ceratodon purpureus* var. *xanthopus* Sullivant, *Dicranum purpureum* Hedwig. REDSHANK, PURPLE MOSS, BURNED GROUND MOSS.

Plants: acrocarpous, dirty-green to yellow-brown to reddish, 0.5-2.5 cm tall; leaves crowded, erect-patent and sometimes crisped when dry, 1.8-2.0 mm long, lanceolate, gradually acuminate, acute or sometimes awned, keeled, margins strongly reflexed or revolute, irregularly serate to uneven; costa single, strong, percurrent to excurrent; cells subquadrate, smooth, short-rectangular below; sporophytes exserted, seta 8-30 mm long, capsules inclined to horizontal, oblong to long-cylindric; dioicous. **Substrate(s):** mineral soil (Crum and Anderson 1981). **BITH Distribution:** LPIB. **Representative Specimen(s):** GS 814.

Ditrichum Hampe, Flora 50:181. 1867. **Etymology:** *di* (two) and *trichos* (hair), referring to the filiform, divided peristome teeth.

Ditrichum pallidum (Hedwig) Hampe, Flora 50: 182. 1867.

Synonym(s): *Ditrichum currituckii* Grout, *Trichostomum pallidum* Hedwig. SAFFRON MOSS.

Plants: acrocarpous, green to yellow-green, 3-5 mm tall; leaves erect spreading to subsecund when wet, flexuose-contorted when dry, 3-5 mm long, ovate-lanceolate and gradually narrowed into a long, subulate acumen, margin serrulate at the apices; costa single, thin, indistinct, filling most of the subula, long excurrent; upper cells linear (belonging to the costa), lamina cells oblong-linear at the shoulders, oblong-hexagonal to rectangular at the base;

sporophytes long exserted, seta 12-40 mm long, capsules suberect to inclined, subcylindric; autoicous. **Substrate(s):** mineral soil. **BITH Distribution**: BEAU, BECR, BSCR, CANY, HCRS, LARO, LNRC, LOBL, LPIB, MECR, NBJG, TKCR, UNRC, VCRC. **Representative Specimen(s):** DAK 1830, 2200, 3089, 3112, 3398; DM 7077 (MO); PVR 118, 141, 289, 397, 595, 762, 772, 782.

ENTODONTACEAE

Entodon Muller Halle, Linnaea 18(6): 704-709. 1844. **Etymology:** *entos* (inside) and *odon* (tooth), alluding to the insertion of the outer peristome teeth inside the capsule mouth.

Key to the Species of *Entodon*

1. Stems terete to somewhat flattened .... *E. seductrix*
1. Stems strongly complanate .... *E. macropodus*

Entodon macropodus (Hedwig) Muller Halle, Linnaea 18(6): 707. 1844.

Synonym(s): *Entodon drummondii* (Sullivant) A. Jaeger, *Neckera macropoda* Hedwig.

Plants: pleurocarpous, light green to yellow, branches strongly flattened; leaves erect to spreading, 1.4-2.0 mm long, oblong-lanceolate to oblong-ovate, acute, strongy complanate, plane, entire proximally to serrulate at apex; costa none, or double and very short; leaf cells linear-elongate, alar cells somewhat differentiated; sporophytes exserted, seta13-33 mm long, capsules erect, long-cylindric; autoicous. **Substrate(s):** mineral soil and tree bases (*Magnolia* *grandiflora, Quercus, Triadica sebiferum, Ulmus*). **BITH Distribution:** BECR, CANY, LARO, LOBL, NBJG, TKCR. **Representative Specimen(s):** DAK 1861, 2472, 2489, 2512; BJE s.n. (NY); PVR 522.

Entodon seductrix (Hedwig) Muller Halle, Linnaea 19(2): 214. 1847.

Synonym(s): *Cylindrothecium demetrii* Renauld & Cardot, *Neckera seductrix* Hedwig. CORD GLAZE MOSS.

Plants: pleurocarpous, green to yellowish to brown-tinged, stems terete to somewhat flattened; leaves imbricate, concave, 1-2 mm long, oblong-ovate to elliptic, abruptly acute or apiculate, entire below to slightly serrulate at apices; costa none or short and double; cells linear to rhomboidal above, alar cells quadrate, and abruptly differentiated; sporophytes exserted, seta 5-16 mm long, capsules erect, cylindric; autoicous. **Substrate(s):** decayed logs and stumps, tree bases (*Carya, Quercus, Taxodium distichum, Triadica sebifera*), manmade substrates (asphalt). **BITH Distribution:** BEAU, BECR, BSCR, HCRS, LARO, LNRC, LOBL, LPIB, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1632, 2183, 2206; DM s.n.; AJN 2032; PVR 360, 430, 509, 560, 594.

EPHEMERACEAE

Ephemerum Hampe, Flora 20: 285. 1837. **Etymology:** *ephemerum* (short-lived plants).

Ephemerum spinulosum Bruch & Schimper, Syn. Musc. Eur. 6. 1860.

Etymology: *spinulosus* (spine) presumably in reference to the spiny leaf margins. **Synonym(s):** *Ephemerum spinulosum* var. *hystrix* (Lindberg) Grout, *Phascum serratum* var. *angustifolium* Drummond. BROWNIES.

Plants: acrocarpous, light green, less than 2.5 mm tall, protonema persistent; leaves 1-2 mm long, setaceous to linear-lanceolate, slenderly acuminate, margins sharply to bluntly spinose with the spines spreading 45˚ or more; costa single, usually strong but often weak in the lower $^{1}/_{3}$, percurrent to excurrent distally; sporophytes immersed, capsules ovoid; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** LARO, MECR. **Representative Specimen(s):** PVR 162, 218.

Micromitrium Bridel, Musci Appalach. 10. 1870. **Etymology:** *micro* (small) and *mitra* (headband) referring to the small calyptra.

Micromitrium tenerum (Bruch & Schimper) Crosby, Bryologist 71: 116. 1968.

Synonym(s): *Micromitrium austinii* Sullivant, *Nanomitrium austinii* (Sullivant) Lindberg, *Nanomitrium austinii* var. *floridanum* Grout, *Phascum tenerum* Bruch & Schimper.

Plants: acrocarpous, pale to bright green, usually less than 1 mm tall, protonema persistent; leaves wide-spreading to recurved, 0.6-1.0 mm long, linear-lanceolate to oblong-lanceolate, gradually acuminate, narrowly to broadly acute, margins entire proximally to bluntly serrate above; costa none, or very weakly expressed near mid-leaf; median cells oblong-rhomboidal; sporophytes immersed, capsules erect, globose; synoicous. **Substrate(s):** mineral soil. **BITH Distribution:** MECR. **Representative Specimen(s):** PVR 485.

FABRONIACEAE

Fabronia Raddi, Atti Accad. Sci. Siena 9: 231-235, pl. 1. 1808. **Etymology:** Florentine administrator Giovanni Valentino Mattia Fabroni (1752-1822), at one time director of the mint in Florence. According to Crum & Anderson (1981) the name was chosen partly as a derivation from the Latin *faber*, meaning ingenious. Raddi later named the liverwort genus *Pellia* after Fabroni's son Leopoldo Pelli Fabroni.

Fabronia ciliaris (Bridel) Bridel, Bryol. Univ. 2: 171. 1827.

Synonym(s): *Fabronia ciliaris* var. *polycarpa* (Hooker) W.R. Buck, *Fabronia ciliaris* var. *wrightii* (Sullivant) W.R. Buck, *Fabronia ravenelii* Sullivant, *Fabronia wrightii* Sullivant, *Hypnum ciliare* Bridel. FALSE CRUSHED RICE MOSS, EIGHT TEETH CRUSHED RICE MOSS.

Plants: pleurocarpous, green to yellow-green; leaves crowded, erect or appressed when dry, erect-spreading to spreading when wet, 0.3-0.8 mm long, ovate-lanceolate to occasionally ovate, gradually narrowed to a long yellowish or hyaline awn, margin coarsely and irregularly serrate; costa single, very slender, about $^1/_2$ leaf length; upper cells short rhomboidal, lower cells quadrate in several marginal rows; sporophytes shortly exserted, seta 2-4 mm long, capsules erect, subcylindric to obovoid; autoicous. **Substrate(s):** tree trunks (*Quercus alba*). **BITH Distribution:** BSCR. **Representative Specimen(s):** PVR 615.

FISSIDENTACEAE

Fissidens Hedwig, Sp. Musc. Frond. 152. 1801. **Etymology:** *fissus* (a split) and *dens* (tooth) alluding to the split peristome teeth.

Key to the Species of *Fissidens*

1.	Plants aquatic	*F. fontanus*
1.	Plants corticulous or terrestrial	2
2(1).	At least some leaves with margins completely, or incompletely, bordered by a row of long hyaline cells	3
2.	Leaves not bordered by long hyaline cells	4
3(2).	Border extending to leaf apices or limited to the vaginant lamina; leaves entire or dentate at the apices only; cells epapillose	*F. bryoides*
3.	Border limited to the vaginant lamina; leaves dentate all around; cells pluripapillose	*F. elegans*
4(2).	Distal end of costa pellucid, obscured by small green cells	*F. subbasilaris*
4.	Distal end of costa not obscured	5
5(4).	Leaves with a pale border several cells wide	6
5.	Leaves not bordered by pale cells	7
6(5).	Leaf cells flat to slightly convex; lamina in cross-section uniformly unistratose; pale border moderate to indistinct	*F. adianthoides*

6.	Leaf cells rounded to bulging; lamina in cross-section occasionally bistratose in places; pale border usually distinct	*F. dubius*
7(5).	Margins of leaf apices entire to finely serrate	8
7.	Margins of leaf apices coarsely and unevenly toothed	*F. adianthoides*
8(7).	Costa percurrent to shortly excurrent	9
8.	Costs excurrent as a short to long, stout apiculus	*F. taxifolius*
9(8).	Plants large (2-5 cm); lamina unistratose throughout	*F. polypodioides*
9.	Plants small (4-7 mm); lamina occasionally bistratose	*F. bushii*

Fissidens adianthoides Hedwig, Sp. Musc. Frond. 157. 1801.

Etymology: *Adiantum* and *eîdos* (likeness) for its resemblance to the fern genus *Adiantum.* **Synonym(s):** *Fissidens adianthoides* var. *immarginatus* Lesquereux & James. MAIDENHAIR POCKET MOSS.

Plants: acrocarpous, pale to dark green, 10-35 mm tall; leaves 1.5-4.0 mm long, broadly oblong, acute, wavy, crenulate below, unevenly serrate at the apices; usually bordered by 4-5 rows of paler cells; costa single, pellucid, ending 2-3 cells below apex, often sinuose above; cells hexagonal, often rounded at the corners, bulging to plane, unistratose; sporophytes exserted, lateral, seta 7-15 mm long, capsules suberect to inclined; dioicous. **Substrate(s):** mineral soil, tree bases and roots (*Magnolia grandiflora*, *Nyssa*) and decayed logs. **BITH Distribution:** BSCR, CANY, LOBL, MECR, TKCR. **Representative Specimen(s):** DAK 2818, 3105, 3257, 3401; PVR 138.

Fissidens bryoides Hedwig, Sp. Musc. Frond. 153. 1801.

Etymology: *Bryum* and and *eîdos* (likeness) for its supposed likeness to the moss genus *Bryum*, a comparison which is not very meaningful in its modern context. **Synonym(s):** *Fissidens andersonii* Grout, *Fissidens bryoides* var. *incurvus* (Starke) Hübener, *Fissidens bryoides* var. *pusillus* (Wilson) Pursell, *Fissidens exiguus* Sullivant, *Fissidens exiguus* var. *falcatulus* (Renauld & Cardot) Grout, *Fissidens pusillus* (Wilson) Milde, *Fissidens synoicous* Sullivant, *Fissidens texanus* Lesquereux & James, *Fissidens viridulus* (Swartz) Wahlenberg, *Fissidens viridulus* var. *pusillus* Wilson, *Fissidens viridulus* var. *tamarindifolius* (Turner) Grout, *Fissidens viridulus* var. *texanus* (Lesquereux & James) Grout. LESSER POCKET MOSS, PIXIE POCKET MOSS.

Plants: acrocarpous, pale to dark green, 3-11 mm tall; leaves 1-2 mm long, oblong to oblong-lingulate, obtuse to gradually or abruptly acute, margins bordered by 1-3 rows of linear hyaline cells to the apices or nearly so (although the border may be limited to the vaginant lamina or varying distances toward the apices), margin entire but occasionally serrulate distally; costa single, excurrent, reaching apices, or ending a few cells below; cells irregularly hexagonal, smooth, unistratose; sporophytes exserted, terminal, seta 3-7 mm long, capsules erect to curved or inclined, polyoicous. **Substrate(s):** mineral soil, tree bases and roots (*Taxodium distichum*) and manmade substrates (concrete). **BITH Distribution:** CANY, MECR, NBJG. **Representative Specimen(s):** DAK 1860; PVR 361, 503.

Fissidens bushii (Cardot & Thériot) Cardot & Thériot, Bot. Gaz. 37: 365. 1904.

Etymology: Benjamin Franklin Bush (1858-1937) an American botanist, ornithologist, and collector. Bush collected the type in Missouri in 1897. **Synonym(s):** *Fissidens subbasilaris* var. *bushii* Cardot & Thériot. BUSH'S POCKET MOSS.

Plants: acrocarpous, pale to dark green, 4-7 m tall; leaves 1.5-2.2 mm long, oblong, broadly acute to rounded-obtuse, abruptly narrowed to a small pellucid apiculus, crenate-serrulate all around, serrulate at apices, often pale margined; costa single, pellucid, ending near the apiculus, but of same color so as to appear excurrent; cells rounded-hexagonal, bulging, unistratose (occasionally bistratose here and there), vaginant lamina usually with 2-3 low blunt papillae; sporophytes exserted, lateral, seta 6-10 mm long, capsules erect or flexuose; dioicous. **Substrate(s):** mineral soil, tree bases (*Nyssa*). **BITH Distribution:** BECR, BSCR, CANY, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1833, 2817; PVR 290, 421, 470, 550, 606.

Fissidens dubius P. Beauvois, Prodr. Aethéogam. 57. 1805.

Synonym(s): *Fissidens adianthoides* var. *semicristatus* Grout, *Fissidens cristatus* Mitten, *Fissidens cristatus* var. *winonensis* (Renauld & Cardot) Grout, *Fissidens decipiens* var. *winonensis* Renald & Cardot, *Fissidens floridanus* Lesquereux & James. ROCK POCKET MOSS.

Plants: acrocarpous, pale to dark green, 10-20 mm tall; leaves 1.5-3.0 mm long, broadly oblong, acute to obtuse, occasionally broadly apiculate, evenly crenulate below, unevenly serrate above, clearly bordered by 3-5 rows of pale cells; costa single, pellucid, ending 2-6 cells below apices, often sinuose above; cells rounded, bulging, irregularly bistratose; sporophytes exserted, lateral, seta 5-10 mm long, capsules suberect to inclined; dioicous. **Substrate(s):** mineral soil, decayed logs, tree bases (*Acer*, *Liquidambar styraciflua*, *Magnolia grandiflora*, *Magnolia virginiana*, *Nyssa sylvatica, Persea borbonia, Quercus nigra, Taxodium distichum*). **BITH Distribution:** BECR, BSCR, CANY, LARO, LOBL, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1891, 3094, 3117, 3258; PVR 138, 281, 475, 723.

Fissidens elegans Bridel, Muscol. Recent.Suppl. 1: 167. 1806.

Etymology: *elegans* (fine, handsome, elegant). **Synonym(s):** *Fissidens ravenelii* Sullivant. ELEGANT POCKET MOSS.

Plants: acrocarpous, pale to dark green, 2-3 mm tall; leaves 1.0-1.25 mm long, oblong or oblong-lanceolate, acute to subacute, often ending in an apiculus formed by a single pellucid cell; margins finely serrulate due to projecting papillae, clearly bordered at the base of the vaginant lamina by elongate, intramarginal cells, occasionally with 1 or more spurs projecting downward; costa single, pellucid, often shiny and yellow, ending 2-4 cells below apices; cells rounded-hexagonal, finely pluripapillose; sporphytes exserted, terminal, seta 2.5-7.5 mm long, capsules erect; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, BSCR, TKCR, VCRC. **Representative Specimen(s):** DAK 2200; PVR 248, 514, 766.

Fissidens fontanus (Bachelot de la Pylaie) Steudel, Nomencl. Bot. 2: 166. 1824.

Etymology: *fontana* referring to the aquatic habitat in fountains or springs where the species typically grows. **Synonym(s):** *Fissidens debilis* Schwägrichen, *Fissidens julianus* (Savi) Schimper, *Octodiceras julianum* var. *ohioense* Emig, *Skitophyllum fontanum* Bachelot de la Pylaie. LIMP POCKET MOSS.

Plants: acrocarpous, pale to dark green, aquatic, 3-12 cm long; leaves 4-8 mm long, flaccid, linear-lanceolate, gradually narrowed to a sharp or bluntly acute point, entire, unbordered; costa single, ending well below the apices; cells unistratose, irregularly hexagonal, incrassate, not bulging; sporophytes terminal, seta 1.0-1.5 mm long, capsules erect; autoicous. **Substrate(s):** tree base. **BITH Distribution:** BEAU. **Representative Specimen(s):** DAK 3377.

Fissidens polypodioides Hedwig, Sp. Musc. Frond. 154. 1801.

Etymology: *Polypodium* and *eîdos* (likeness) for its resemblance to the fern genus *Polypodium*.

Plants: acrocarpous, pale to dark green, 2-5 cm tall; leaves 3.0-4.5 mm long, oblong-lingulate, rounded-obtuse, or rounded, bluntly mucronate, margins entire below to somewhat serrulate at the apices, unbordered; costa single, ending 2-3 cells below apices; cells irregularly hexagonal, incrassate, smooth; sporophytes exserted, terminal, seta 8-12 mm long, capsules suberect to inclined; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, BSCR, MECR, TKCR. **Representative Specimen(s):** DAK 1627, 1829, 3092; AJN 1241 (MO).

Fissidens subbasilaris Hedwig, Sp. Musc. Frond. 155. pl. 39: f. 6-9. 1801.

Etymology: in reference to the lateral or basal position of the sporophytes.

Plants: acrocarpous, pale to dark green, 4-7 mm tall; leaves 1.0-1.5 mm long, oblong, obtuse, or rounded-obtuse to broadly acute, apiculate, evenly crenulate all around and sometimes serrulate at the apices; costa single, ending below the apices and covered with short, green cells obscuring the tip of the costa; cells rounded hexagonal, bulging, irregularly bistratose; sporophytes exserted, lateral, seta 2.5-4.0 mm long, capsules erect, narrowly cylindrical; dioicous. **Substrate(s):** tree base (*Quercus*). **BITH Distribution:** CANY, LOBL. **Representative Specimen(s):** DAK 3248; PVR 430.

Fissidens taxifolius Hedwig, Sp. Musc. Frond. 155. pl. 39: f. 1-5. 1801.

Etymology: from the gymnosperm genus *Taxus* and *folium* (leaf) alluding to the resemblance of the leaves. **Synonym(s):** *Fissidens clebschii* Steere. COMMON POCKET MOSS.

Plants: acrocarpous, pale to dark green, 4-8 mm tall; leaves 1.5-2.2 mm long, oblong, obtuse or broadly acute, stoutly apiculate to cuspidate, evenly serrulate, faintly pale margin; costa brownish, disappearing into the cuspidate tip; cells rounded-hexagonal, bulging, vaginant lamina cells with blunt, conical, low papilla; autoicous. **Substrate(s):** mineral soil and tree bases (*Quercus phellos*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, MECR, NBJG. **Representative Specimen(s):** DAK 1856, 3074; PVR 279, 379, 502, 692.

FONTINALACEAE

Fontinalis Hedwig, Sp. Musc. Frond., 298-299. 1801. **Etymology:** *fontana* referring to the aquatic habitat in fountains or springs.

Key to the Species of *Fontinalis*

1.	Stem and branch leaves similar; plants lax	*F. novae-angliae*
1.	Stem and branch leaves differing (branch leaves smaller than stem leaves); plants rigid	*F. sullivantii*

Fontinalis novae-angliae Sullivant, Musci Hep. U.S. (repr.) 104. 1856.

Etymology: *novae-angliae* (of New England) the type was collected in Rockport, Massachusetts by Thomas Potts James (1803-1882). **Synonym(s):** *Fontinalis delamarei* (Renauld & Cardot) Renauld & Cardot, *Fontinalis involuta* Renauld & Cardot, *Fontinalis lescurii* var. *cymbifolia* Austin, *Fontinalis novae-angliae* var. *cymbifolia* (Austin) W.H. Welch, *Fontinalis waghornei* Cardot.

Plants: pleurocarpous, green to yellowish or brownish, aquatic, up to about 40 cm long; stem and branch leaves not differentiated, loosely erect to erect-spreading, 2.5-5.0 mm long, oblong-lanceolate to ovate lanceolate, gradually narrowed to an acute to obtuse apices; margins entire with an entire to serrulate, erect or culcullate apices; ecostate; medial cells linear-fusiform, alar cells shortly oblong in well-marked groups; sporophytes immersed to slightly emergent, seta

0.1-0.3 mm long, capsules erect, oblong-cylindric; dioicous. **Substrate(s):** tree bases (*Nyssa*). **BITH Distribution:** BSCR, TKCR, VCRC. **Representative Specimen(s):** PVR 315, 678, 769.

Fontinalis sullivantii Lindberg, Oefvers. Förh. Finska Vetensk.-Soc. 12: 78. 1869.

Etymology: William Starling Sullivant (1803-1873), American businessman and bryologist who studied at Yale University and was active as a surveyor, as well as a private scientist. **Synonym(s):** *Fontinalis dichelymoides* Lindberg, *Fontinalis disticha* var. *tenuior* Sullivant, *Fontinalis filiformis* Sullivant & Lesquereux, *Fontinalis filiformis* var. *tenuifolia* Cardot, *Fontinalis flaccida* Renauld & Cardot, *Fontinalis langloisii* Cardot, *Fontinalis lescurii* var. *gracilescens* Sullivant, *Fontinalis microdonta* Renauld, *Fontinalis missourica* Cardot, *Fontinalis renauldii* Cardot.

Plants: pleurocarpous, light to dark green or yellowish, up to about 15 cm long; stem and branch leaves differentiated, stem leaves loosely erect to erect-spreading, 4-5 mm long, narrowly lanceolate, gradually long acuminate and acute, serrulate at the apices, slightly decurrent; medial cells linear-fusiform, cells at basal angles oblong; branch leaves similar but smaller, 2-4 mm long; ecostate; sporophytes immersed to slightly emergent, seta 1.7-3.0 mm long, capsules erect, narrowly cylindric; dioicous. **Substrate(s):** tree bases (*Taxodium distichum*). **BITH Distribution:** BECR, NBJG. **Representative Specimen(s):** DAK 1622; PVR 359.

FUNARIACEAE

Funaria Hedwig, Sp. Musc. Frond. 172. 1801. **Etymology:** *funis* (cord) and *aris* (resembling) alluding to the twisted, cord-like seta of *F. hygrometrica.*

Key to the Species of *Funaria*

1.	Leaves serrate above; costa ending 3-5 cells below apices	*F. serrata*
1.	Leaves entire to slightly serrate above; costa subpercurrent to excurrent	2
2(1).	Annulus absent; capsules short (< 2.0 mm), erect to slightly inclined	*F. americana*
2.	Annulus present, revoluble; capsules longer (> 2.0 mm), horizontal to pendant	3
3(2).	Capsules horizontal to pendant; operculum strongly oblique and oriented on the side of the urn	*F. hygrometrica*
3.	Capsules inclined to horizontal; operculum oriented at the apices of the urn	*F. flavicans*

Funaria americana Lindberg, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 20: 398. 1863.

Etymology: Although the intent was clear, for the USA, (Muhlenberg collected the species in Pennsylvania) the original descriptions were made from European material. **Synonym(s):** *Entosthodon americanus* (Lindberg) Fife.

Plants: acrocarpous, pale olive green, 2-5 mm tall; leaves larger and crowded above, reduced below, 2-5 mm long, erect-spreading, elliptic to oblong-lanceolate or obovate gradually narrowing to a slender acumen; margins entire to weakly serrate distally; costa single, ending in the acumen; cells rhomboid to oblong-hexagonal distally and rectangular at base; sporophytes exserted, seta 6-10 mm long, capsules inclined, elongate-pyriforme; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** LARO. **Representative Specimen(s):** DM s.n.

Funaria flavicans Michaux, Fl. Bor.-Amer. 2: 303. 1803.

Plants: acrocarpous, yellow-green, 2-5 mm tall; leaves imbricate, scarcely contorted when dry, 2-3 mm long, broadly oblong-ovate to obovate, abruptly narrowed to a long slender acumen, entire; cells hexagonal to oblong-hexagonal above; costa single, excurrent; sporophytes exserted, seta 8-20 mm long; capsules inclined to horizontal, ovoid-pyriform, mouth slightly oblique, annulus revoluble; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** LARO. **Representative Specimen(s):** PVR 705.

Funaria hygrometrica Hedwig, Sp. Musc. Frond. 172. 1801.

BONFIRE MOSS, FUNARIA MOSS, CORD MOSS.

Plants: acrocarpous, light green to yellowish, 4-10 mm tall; leaves larger above, 2-4 mm long, crowded, erect, deeply concave, oblong-ovate to broadly obovate, acute to apiculate or short acuminate, entire or slightly serrulate above; cells hexagonal or oblong-hexagonal above, longer and oblong below; costa single, subpercurrent to short excurrent; sporophytes exserted, seta 20-45 mm long, capsules horizontal to pendant, broadly pyriform, mouth strongly oblique, annulus revoluble; autoicous. **Substrate(s):** mineral soil, manmade substrate (concrete). **BITH Distribution:** BSCR, LARO, LPIB. **Representative Specimen(s):** CG 335; DAK 3418; DM s.n.

Funaria serrata Bridel, Muscol. Recent. Suppl. 3: 70. 1817.

Etymology: *serratus* (serrate, saw-edged with teeth pointing forward) presumably referring to the serrulate leaf margins.

Plants: acrocarpous, yellow-green, up to 6 mm tall; leaves larger and crowded above, 2-3 mm long, elliptic to oblong-lanceolate, broadly acute or short-acuminate; margins plane, serrate above; costa single, ending 3-5 cells below apices; cells oblong-hexagonal above, longer and oblong below; sporophytes exserted, seta 19-26 mm long, capsules inclined to pendant, pyriform, strongly curved, annulus revoluble; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, LARO, MECR, VCRC. **Representative Specimen(s):** PVR 300, 766; DM s.n.

Physcomitrium (Bridel) Fürnrohr, Bryol. Univ. 2: 815. 1827. **Etymology:** *physce* (bladder) and *mitrion* (little cap) presumably alluding to the shape of the operculum.

Key to the Species of *Physcomitrium*

1. Capsules exserted, globose to pyriform; plants taller (3-10 mm) .... *P. pyriforme*
1. Capsules immersed, subglobose; plants shorter (<4 mm) .... *P. immersum*

Physcomitrium immersum Sullivant, Manual 648. 1848.

Etymology: *immersus* (submerged, imbedded) in reference to the immersed capsules, a feature that is unusual for the genus.

Plants: acrocarpous, light green, up to about 3 mm tall; leaves erect-spreading, 2-3 mm long, narrowly elliptic to ovate or spatulate, acute or acuminate, entire and serrulate above the middle; costa single, subpercurrent or ending slightly below apices; cells oblong-hexagonal above, rectangular below; sporophytes immersed, seta 0.5-1.2 mm long, capsules erect, subglobose; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** LNRC. **Representative Specimen(s):** PVR 788.

Physcomitrium pyriforme (Hedwig) Hampe, Linnaea 11: 80. 1837.

Etymology: *pyriformis* (pear shaped) probably in reference to the shape of the capsules. **Synonym(s):** *Gymnostomum pyriforme* Hedwig, *Physcomitrium californicum* E. Britton, *Physcomitrium drummondii* E. Britton, *Physcomitrium kellermanii* E. Britton, *Physcomitrium megalocarpum* Kindberg, *Physcomitrium pygmaeum* James, *Physcomitrium turbinatum* (Michaux) E. Britton. COMMON BLADDERMOSS, GOBLET MOSS, TOP MOSS, URN MOSS.

Plants: acrocarpous, light green to yellowish-green, 3-10 mm tall; leaves erect-spreading when wet, contorted when dry, 2-5 mm long, oblong-lanceolate to oblong-ovate, acuminate; margins plane and bluntly serrate to entire above the middle; costa single, ending near the apices to shortly excurrent; upper cells oblong-hexagonal, narrower and sometimes inflated near the margin (forming a pale border of 1-2 rows), lower cells large, oblong; sporophytes exserted, seta 6-14 mm long, capsules erect, globose-pyriform; autoicous. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, BSCR, LARO, LNRC, LOBL, MECR, NBJG. **Representative Specimen(s):** DAK 2205; DM s.n.; PVR 215, 410, 478, 597, 611.

HYPNACEAE

Ctenidium (Schimper) Mitten, J. Linn. Soc., Bot. 12: 509. 1869. **Etymology:** *ktenos* (comb) and *idium* (diminutive) alluding to branching pattern .

Ctenidium molluscum (Hedwig) Mitten, Journal of the Linnean Society, Botany 12: 509. 1869.

Synonym(s): *Ctenidium molluscum* var. *condensatum* (Schimper) E. Britton, *Ctenidium subrectifolium* (Bridel) G. Pedano ex W.R. Buck & B.H. Allen, *Hypnum molluscum* Hedwig, *Hypnum subrectifolium* Bridel, *Stereodon molluscus* (Hedwig) Mitten. COMB-MOSS, FEATHER COMB MOSS.

Plants: pleurocarpous, green, yellowish-green, golden-brown; stem and branch leaves differentiated, stem leaves crowded, 1.2-2.0 mm long, spreading to squarrose or squarrose-recurved, broadly decurrent, ovate-cordate and abruptly acuminate, margins distinctly serrate all around; branch leaves 1.0-1.4 mm long, lanceolate, gradually acuminate, upper cells papillose at back due to projecting cell ends; costa double and short (to $^{1}/_{4}$ leaf length); sporophytes exserted, seta 13-20 mm long, capsules nodding to horizontal, short elliptic to cylindrical; dioicous.

Substrate(s): mineral soil. **BITH Distribution:** CANY. **Representative Specimen(s):** PVR 386.

Homomallium (Schimper) Loeske, Hedwigia 46(5): 314. 1907. **Etymology:** *homos* (similar) and *mallos* (wool) thus bending to one side, alluding to leaves slightly and uniformly curved.

Homomallium adnatum (Hedwig) Brotherus in H.G.A. Engler and K. Prantl, Nat. Pflanzenfam. 231[I,3]: 1027. 1908.

Etymology: *adnatus* (attached the whole length) in reference to the close attachment to a substrate. **Synonym(s):** *Hypnum adnatum* Hedwig.

Plants: pleurocarpous, dark green to blackish or yellow-brown; leaves erect or slightly homomallous when dry, erect-spreading when wet, 0.5-0.8 mm long, oblong-ovate, abruptly short-acuminate, margins erect, entire; costa absent, or costa short and double; upper cells rhomboidal, median cells fusiform to shortly linear-flexuose, alar cells quadrate in triangular groups extending about $^{1}/_{3}$ of the leaf length; sporophytes exserted, seta 6-12 mm long, capsules inclined to horizontal, oblong-cylindric; autoicous. **Substrate(s):** tree bases (*Magnolia grandiflora*). **BITH Distribution:** NBJG. **Representative Specimen(s):** PVR 656.

Hypnum Hedwig, Sp. Musc. Frond. 236-297, pl. 59, f. 8-9; pl. 60-77. 1801. **Etymology:** *hypnon*, an ancient name for an unidentified bryophyte, probably a moss.

Hypnum lindbergii Mitten, J. Bot. 2(4): 123. 1864.

Etymology: Sextus Otto Lindberg (1835-1889) a Swedish bryologist, teacher at the Pharmaceutical Institution of Stockholm, and professor of botany at Helsingfors University. **Synonym(s):** *Calliergonella lindbergii* (Mitten) Hedenas, *Hypnum arcuatiforme* Kindberg, *Hypnum arcuatum* Lindberg, *Hypnum arcuatum* var. *americanum* Renauld & Cardot, *Hypnum renauldii* Kindberg, *Stereodon patientiae* Lindberg. PALE PLAIT MOSS, LINDBERG'S HYPNUM MOSS.

Plants: pleurocarpous, light green to yellowish to brownish; leaves erect-spreading, loosely complanate, 1.0-2.5 mm long, falcate-secund at tips, oblong-ovate, gradually narrowed to a broad or narrow acumen, acute, decurrent, sometimes auriculate; margins plane, entire to serrulate at apices; costa short and double; upper cells linear, alar cells abruptly defined, quadrate to short-oblong in 2-4 rows along margins; sporophytes exserted, seta 25-40 mm long, capsules inclined, cylindric; dioicous. **Substrate(s):** mineral soil, tree bases (*Magnolia grandiflora*, *Nyssa*). **BITH Distribution:** BEAU, BECR, LNRC, MECR, TKCR, VCRC. **Representative Specimen(s):** PVR 138, 543, 596, 691, 780, 792.

Isopterygium Mitten, J. Linn. Soc., Bot. 12: 21, 497-500. 1869. **Etymology:** *iso* (equal) and *pterygion* (little wing). Like most of Mitten’s names, the meaning is obscure. Crum and Anderson (1981) suggested that it could refer to the fact that the lateral leaves are, in most species, somewhat spreading and flattened together in two indistinct rows.

Isopterygium tenerum (Swartz) Mitten, J. Linn. Soc., Bot. 12: 499. 1869.

Synonym(s): *Hypnum albulum* Muller Halle, *Hypnum chapmanii* Duby, *Hypnum fulvum* Hooker & Wilson, *Hypnum micans* Swartz, *Hypnum tenerum* Swartz, *Isopterygium drummondii* H.A. Crum, Steere & L.E. Anderson, *Isopterygium fulvum* (A. Jaeger) Kindberg, *Isopterygium groutii* (Cardot & Theriot) Grout, *Isopterygium micans* (Swartz) Kindberg, *Isopterygium micans* var. *latifolium* (Grout) Schornherst, *Isopterygium micans* var. *minus* (Grout) H.A. Crum & L.E. Anderson, *Isothecium tenerum* (Swartz) Bridel, *Plagiothecium fulvum* A. Jaeger, *Plagiothecium groutii* Cardot & Theriot, *Plagiothecium micans* (Swartz) Paris, *Plagiothecium micans* var. *fulvum* (A. Jaeger) Paris, *Rhaphidostegium ludovicianum* Renauld & Cardot, *Rhynchostegium micans* (Swartz) Austin.

Plants: pleurocarpous, light whitish to yellow-green, occasionally brown or golden; leaves crowded to overlapping, 0.7-1.0 mm long, spreading or erect-spreading when wet, twisted, flexuose, and second at the tips when dry, oblong-lanceolate, gradually acuminate; margins entire to serrulate above; costa absent or costa double and short; median cells linear-fusiform, alar cells few and short-rectangular, quadrate, or transversely elongate; sporophytes exserted, seta 8-20 mm long, capsules horizontal to pendulous, ovoid-cylindric; autoicous. **Substrate(s):** mineral soil, tree bases (*Acer, Ilex opaca, Nyssa sylvatica, Pinus taeda, Quercus alba, Quercus falcata, Quercus nigra, Taxodium distichum, Triadica sebifera*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1602, 1656, 1870, 2201; PVR 118, 142, 214, 292, 428, 647, 676, 764.

Platygyrium Schimper, Bryol. Eur. 5: 95 (fasc. 46-47. Mon. 1). 1851. **Etymology:** *platys* (flat or broad) and *gyros* (circle) alluding to the wide annulus.

Platygyrium repens (Bridel) Schimper in P. Bruch and W.P. Schimper, Bryol. Eur. 5: 98. 458 (fasc. 46-47 Mon. 4. l.). 1851.

Etymology: *repens* (having creeping and rooting stems). **Synonym(s):** *Pterigynandrum repens* Bridel, *Pterigynandrum repens* var. *ascendens* (Schwagrichen) Grout, *Pterigynandrum repens* var. *orthoclados* Kindberg. FLAT BROCADE MOSS, OIL SPILL MOSS.

Plants: pleurocarpous, green to bronze; leaves ascending to imbricate, 0.8-1.3 mm long, erect-spreading when wet, erect or appressed when dry, ovate to oblong-lanceolate, acuminate, slightly decurrent; margins entire or nearly so, reflexed in the lower $^{1}/_{3}$-$^{2}/_{3}$; costa absent or short and double; cells rhomboidal, shorter at the apices, quadrate in several, well-marked, triangular, alar groups; sporophytes exserted, seta 10-25 mm long; capsules erect, cylindric; dioicous. **Substrate(s):** tree bases, stumps, and logs (Crum and Anderson 1981). **BITH Distribution:** BSCR, LARO. **Representative Specimen(s):** DM s.n.; AS 1394.

Taxiphyllum M. Fleischer, Musci Buitenzorg 4: 1434-1438. 1922. **Etymology:** *taxis* (arrangement) and *phyllon* (leaf) alluding to the leaf pattern.

Taxiphyllum taxirameum (Mitten) M. Fleischer, Musci Buitenzorg 4: 1435. 1922.

Synonym(s): *Isopterygium geophilum* (Austin) A. Jaeger, *Isopterygium taxirameum* (Mitten) A. Jaeger, *Plagiothecium geophilum* (Austin) Grout, *Rhynchostegium geophilum* Austin, *Stereodon taxirameus* Mitten, *Taxiphyllum geophilum* (Austin) M. Fleischer. YEW LEAF MOSS, COMMON SCALE LEAF MOSS.

Plants: pleurocarpous, dark green to yellow; leaves adjacent to overlapping, 1.2-1.5 mm long; rigidly wide-spreading to squarrose and complanate, oblong-lanceolate, broadly and shortly acuminate, acute; margins plane or narrowly recurved, serrulate all around; costa absent, or costa short and double; median cells linear, distal cells rhombic, alar cells somewhat differentiated, long to short rectangular; sporophytes exserted, seta 8-12 mm long; capsules inclined, oblong-ovoid; dioicous. **Substrate(s):** decayed log. **BITH Distribution:** TKCR. **Representative Specimen(s):** LB 252 (SHST).

LEPTODONTACEAE

Forsstroemia Lindberg, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 19(10): 605. 1862.

Etymology: Johann Eric Forsström (1775-1824), Swedish clergyman, physician, and naturalist on St Barthélemy in the Lesser Antilles, who collected the type specimen of *Forsstroemia trichomitria*.

Forsstroemia trichomitria (Hedwig) Lindberg, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 19(10): 605. 1862.

Synonym(s): *Leptodon trichomitrius* (Hedwig) Sullivant & Lesquereux, *Leptodon trichomitrius* var. *floridanus* (Lindberg) Grout, *Leptodon trichomitrius* var. *immersus* (Sullivant & Lesquereux) Sullivant, *Pterigynandrum trichomitrion* Hedwig. FAN MOSS.

Plants: pleurocarpous, green to pale yellowish-brown; leaves crowded, 1.2-2.0 mm long, erect and somewhat plicate when dry, erect-spreading when wet,oblong-ovate to ovate-lanceolate, acute to short acuminate; margins entire to slightly serrulate at the apices; costa single, slender, extending past mid-leaf, or sometimes double to nearly lacking; upper cells oblong-fusiform, shorter distally, alar cells small, rounded-quadrate or transversely oblong and opaque in extensive groups extending up the margins to $^{1}/_{3}$ leaf length; sporophytes immersed to shortly exserted, seta 0.4-3.9 mm long; capsules erect, oblong-ovoid; autoicous. **Substrate(s):** tree trunks and bases (*Carpinus caroliniana, Carya, Celtis laevigata, Crataegus viridis, Fagus grandifolia, Liquidambar styraciflua, Magnolia grandiflora, Magnolia virginiana, Nyssa , Quercus alba, Quercus phellos, Ulmus americana*), woody vines (*Berchemia scandens*), and manmade substrates (concrete). **BITH Distribution:** BEAU, BECR, BSCR, CANY, LARO, LNRC, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1649; PVR 99, 135, 156, 220, 283, 375, 434, 591, 670, 688, 763.

LESKEACEAE

Haplocladium (Muller Halle) Muller Halle, Hedwigia 38: 149. 1899. **Etymology:** *haplos* (simple) and *kladion* (branchlet) referring to the once-pinnate branching.

Haplocladium microphyllum (Hedwig) Brotherus in H.G.A. Engler and K. Prantl, Sp. Musc. Frond. 269, plate 69, figs. 1-4. 1801.

Etymology: *micro* (small) and *phyllo* (leaf) in reference to the small leaves.
Synonym(s): *Hypnum microphyllum* Hedwig.

Plants: pleurocarpous, olive green to yellow green to brownish, stem and branch leaves somewhat differentiated; stem leaves loosely erect to flexuose or subsecund when dry, 0.55-1.3 mm long, ovate to ovate-lanceolate, gradually or abruptly long acuminate, biplicate at base; margins revolute below, sinuate-serrulate above; cells subquadrate to subrhombic or short rectangular, unipapillose over lumen; costa single, subpercurrent; branch leaves erect and often incurved, ovate-lanceolate, acuminate; paraphyllia few to numerous; sporophytes exserted, seta 15-30 mm long; capsules inclined to horizontal, oblong; autoicous. **Substrate(s):** soil, manmade substrate (concrete/masonry). **BITH Distribution:** BEAU, LARO, MECR. **Representative Specimen(s):** PVR 576, 692, 725.

Leskea Hedwig. Sp. Musc. Frond. 211-235, pl. 49-58; pl. 59, f. 1-5. 1801. **Etymology:** Nathanael Gottfried Leske (1751-1786) German botanist and professor of agricultural economy at Leipzig.

Key to the Species of *Leskea*

1.	Leaf apices rounded, obtuse, or broadly acute	*L. obscura*
1.	Leaf apices narrowly acute to acuminate	2
2(1).	Stem leaves > 0.8 mm long, margins plane....................................	*L. australis*
2.	Stem leaves < 0.8 mm long, margins at least somewhat revolute below	3
3(2).	Stem and branch leaves similar, erect spreading when moist, ovate to ovate lanceolate and biplicate below, obscurely bulging papillose	*L. gracilescens*
3.	Stem and branch leaves differentiated, spreading and subsecund at apices, acuminate and smooth to slightly biplicate, obscurely papillose	*L. polycarpa*

Leskea australis Sharp, Moss Fl. N. Amer. 3(4): 193. 1934.

Etymology: *austral* (southern) referring to the distribution of the species in the southern [southeast] United States. **Synonym(s):** *Leskea microcarpa* Schimper ex Sullivant.

Plants: pleurocarpous, dark green to brown; stem and branch leaves slightly differentiated, stem leaves distinctly longer than broad, 0.4-0.7 mm long, more slenderly acuminate than branch leaves, branch leaves 0.2-0.5 mm long, ovate-lanceolate, gradually acuminate to acute; margins plane, entire; costa single, strong, subpercurrent; cells irregularly quadrate-hexagonal, upper cells bulging-papillose abaxially; sporophytes exserted, seta 4-9 mm long; capsules erect, cylindric; autoicous. **Substrate(s):** tree bases and decayed logs (*Quercus* *nigra*). **BITH Distribution:** BEAU, CANY, LNRC. **Representative Specimen(s):** PVR 460, 594, 690.

Leskea gracilescens Hedwig, Sp. Musc. Frond. 222-223, pl. 56, f. 8-13. 1801.

Etymology: *gracilis* (slender, thin) presumably in reference to the slender stems. NECKLACE CHAIN MOSS.

Plants: pleurocarpous, dark green to brownish; leaves crowded, 0.6-0.8 mm long, rigid to somewhat incurved-erect when dry, erect-spreading when wet, ovate to ovate-lanceolate, acute to bluntly pointed, biplicate at the base; margins entire, irregularly revolute proximally; costa single, ending below apices; cells irregularly quadrate-hexagonal, obscurely bulging-papillose on both surfaces; sporophytes exserted, seta 5-8 mm long; capsules erect, oblong-cylindric; autoicous. **Substrate(s):** tree bases and trunks (*Ilex opaca*). **BITH Distribution:** VCRC. **Representative Specimen(s):** PVR 170.

Leskea obscura Hedwig, Sp. Musc. Frond. 223-224, pl. 57, f. 1-9. 1801.

Synonym(s): *Leskea cardotii* Kindberg, *Leskea obtusa* Renauld.

Plants: pleurocarpous, dark green to brownish; stem and branch leaves somewhat differentiated, stem leaves 0.9-1.2 mm long, rounded obtuse to acute or short acuminate, occasionally slightly biplicate, branch leaves loosely erect to slightly incurved when dry, spreading when moist, 0.4-0.8 mm long, elliptic to broadly oblong-ovate, not at all biplicate;

margins erect, entire; costa single, ending below apices; cells irregularly quadrate-hexagonal, indistinctly bulging-papillose abaxially; sporophytes exserted, seta 5-12 mm long; capsules erect, oblong-cylindric; autoicous. **Substrate(s):** tree bases and trunks (*Quercus falcata*). **BITH Distribution:** BEAU, LARO, NBJG. **Representative Specimen(s):** PVR 358, 693, 784.

Leskea polycarpa Hedwig, Sp. Musc. Frond. 225-226, 1801.

Etymology: *poly* (many) and *carpa* (fruit) in reference to the production of abundant sporophytes. **Synonym(s):** *Leskea arenicola* Best, *Leskea polycarpa* var. *paludosa* (Hedwig) Schimper. MANY-FRUITED LESKEA.

Plants: pleurocarpous, pale green to brownish; stem and branch leaves differentiated, stem leaves clearly longer than broad, 0.8-1.2 mm long, obliquely acuminate and subsecund at the tips, branch leaves remote to crowded, somewhat biplicate, 0.5-0.8 mm long, ovate-lanceolate, blunt or acute; margins entire, plane to recurved proximally; costa single, ending near the apices; cells irregularly quadrate-hexagonal, papillose abaxially; sporophytes exserted, seta 7-12 mm long; capsules erect, subcylindric; autoicous. **Substrate(s):** tree trunks and bases. **BITH Distribution:** BEAU, BSCR, LARO. **Representative Specimen(s):** DAK 2214, 3427; DM 7222.

LEUCOBRYACEAE

Leucobryum Hampe, Linnaea 13: 42. 1839. **Etymology:** *leukos* (white) and *bryon* (moss), clearly alluding to the typically almost white color (usually very pale green to bluishgreen).

Key to the Species of *Leucobryum*

1. Plants in low cushions; stems short (< 1 cm); limb of leaves shorter than sheath; leaves in cross-section with 2 layers of leucocysts above and below chlorocysts .... *L. albidum*
1. Plants in tall cushions; stems longer (>1-2 cm); limb of leaves longer than sheath; leaves in cross-section with 2-3 layers of leucocysts above and below chlorocysts .... *L. glaucum*

Leucobryum albidum (P. Beauvois) Lindberg, Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 20: 403. 1863.

Etymology: *albida* (white, pale) presumably referring to the whitish color of the leaves. **Synonym(s):** *Dicranum albidum* P. Beauvois. WHITE MOSS, CUSHION MOSS, WHITE CUSHION MOSS, COMMON WHITE MOSS, PINCUSHION MOSS, WHITE FORK MOSS, COMMON WHITE HAIR MOSS, BLUE MOSS.

Plants: acrocarpous, gray-green to whitish to yellow-gray when wet, 6-9 mm tall; leaves crowded to imbricate, 2-4 mm long, narrowed from an oblong-ovate base to a wide-spreading, subtubulose point, the point about as long as the base, apiculate; lamina very narrow and confined to the base of the leaf, margins entire; costa very broad, comprising most of the leaf above the shoulders, 2 layers of leucocysts above and below the central layer of chlorocysts; sporophytes infrequent, exserted, seta 8-12 mm long; capsules inclined; dioicous**. Substrate(s):** organic soil, manmade substrate (creosote railroad tie), tree bases and trunks (*Acer, Ilex opaca, Magnolia grandiflora*, *Magnolia virginiana*, *Nyssa sylvatica, Pinus taeda, Quercus, Taxodium* *distichum*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LNRC, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1658, 1862, 2203, 2164a; DM 7163; PVR 117, 137, 329, 362, 432, 543, 676, 766.

Leucobryum glaucum (Hedwig) Ångström, Summa Veg. Scand. 1: 94. 1845.

Etymology: *glaucum* (bluish gray) presumably in reference to the color of the leaves. **Synonym(s):** *Dicranum glaucum* Hedwig. LARGE WHITE MOSS, PINCUSHION MOSS.

Plants: acrocarpous, gray-green, to whitish or yellow-gray when wet, 2-9 cm tall; leaves 4-8 mm long, erect to erect-spreading from an oblong-obovate base (1.5-3.0 mm long), acute to apiculate; margins usually serrulate at the tip; costa with 5-6 irregular layers of leococysts (3 below and 2 above) the enclosed chlorocysts; sporophytes rare, exserted, seta 9-17 mm long; capsules inclined; dioicous. **Substrate(s):** organic soil. **BITH Distribution:** BECR, CANY, NBJG. **Representative Specimen(s):** DAK 1607, 1619, 2824.

LEUCODONTACEAE

Leucodon Schwäegrichen, Sp. Musc. Frond., Suppl. 1 (2): 1-3. 1816. **Etymology:** *leuco* (white) and *odon* (tooth) alluding to the pale peristome teeth.

Leucodon julaceus (Hedwig) Sullivant, Musci Allegh. 87 [Schedae 25] 1846.

Synonym(s): *Pterigynandrum julaceum* Hedwig. SOUTHERN LEUCODON.

Plants: pleurocarpous, dark green to yellow-brown; leaves closely imbricate, 1.0-1.3 mm long, erect and appressed when dry, wide-spreading when wet, broadly oblong-ovate, abruptly short acuminate, concave; margins plane to somewhat reflexed, entire except serrulate at extreme apices; costa absent; median cells oblong-rhomboidal to linear, distal cells papillose abaxially; sporophytes immersed to exserted, seta 2.5-8.0 mm long; capsules erect, oblong-ellipsoidal; dioicous. **Substrate(s):** decayed logs and stumps, tree trunks and branches (*Acer, Fagus grandifolia, Fraxinus pennsylvanica, Liquidambar styraciflua, Magnolia grandiflora, Magnolia virginiana, Quercus alba, Quercus nigra, Ulmus americana*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1869, 3109; AFR 275; PVR 121, 482, 600, 614, 661, 695.

MNIACEAE

Plagiomnium T.J. Koponen, Ann. Bot. Fenn. 5(2): 145-147, f. 14-15, 20, 31-32, 35-36, 41, 43, 44, 47, 60, 69, 78, 81, 98, 100. 1968. **Etymology:** *plagios* (oblique) and *mnion* (moss), alluding to the presence of plagiotropic stolons in most species, a feature which distinguishes the genus from *Mnium*.

Key to the Species of *Plagiomnium*

1. Leaf margin toothed nearly to the base, teeth 2-3 cells long; leaves long decurrent .... *P. ciliare*
1. Leaf margin weakly toothed distally or to ¾ of the leaf, teeth 1-2 cells long; leaves not decurrent .... *P. ellipticum*

Plagiomnium ciliare (C. A. Muller) T.J. Koponen, Ann. Bot. Fenn. 5(2): 146. 1968.

Synonym(s): *Bryum ciliare* Greville, *Mnium affine* var. *ciliare* Muller Halle. SABRE TOOTH MOSS.

Plants: acrocarpous, green to yellow-green, 3-9 cm tall; leaves distant to adjacent, 5-8 mm long, erect to spreading and strongly contorted when dry, spreading when wet, smaller below and becoming larger toward the apices of the stem, forming a terminal rosette in fertile stems, elliptic to broadly acute or rounded-obtuse, abruptly cuspidate, narrowly long-decurrent; margins bordered by 2-4 rows of linear cells, toothed nearly to the base, teeth single, 1-3 cells long; costa single, excurrent as a cuspidate point; upper median cells hexagonal to oblong-hexagonal in oblique rows; sporophyte exserted, seta 18-50 mm long; capsules pendulous, oblong-cylindric; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** CANY. **Representative Specimen(s):** DAK 3254.

Plagiomnium ellipticum (Bridel) T.J. Koponen, Ann. Bot. Fenn. 8(4): 367. 1971.

Synonym(s): *Mnium ellipticum* Bridel, *Mnium affine* var. *rugicum* (Laurer) Bruch & Schimper, *Plagiomnium rugicum* (Laurer) T.J. Koponen. MARSH THYME MOSS, ELLIPTIC MOSS, ELLIPTIC PLAGIOMNIUM MOSS.

Plants: acrocarpous, green to yellow-green, 2-5 cm tall; leaves crisped and contorted when dry, flat when wet, 2-6 mm long, broadly elliptic, ovate, orbicular, or oblong-elliptic, not decurrent, apices broadly rounded, obtuse, or occasionally retuse; margins weakly to moderately toothed distally or to 3/4 of the leaf length, teeth single, 1(2) cells long; costa single, percurrent to excurrent; median cells elongate to isodiametric, smaller near the margins, marginal cells in longitudinal rows and short-linear to rhomboidal; sporophytes exserted (often in clusters of 1-3), setae 18-45 mm long; capsules pendant, cylindric or oblong-cylindric; dioicous**. Substrate(s):** mineral soil and tree bases (*Carpinus caroliniana*, *Taxodium distichum*). **BITH Distribution:** BSCR, CANY, MECR, TKCR. **Representative Specimen(s):** PVR 320, 547, 605, 759.

Rhizomnium (Mitten ex Brotherus) T.J. Koponen, Ann. Bot. Fenn. 5(2): 142. 1968. **Etymology:** *rhiza* (root) and *gonima* (fruit), alluding to the fact that the sporophytes appear to arise from the 'root' of the plant.

Rhizomnium punctatum (Hedwig) T.J. Koponen, Ann. Bot. Fenn. 5(2): 143. 1968.

Synonym(s): *Mnium punctatum* Hedwig; *Rhizomnium punctatum* subsp. *chlorophyllosum* (Kindberg) T.J. Koponen. DOTTED THYME MOSS, RED PENNY MOSS.

Plants: acrocarpous, pale green to dark green to reddish, 1-5 cm tall; leaves distant, erect or spreading and somewhat contorted when dry, spreading when wet, congested near stem apices, 3-7 mm long, elliptic or obovate from a narrow base, apices broadly rounded to emarginate, usually ending in a short mucro; margins entire, strongly bordered by several rows of linear cells; costa single, percurrent, not confluent with the border; upper cells irregularly hexagonal to oblong-hexagonal; sporophytes exserted, seta 14-35 mm long; capsules pendulous, oblong-cylindric; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR. **Representative Specimen(s):** DAK 1819.

MYRINIACEAE

Schwetschkeopsis Brotherus, Nat. Pflanzenfam. 227/228[I,3]: 877-878, f. 643. 1907. **Etymology:** *opsis* (resembling) for its resemblance to the genus *Schwetschkea.*

Schwetschkeopsis fabronia (Schwägrichen) Brotherus in H.G.A. Engler and K. Prantl, Nat. Pflanzenfam. 227/228[I,3]: 878. 1907.

Synonym(s): *Helicodontium fabronia* Schwagrichen, *Leskea dentifulata* Sullivant, *Schwetschkea denticulata* (Sullivant) Cardot, *Schwetschkeopsis denticulata* (Sullivant) Brotherus. RAPUNZEL MOSS.

Plants: pleurocarpous, green to yellow-green; leaves crowded, erect to imbricate, loosely erect when wet, 0.5-0.7 mm long, ovate-lanceolate, acuminate; margins serulate all around; ecostate; upper cells oblong-rhomboidal, papillose abaxially from projecting cell ends, basal cells subquadrate in several rows; sporophytes exserted, seta 4-7 mm long; capsules erect, oblong-cylindric; phyllodioicous. **Substrate(s):** tree bases and trunks (*Acer, Carpinus caroliniana, Liquidambar styraciflua, Magnolia virginiana, Nyssa sylvatica, Quercus*). **BITH Distribution:** BSCR, HCRS, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** WDR 3569 (MO); PVR 121, 136, 221, 374, 516.

ORTHOTRICHACEAE

Orthotrichum Hedwig, Sp. Musc. Frond. 162-163. 1801. **Etymology:** *orthos* (upright) and *trichos* (hair), alluding to the more or less erect hairs on the capsules of most species.

Orthotrichum diaphanum Schrader ex Bridel, Muscol. Recent. 2(2): 29-30. 1801.

Etymology: *diaphanus* (transparent) in reference to the hyaline hair points. **Synonym(s):** *Orthotrichum garretii* Grout & Flowers. WHITE TIPPED BRISTLE MOSS.

Plants: acrocarpous, dark green to brownish or yellowish, 5-7 mm tall; leaves loosely erect and somewhat contorted when dry, 2-3 mm long, ovate to ovate-lanceolate, gradually acuminate to a smooth or serrulate, yellowish awn; margins revolute nearly to the base of awn; costa single, slender, excurrent into the awn; upper cells rounded-hexagonal, smooth or weakly 1-2 papillose, lower cells smooth and pale, rectangular toward the costa and quadrate toward the margin; sporophytes immersed to emergent, seta 0.7-1.0 mm long; capsules erect, oblong-cylindric. autoicous. **Substrate(s):** tree trunks. **BITH Distribution:** LARO. **Representative Specimen(s):** DD 25.

Schlotheimia, Bridel, Muscol. Recent. Suppl. 2: 16-22. 1812. **Etymology:** Ernst Friedrich von Schlotheim (1764–1832) a German magistrate, paleontologist, geologist, and an acquaintance of Bridel.

Schlotheimia rugifolia (Hooker) Schwägrichen, Sp. Musc. Frond., Suppl. 2. 150. 1824.

Etymology: *rugosus* (wrinkled or shrivelled) and *folium* (leaf) in reference to the waviness of the leaves. **Synonym(s):** *Orthotrichum rugifolium* Hooker.

Plants: pleurocarpous, reddish-brown to dark brown, 0.2-0.8 mm tall; leaves appressed to loosely appressed, erect, and spirally twisted when dry, wide-spreading when wet, rugose wet and dry, 1.4-1.6 mm long, oblong or oblong-lingulate, broadly acute and strongly apiculate; margins broadly reflexed and slightly crenulate above due to projecting cells; costa single, stout, excurrent into the apiculus; upper cells rounded-quadrate, basal cells linear; sporophytes exserted, seta 2.5-3.5 mm long; capsules erect, elliptic to cylindric; pseudoautoicous. **Substrate(s):** decayed logs and tree trunks (*Fagus grandifolia, Ilex opaca, Magnolia grandiflora*, *Magnolia virginiana*, *Quercus nigra*). **BITH Distribution:** BECR, BSCR, CANY, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 2162, 2498, 2562, 2794, 3104; PVR 539, 629.

POLYTRICHACEAE

Atrichum P. Beauvois, Mag. Encycl. 5: 329. 1804. **Etymology:** *a* (lacking) and *trichos* (hair) from the almost complete lack of hairs on the calyptra, unlike other genera in the Polytrichaceae. Originally the genus was named *Catherinea*, in honor of Yekaterina Alexeevna, or Catherine II, also known as Catherine the Great (1729-1796), Empress of Russia.

Atrichum angustatum (Bridel) Bruch & Schimper, Bryol. Eur. 4: 237 (fasc. 21-22 Monogr. 9), 1844.

Etymology: *angustatus* (narrow, small) in reference to the very narrow leaves and capsules. **Synonym(s):** *Atrichum angustatum* var. *plurilamellatum* (Jennings) Frye, *Atrichum macmillanii* (Holzinger) Frye, *Atrichum papillosum* (Jennings) Frye, *Atrichum xanthopelma*

(Müller Halle) A. Jaeger & Sauerbeck, *Polytrichum angustatum* Bridel. LESSER SMOOTHCAP, SLENDER STARBURST MOSS, CATHERINEA MOSS, LESSER SMOOTHCAP, ATRICHUM MOSS.

Plants: acrocarpous, yellowish-green, 10-20 mm tall; leaves imbricate, 3.5-7.0 mm long, oblong-lanceolate or narrowly oblong, acute, concave distally, undulate, toothed abaxially corresponding to the undulations; margins with mostly double, unicellular teeth; costa subpercurrent, coarsely toothed abaxially; lamellae 5-6, wavy, 5-14 cells high, obscuring $^1/_4$-$^1/_2$ of the leaf width in the upper $^1/_3$ of the leaf; cells irregularly isodiametric to somewhat broader than long; sporophytes exserted, seta 10-31 mm long; capsules suberect to inclined, cylindric; dioicous**. Substrate(s):** mineral soil. **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LOBL, LPIB, MECR, NBJG, TKCR, UNRC. **Representative Specimen(s):** DAK 1855, 2204, 2508, 3140, 3259; DM 7078; PVR 118, 269, 426, 543, 722, 778.

Pogonatum P. Beauvois, Mag. Encycl. 5: 329. 1804. **Etymology:** *pogonatos* (bearded) alluding to the densely hairy calyptra.

Key to the Species of *Pogonatum*

1. Leaves short (1.5-3.0 mm); lamellae numerous (25-39), each 9-12 cells high .... *P. brachyphyllum*

1. Leaves longer (2-4 mm); lamellae fewer (11-16), each 4-5 cells high .... *P. pensilvanicum*

Pogonatum brachyphyllum (Michaux) P. Beauvois, Prodr. Aethéogam. 84. 1805.

Etymology: *brachy* (short) and *phyllus* (leaved) in reference to the short leaves. **Synonym(s):** *Polytrichum brachyphyllum* Michaux. SHORT LEAVED HAIRCAP MOSS, SHORT LEAVED POGONATUM.

Plants: acrocarpous, dull green to red-brown, 0.2-0.3 mm tall, plants scattered among a persistent protonema; leaves erect-spreading and incurved when dry, spreading when wet, 1.5-3.0 mm long, broadly and bluntly pointed from an oblong base; margins entire; costa single, subpercurrent; lamellae 25-39, straight, 9-12 cells high; cells at and above shoulders incrassate, irregularly subquadrate; sporophytes exserted, seta 17-26 mm long; capsules suberect to inclined to almost horizontal, shortly cylindric, symmetric; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, CANY, NBJG. **Representative Specimen(s):** DAK 2819; DM 7184; PVR 521.

Pogonatum pensilvanicum (Hedwig) P. Beauvois, Mém. Soc. Linn. Paris 1: 461. 1822.

Etymology: named by Hedwig from a Muhlenberg collection made near Lancaster, Pennsylvania. **Synonym(s):** *Pogonatum brevicaule* (Bridel) P. Beauvois, *Pogonatum tenue* Rau & Hervey, *Polytrichum pensilvanicum* Hedwig. ALGAL HAIRCAP MOSS.

Plants: acrocarpous, dull green to red-brown, 2-6 mm tall, plants scattered among a persistent protonema; leaves moderately curved-contorted when dry, 2-4 mm long, abruptly acuminate from an oblong or oblong-ovate bases; margins irregularly notched-dentate from apices to the shoulders; costa single, percurrent; lamellae 11-16, straight, 4-5 cells high; cells at shoulders and above irregular, mostly subquadrate; sporophytes exserted, seta 10-35 mm; capsules erect to slightly inclined, cylindrical; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, LARO, NBJG. **Representative Specimen(s):** DAK 2513; PVR 542, 612.

Polytrichum Hedwig, Sp. Musc. Frond. 88. 1801. **Etymology:** *polys* (many) and *trichos* (hair) alluding to the hairy calyptra.

Polytrichum commune Hedwig Sp. Musc. Frond. 88. 1801.

Etymology: *communis* (common, ordinary) presumably in reference to the common occurrence of the species. **Synonym(s):** COMMON HAIRCAP MOSS.

Plants: acrocarpous, dark green to brownish, 4-45 cm tall; leaves erect or erect-spreading when dry, spreading and recurved when wet, 6-10 mm long, lance-acuminate from a narrowly ovate bases; margins erect, sharply serrate nearly to the sheaths; costa excurrent; lamellae 21-55, straight, 4-9 cells high, terminal cells somewhat to considerably broader than those below, distinctly notched, lamellae covering nearly all of the lamina above the shoulders; cells at the shoulders shortly oblate-oblong, cells of the sheathing base long-linear, yellow-brown becoming narrower and pale toward the sheath margin; sporophytes exserted, seta 50-90 mm long; capsules inclined to horizontal, 4 angled; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, NBJG, TKCR. **Representative Specimen(s):** DAK 1667, 1853, 2320.

POTTIACEAE

Barbula Hedwig, Sp. Musc. Frond. 115. 1801. **Etymology:** Diminutive (*ula*) and *barba* (beard), alluding to the hairy appearance of the peristome.

Barbula indica (Hooker) Sprengel var. ***indica***, Nomencl. Bot. 2: 72. 1824.

Synonym(s): *Barbula cancellata* Müller Halle, *Barbula cruegeri* Müller Halle. SMALL TWIST TEETH MOSS.

Plants: acrocarpous, yellow-brown to brown to blackish distally, yellow-brown to reddish-brown proximally, stems up to 1.2 cm tall; leaves firm when wet, long ovate to ligulate, acute to rounded, apiculate or muticous; margins plane to weakly recurved at mid-leaf; costa single, percurrent, doubly prorate abaxially, with single or bifid papillae, adaxial stereid band usually present; distal laminal cells quadrate; fruiting specimens rare in the flora area.
Substrate: mineral soil. **BITH Distribution:** LARO, TKCR. **Representative Specimen(s):** PVR 603, 753.

Syntrichia Bridel, J. Bot. (Schrader) 1800(2): 299. 1801. **Etymology:** *syn* (together, joined) and *trichos* (hair) alluding to the attachment of the bases of the hair-like peristome teeth to the inner membrane.

Key to the Species of *Syntrichia*

1. Costa excurrent as a long, smooth hyaline or yellowish awn .... *S. laevipila*

1. Costa percurrent, or excurrent as a short mucro .... *S. fragilis*

Syntrichia fragilis (Taylor) Ochyra, Fragm. Florist. Geobot. 37: 212. 1992.

Etymology: *frango* (break, shatter) presumably referencing the brittle nature of the leaves which are often broken or otherwise incomplete. **Synonym(s):** *Tortula fragilis* Taylor.

Plants: acrocarpous, dark to glaucous green, 0.5-3.0 cm tall; leaves erect-incurved and twisted arund the stem when dry, erect spreading when moist, 2.0-4.5 mm long, oblong-elliptic or oblong-ovate, obtuse to rounded, mucronate; margins recurved in lower 1/2, crennulate-lobed above; costa single, strong, red-brown, slightly excurrent, 1 stereid band; upper cells hexagonal, pluripapillose, papilla c-shaped, lower cells laxly rectangular, smooth; sporophytes exserted, seta 10-20 mm long; capsules erect to inclined, curved, long-cylindric; dioicous. **Substrate(s):** tree trunks. **BITH Distribution:** LNRC. **Representative Specimen(s):** DM 7168.

Syntrichia laevipila Bridel, Muscol. Recent. Suppl. 4: 98. 1819.

Synonym(s): *Syntrichia pagorum* (Milde) J. J. Amann, *Tortula laevipila* var. *meridionalis* (Schimper) Wijk & Margadant, *Tortula pagorum* (Milde) De Notaris. SMALL HAIRY SCREWMOSS.

Plants: acrocarpous, dark green or brownish, 2-5 mm tall; leaves incurved-appressed and twisted around the stems when dry, wide spreading when wet, 1.2-2.0 mm long, oblong or oblong-ovate, rounded and often retuse, abruptly awned; costa single, excurrent into the smooth, yellowish or hyaline awn, 1 stereid band; upper cells quadrate to hexagonal, pluripapillose, papilla c-shaped, lower cells sharply differentiated extending farther up margins than at costa; sporophytes shortly exserted, seta 5-9 mm long; capsules erect, short-cylindric; dioicous. **Substrate(s):** decayed log. **BITH Distribution:** CANY. **Representative Specimen(s):** DAK 3248.

Tortella (Lindberg) Limpricht, Laubm. Deutschl. 1: 520. 1888. **Etymology:** *tortus* (twisted) and diminutive suffix -*ellus* alluding to the characteristic twisting of the long peristome teeth.

Tortella humilis (Hedwig) Jennings, Man. Mosses W. Pennsylvania 96. 1913.

Etymology: *humilis* (low, small) in reference to the low growing nature of the plants. **Synonym(s):** *Barbula caespitosa* Schwägrichen, *Barbula humilis* Hedwig, *Tortella caespitosa* (Schwägrichen) Limpricht. TINY TORNADO MOSS.

Plants: acocarpous, green to yellow-green, to 5 mm tall (rarely 10 mm); leaves curled and contorted when dry, spreading when moist, 2.2-3.5 mm long, oblong-lanceolate, narrow to broadly acute, short apiculate, concave; margins flat to weakly and broadly undulate; costa single, short-excurrent, 2 stereid bands; upper cells quadrate to short rectangular, pluripapillose, proximal cells elongate, yellow-hyaline; sporophytes exserted, seta 7-18 mm long; capsules erect, cylindrical; autoicous. **Substrate(s):** tree bases and trunks. **BITH Distribution:** CANY, LARO. **Representative Specimen(s):** DAK 3423; PVR 407.

Weissia Hedwig, Sp. Musc. Frond. 64. 1801. **Etymology:** Friederich Wilhelm Weiss (1744–1826), botanist in Göttingen. His first name was Friederich on his birth certificate but Friedrich on his death certificate, and his surname was Weiß (= Weisz or Weiss) in German, but Weis in the Latinised form used in his doctoral dissertation, and presumably subsequently in his professional career. Thus *Weissia* is based on his German name but *Dicranoweisia* is based on his Latinised name.

Key to the Species of *Weissia*

1. Plants 2-5 mm high; leaves 1-2 mm; capsules operculate, yellowish, 0.7-1.2 mm long; mucro weak (1-5 cells long) .... *W. controversa*
1. Plants up to about 8.0 mm tall; leaves 2-4 mm; capsules inoperculate, orange-brown to red-brown, 0.8-1.5 mm long; mucro strong (7-10 cells long) .... *W. ludoviciana*

Weissia controversa Hedwig, Sp. Musc. Frond. 67. 1801.

Etymology: the name refers to the confusion in nomenclature and the disagreement by early bryologists. **Synonym(s):** *Gymnostomum rauanum* Austin, *Mollia viridula* (Withering) Lindberg, *Weissia andrewsii* E. B. Bartram, *Weissia brandegeei* Austin, *Weissia controversa* var. *australis* (Austin) Schornherst, *Weissia controversa* var. *longiseta* (Lesquereux & James) H. A. Crum, Steere & L. E. Anderson, *Weissia controversa* var. *wolffii* (Lesquereux & James) H. A.

Crum, Steere & L. E. Anderson, *Weissia curvicaulis* Bridel, *Weissia longiseta* Lesquereux & James, *Weissia microodonta* Hedwig, *Weissia viridula* var. *nitida* Renauld & Cardot, *Weissia wolffii* Lesquereux & James. GREEN TUFTED STUBBLE MOSS, PIGTAIL MOSS.

Plants: acrocarpous, green distally, brown to tan or yellow proximally, 2-5 mm tall; leaves curled and contorted when dry, erect-spreading to spreading when wet, 1-2 mm long, linear-lanceolate, narrowly acute and gradually apiculate; margins tightly involute above; costa single, shortly excurrent, 2 stereid bands (abaxial larger than adaxial); upper and median cells rounded to quadrate, differentiated across leaf from basal cells (generally not in a V-shaped line), papilla C-shaped; sporophytes exserted, seta 3-8 mm long; capsules erect, ellipsoidal to oblong-cylindric; autoicous**. Substrate(s):** mineral soil. **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LPIB, LOBL, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** CG 7256 (MO); DAK 1856; DM 7330; PVR 171, 290, 380, 468, 511, 520, 559, 602, 714.

Weissia ludoviciana (Sullivant) W. D. Reese & B. A. E. Lemmon, Bryologist 68: 282. 1965.

Etymology: the name refers to the type location in New Orleans, Louisiana. **Synonym(s):** *Astomum ludovicianum* (Sullivant) Sullivant, *Phascum ludovicianum* Sullivant.

Plants: acrocarpous, green to brownish, up to about 8 mm tall; leaves curled and contorted when dry, erect-spreading to spreading when wet, 2-4 mm long, long-lanceolate with a long-elliptic or rarrowly ovate base, acute, strongly mucronate; costa single, 2 stereid bands (abaxial larger than adaxial); upper cells hexagonal, papillose, lower cells laxly rectangular;

sporophytes immersed, seta 0.8-1.5 mm; capsules erect, ovoid; rhizautoicous. **Substrate(s):** mineral soil, manmade substrates (concrete, asphalt). **BITH Distribution**: MECR. **Representative Specimen(s):** PVR 504.

PTYCHOMITRIACEAE

Ptychomitrium Fürnrohr, Flora 12((2) Erganzungsblatter): 19. 1829. **Etymology:** *ptyche* (pleat) and *mitrion* (little cap) alluding to the plicate calyptra.

Ptychomitrium drummondii (Wilson) Sullivant, Manual 636. 1856.

Etymology: the type collection was made in Louisiana by Thomas Drummond (1793-1835), a Scottish botanical collector and the younger brother of the botanist James Drummond. **Synonym(s):** *Grimmia drummondii* Wilson.

Plants: acrocarpous, dark to blackish green to brown, up to about 1.5 mm tall; leaves erect to somewhat curled when dry, erect-spreading when wet, 1.5-2.2 mm long, linear-lanceolate, acute, not plicate; margins entire, minutely notched-serrulate near apices or in upper $^{1}/_{2}$; costa single, subpercurrent; cells rounded to subquadrate, bistratose toward the apices, along the margins and inward in longitudinal strips to the shoulders, basal cells oblong, yellowish; sporophytes exserted, seta 2-3 mm long; capsules erect, oblong to ovoid-cylindric; autoicous. **Substrate(s):** tree bases (*Liquidambar styraciflua, Quercus, Taxodium distichum*). **BITH Distribution:** BEAU, LARO, VCRC. **Representative Specimen(s):** DAK 1631; PVR 698, 801.

SEMATOPHYLLACEAE

Brotherella Loeske ex M. Fleischer, Nova Guinea 12(2): 119-121. 1914. **Etymology:** Viktor Ferdinand Brotherus (1849-1929) a Finnish teacher and bryologist who published *Musci Lapponiae Kolaensis* (1890) and *Die Laubmoose Fennoskandias* (1923), in addition to contribtions in *Musci of Die Naturlichen Pflanzenfamilien, Die Musci der Flora von Buitenzorg in Die Naturlichen Pflanzenfamilien,* and *Symbolae Sinicae.*

Brotherella recurvans (Michaux) M. Fleisher, Nova Guinea 12(2): 120. 1914.

Etymology: *recurvans* (recurved) in reference to the curved and inclined capsules. **Synonym(s):** *Leskea recurvans* Michaux, *Brotherella delicatula* (James) M. Fleischer, *Rhynchostegium delicatulum* James. SATIN MOSS.

Plants: pleurocarpous, green, yellow or golden; leaves erect-spreading and loosely complanate with falcate-secund tips, 1.0-1.4 mm long, oblong-ovate to oblong-lanceolate, slenderly acuminate; margins sharply serrulate above; ecostate or costa very short and double; upper cells linear, lower cells shorter and broader and yellow at the insertion, alar cells 4-8, conspicuously inflated and yellowish in a single transverse row with 1-2 rows of moderately inflated, hyaline cells above; sporophytes exserted, seta 7-17 mm long; capsules inclined to sub-erect, cylindric to oblong cylindric; dioicous. **Substrate(s):** decayed logs and tree trunks. **BITH Distribution:** LOBL. **Representative Specimen(s):** AS 1096.

Sematophyllum Mitten, J. Linn. Soc., Bot. 8: 5. 1864. **Etymology:** *semato* (marked) and *phyllon* (leaf) alluding to the distinctive alar cells that distinguish the genus.

Sematophyllum adnatum (Michaux) E. Britton, Bryologist 5: 65. 1902.

Etymology: *adnatus* (attached the whole length) in reference to the close attachment to a substrate. **Synonym(s):** *Leskea adnata* Michaux.

Plants: pleurocarpous, green to golden yellow; leaves crowded, erect or erect spreading, homomallous, 1.0-1.4 mm long, oblong-lanceolate, gradually acuminate; margins entire, reflexed; ecostate or costa very short and double; cells elongate-rhomboidal to linear fusiform, alar cells 4-6, inflated, in 1 row, supra-alar cells in 2 rows quadrate to short rectangular; sporophytes exserted, seta 4.5-8.0 mm long; capsules erect, oblong-cylindric; autoicous. **Substrate(s):** tree bases (A*cer, Betula nigra, Cornus florida, Fagus grandifolia, Liquidambar styraciflua, Magnolia grandiflora, Magnolia virginiana, Nyssa sylvatica, Persea borbonia, Pinus, Quercus nigra, Taxodium distichum*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LOBL, LPIB, MECR, NBJG, TKCR, UNRC. **Representative Specimen(s):** DAK 1813; DM 7076; PVR 119, 139, 158, 282, 338, 429, 456, 509, 669, 686.

SPHAGNACEAE

Sphagnum Linnaeus, Sp. Pl. 2: 1106. 1753. **Etymology:** *sphagnos*, an ancient name applied by Pliny to a lichen or moss, and by Johann Dillenius to the genus, and subsequently ratified by Linnaeus and Hedwig.

Key to the Species of *Sphagnum*

1.	Cortical cells of stems reinforced with spiral thickenings	2
1.	Cortical cells of stems not reinforced with spiral thickenings	5
2(1).	Chlorophyllous cells elongate, narrowly rectangular, lenticular, or trapezoidal in cross-section, exposed more less equally on both upper and lower surfaces of leaf	*S. perichaetiale*
2.	Chlorophyllous cells isosceles or equilaterally triangular in cross-section, the base exposed on the upper leaf surface	3
3(2).	Hyaline cells on outer surface of leaf with numerous pores (>4) ...	*S. henryense*
3.	Hyaline cells on outer surface of leaf without pores or with a single pore	4
4(3).	Chlorophyllous cells isosceles triangular in cross-section with a narrow exposure on the upper leaf surface	*S. palustre*
4.	Chlorophyllous cells eguilaterally triangular in cross-section, with broad exposure on upper leaf surface	*S. affine*
5(1).	Plants aquatic-submerged; hyaline cells very elongate and narrow with numerous pores in 1 or 2 rows	*S. macrophyllum*
5.	Plants terrestrial in wet or boggy sites but not submerged; hyaline cells shorter; pores numerous or few	6
6(5).	Pores on hyaline cells few, not crowded in rows along the commissures	*S. molle*
6.	Pores on hyaline cells numerous, crowded in rows along commissures	*S. lescurii*

Sphagnum affine Renauld & Cardot, Rev. Bryol. 12: 44. 1885.

Synonym(s): *Sphagnum imbricatum* subsp. *affine* (Renauld & Cardot) Flatberg, *Sphagnum imbricatum* var. *affine* (Renauld & Cardot) Warnstorf, *Sphagnum imbricatum* var. *laeve* Warnstorf. IMBRICATE BOG-MOSS.

Plants: acrocarpous, pale green to dull yellow-brown or golden brown; branch fascicles with 2 spreading and 2-3 pendant branches; outer stem cortical cells thinly fibrillose, 1-6(+) pores; stem leaves flat, oblong, rectangular, or ligulate, broadly rounded apices, margins finely fringed, 1.5-2.0 mm long, hyaline cells with 0-1 septate, without comb-fibrils; branch leaves broadly ovate to ovate-elliptical, 1.5-2.0 mm long, side walls of hyaline cells with comb-fibrils but often lacking, pores variable in number and shape; chlorophyllose cells equilateral-triangular with greater exposure on inner surface; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, TKCR. **Representative Specimen(s):** DAK 1835; PVR 229.

Sphagnum henryense Warnstorf, Hedwigia 39: 107. 1900.

Synonym(s): *Sphagnum henryense* var. *bartlettii* Warnstorf.

Plants: acrocarpous, green to pale green to often pinkish tinged; fascicles with 2 spreading and mostly 2 pendant branches; stem cortical cells with thin fibrils and 2-5 round pores; stem leaves to 2 mm long, ligulate with rounded finely fringed apices, hyaline cells as broad as long distally, becoming long and linear proximally; branch leaves broadly ovate, 2 mm or more long, concave-culcullate, hyaline cells variable in the number of pores; chlorophyllous cells narrowly isosceles-triangular with greater exposure on the inner surface; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** PVR 682.

Sphagnum lescurii Sullivant, Manual. (ed.2) 611. 1856.

Etymology: Charles Leo Lesquereux (1806-1889) a Swiss born paleobotanist and bryologist who, with William Starling Sullivant published *Musci Exsiccati Americani* (1856, 1865), and with Thomas Potts James, *Mosses of North America* (1884). **Synonym(s):** *Thelia asprella* var. *lescurii* (Sullivant) Renauld & Cardot. **Synonym(s):** *Sphagnum orlandense* Warnstorf, *Sphagnum plicatum* Warnstorf, *Sphagnum wieboldtii* H. A. Crum.

Plants: acrocarpous, green to pale yellow to golden-brown; fascicles with 2-3 spreading and 1-2 pendant branches; stem cortical cells aporose; stem leaves 0.9-2.0 mm long, broadly triangular-ligulate, obtuse to rounded apices, hyaline cells fibrillose, pores abundant on the outer surface at least near the apices, sometimes almost to the base; branch leaves as large as or larger than the stem leaves, oblong-ovate, pores of hyaline cells numerous, beadlike, in rows along the commissures on the outer surface; chlorophyllous cells more or less rectangular, with more or less equal exposure on both surfaces; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, BSCR, CANY, HCRS, LARO, NBJG, TKCR. **Representative Specimen(s):** DAK 1831; PVR 123, 295, 327, 334, 373, 458.

Sphagnum macrophyllum Bernhardi ex Bridel, Bryol. Univ. 1: 10. 1826.

Etymology: *macro* (large) and *phyllo* (leaf) presumably in reference to the long leaves. **Synonym(s):** *Isocladus macrophyllus* (Bridel) Lindberg, *Sphagnum macrophyllum* var. *burinense* W.S.G. Maas.

Plants: acrocarpous, deep green when wet, dark reddish-brown when dry; fascicles with 2-3 branches little differentiated into spreading and pendant forms; stem cortical cells aporose, without fibrils; stem leaves 0.8-1.0 mm long, broadly triangular, rounded, somewhat concave, hyaline cells undivided, without fibrils, with 1 to sometimes 2-5 pores on the outer surface; branch leaves long, 4.0-6.5 mm long, long-elliptic to lanceolate or linear-lanceolate, acute to acuminate, toothed and involute apices, hyaline cells long-linear, sinuate, with numerous pores on the outer surface near the commissures; chlorophyllous cells rectangular, with more or less equal exposure on both surfaces; dioicous. **Substrate(s):** water/aquatic. **BITH Distribution:** HCRS, LARO, TKCR. **Representative Specimen(s):** DAK 3106, 3122; PVR 259

Sphagnum molle Sullivant, Musci Allegh. 205 [Schedae 50]. 1846.

Synonym(s): *Sphagnum labradorense* Warnstorf, *Sphagnum tabulare* Sullivant. BLUSHING BOGMOSS.

Plants: acrocarpous, whitish to pale green or yellowish with occasional pink tinged; fascicles with 2 spreading and 1-2 pendant branches; stem cortical cells aporose and without fibrils; stem leaves 2.0-2.5 mm long, elongate-ligulate to ovate, flat, broadest above the middle and tapered to a truncate, broad, concave, toothed apices; branch leaves ovate, strongly involute-concave, 1.1-1.9 mm long, toothed across a narrow, truncate apices, margins denticulate because of resorption furrow; hyaline cells with 2-5 large, ellipsoidal pores along the commissures on the outer surface; chlorophyllous cells triangular with greater exposure on the inner surface; monoicous. **Substrate(s):** mineral soil. **BITH Distribution:** HCRS. **Representative Specimen(s):** PVR 240.

Sphagnum palustre Linnaeus, Sp. Pl. 2: 1106. 1753.

Etymology: *palustre* (marsh, swamp) presumably in reference to the habitat where the species grows. **Synonym(s):** *Sphagnum cymbifolium* (Ehrhart) R. Hedwig. BLUNT-LEAVED BOG MOSS, BLUNT LEAVED PEAT MOSS.

Plants: acrocarpous, green to pale green to often pinkish tinged; fascicles with 2 spreading and mostly 2 pendant branches; stem cortical cells with thin fibrils and 2-5 round pores; stem leaves to 2 mm long, ligulate with rounded finely fringed apices, hyaline cells as broad as long distally, becoming long and linear proximally; branch leaves broadly ovate, 2 mm or more long, concave-culcullate, hyaline cells variable in the number of pores; chlorophyllous cells narrowly isosceles-triangular with greater exposure on the inner surface; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, CANY, LARO, LPIB, NBJG, TKCR. **Representative Specimen(s):** DAK 1892; DML 1044 (DUKE); PVR 18; AS 1073; RW 1080 (DUKE); FW s.n. (MO).

Sphagnum perichaetiale Hampe, Syn. Musc. Frond. 1: 93. 1848.

Synonym(s): *Sphagnum brevicaule* Warnstorf, *Sphagnum cymbifolium* var. *ludovicianum* Cardot, *Sphagnum harperi* Warnstorf, *Sphagnum ludovicianum* (Cardot) Warnstorf.

Plants: acrocarpous, orange to yellowish-brown; fascicles with 2 spreading and 2-3 pendant branches; stem cortical cells faintly fibrillose, with 1 large pore or 1-3 smaller pores; stem leaves short-ligulate, up to 2 mm or more long, flat, rounded, concave culcullate, hyaline cells 1-2 septate; branch leaves broadly ovate, 2.0 mm or more long, pores in groups of 3 adjacent to corners with a few commissural pores; chlorophyllous cells rectangular, equally exposed on both surfaces; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** PVR 527.

THELIACEAE

Thelia Sullivant, Manual (ed. 2) 660-661. 1856. **Etymology:** *thele* (nipple) referring to mammilose leaf cells.

Key to the Species of *Thelia*

1.	Papilla simple	*T. hirtella*
1.	Papilla branched	*T. lescurii*

Thelia hirtella (Hedwig) Sullivant in A. Gray, Manual (ed. 2) 660. 1856.

Etymology: *hirtellus* (having minuscule hairs) in reference to the ciliate leaf margins. **Synonym(s):** *Pterigynandrum hirtellum* Hedwig. TRAIN TRACKS MOSS.

Plants: pleurocarpous, green to yellow-brown to grayish-yellow; stem leaves 1.0-1.3 mm long, strongly ciliate on the margins; branch leaves about 1.0 mm long, deltoid-ovate and abruptly narrowed to a short or long, flexuose apiculus; margins dentate all around, and usually spinose-ciliate especially toward the base; costa single, $^1/_2$ to $^3/_4$ leaf length; upper cells rhombic, unipapillose abaxially, papilla simple; paraphyllia numerous, polymorphous; sporophytes exserted, seta 5-12 mm; capsules erect, cylindric to ovoid-cylindric; dioicous. **Substrate(s):** tree bases and trunks (*Carpinus caroliniana, Fraxinus pennsylvanica, Liquidambar styraciflua, Magnolia grandiflora, Quercus, Salix nigra, Ulmus americana*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, LARO, LOBL, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1647, 1859, 2488, 2503, 3379; PVR 224, 234, 482, 720.

Thelia lescurii Sullivant in A. Gray, Manual (ed. 2) 660-661. 1856.

Etymology: Charles Leo Lesquereux (1806-1889) a Swiss born paleobotanist and bryologist who, with William Starling Sullivant published *Musci Exsiccati Americani* (1856, 1865), and with Thomas Potts James, *Mosses of North America* (1884). **Synonym(s):** *Thelia asprella* var. *lescurii* (Sullivant) Renauld & Cardot. LESCUR'S THELIA MOSS.

Plants: pleurocarpous, bluish to grayish-yellow to grayish-brown, branches stoutly julaceous wet and dry; leaves closely crowded, about 1.0 mm long, very concave, broadly deltoid-ovate, obtuse, abruptly short apiculate; margins not, or only somewhat, ciliate-papillose; costa single, $^{1}/_{2}$ to $^{3}/_{4}$ leaf length; cells rhombic nearly to the base, oblong near the costa and subquadrate at the basal angles, unipapillose abaxially, the papilla with 3-6 apical branches; paraphyllia few; sporophytes exserted, seta 8-15 mm; capsules erect, cylindric; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, CANY. **Representative Specimen(s):** DAK 2813; PVR 616.

THUIDACEAE

Cyrto-hypnum (Hampe) Hampe & Lorentz, Bot. Zeitung (Berlin) 27: 455. 1869. **Etymology:** *kyrtos* (curved or arched) and *hypnon* (moss) referring to the incurved dry leaves.

Cyrto-hypnum minutulum (Hedwig) W.R. Buck & H.A. Crum, Contr. Univ. Michigan Herb. 17: 66. 1990.

Synonym(s): *Hypnum minutulum* Hedwig, *Thuidium minutulum* (Hedwig) Schimper.

Plants: pleurocarpous, dark green, stems 2-5 cm long; stem leaves erect, to somewhat incurved when dry, wide-spreading to squarrose when wet, 0.3-0.55 mm long, oblong-ovate, gradually acuminate; margins papillose-crennulate, revolute below; costa single, $^{2}/_{3}$-$^{4}/_{5}$ leaf length; upper cells irregularly oblong to rounded-hexagonal, pluripapillose on both surfaces; branch leaves incurved-catenulate when dry, wide-spreading when wet, ovate, short acuminate, with 1-2 cells projecting as a hyaline, pluripapillose apices; leaves of secondary branches 0.2-0.25 mm long, the terminal cell pluripapillose but not projecting as an apiculus; paraphyllia numerous on stems and primary branches, 3(6) cells long, ending in a truncate, pluripapillose cell; sporophytes exserted, seta 7-21 mm long; capsules inclined to horizontal, oblong to oblong-ovoid; autoicous. **Substrate(s):** mineral soil, decayed logs. **BITH Distribution:** BEAU, CANY, NBJG. **Representative Specimen(s):** DAK 1603; PVR 381, 665.

Thuidium Bruch, Schimper & Guembel, Bryol. Eur. 5: 157 (fasc. 49-51. Mon. 1.). 1852.

Etymology: Genus *Thuja* (Cupressaceae) and the diminutive suffix (*idiom*), alluding to the resemblance of the feathery, branched fronds to the foliage of those trees.

Key to the Species of *Thuidium*

1. Stems loosely foliate, branches irregularly twice-pinnate; cells mostly pluripapillose .... *T. alleniorum*
1. Stems closely foliate; branches regularly twice-pinnate; cells strongly unipapillose .... *T. delicatulum*

Thuidium alleniorum Austin, Bull. Torrey Bot. Club 7(2): 16. 1880. **Etymology:** the original collection, from New Haven Connecticut, was made by John Allen. The collection was sent by his father, Professor O.E. Allen of Yale University, to Coe Finch Austin (1830-1880) who named the species in their honor (*Thuidium alenii* Austin). Since the species was dedicated to both of them the name should have been *T. alleniorum*. **Synonym(s):** *Thuidium glaucinum* var. *ludovicianum* Cardot. ALLENS THUIDIUM MOSS.

Plants: pleurocarpous, light green to yellowish, stems irregularly pinnately branched; stem leaves loosely erect or slightly incurved when dry, erect-spreading when wet, about 1.0 mm long, ovate, broadly sharp pointed, acute, not plicate, margins denticulate all around due to projecting cell ends; costa single, ending near apices; cells hexagonal, with 1-3 low, simple, papilla abaxially; paraphyllia abundant on stems, polymorphous, but mostly linear, curved and often branched, ending in a pluripapillose cell; sporophytes unknown; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, LARO, MECR, TKCR. **Representative Specimen(s):** WDR 3579 (MO); PVR 139, 570, 742.

Thuidium delicatulum (Hedwig) Schimper in Bruch, Schimper & Guembel, Bryol. Eur. 5: 164 (fasc. 49-51. Monogr. 8). 1852.

Etymology: *delicatulum* (delicate) in reference to the dainty appearance of the stems. **Synonym(s):** *Hypnum delicatulum* Hedwig, *Thuidium recognitum* var. *delicatulum* (Hedwig) Warnstorf. DELICATE TAMARISK MOSS, DELICATE FERN MOSS, DELICATE THUIDIUM MOSS, FERN MOSS, DELICATE FERN MOSS.

Plants: pleurocarpous, green to yellow-green, stems regularly 2-3 pinnately branched; stem leaves appressed when dry, erect-spreading when wet, 0.6-1.4 mm long, triangular-ovate, gradually to abruptly narrowed to a broad acumen, margins papillose-serrate; costa single, ending in the acumen well below the apices; cells oblong-hexagonal, unipapillose abaxially; branch leaves erect-spreading, to 0.5 mm long, acute, costa $^{1}/_{2}$-$^{2}/_{3}$ leaf length, cells rhombic, unipapillose abaxially; paraphyllia abundant on stems, polymorphous but mostly linear, curved, branched ending in a pluripapillose cell; sporophytes exserted, seta 15-45 mm; capsules suberect, cylindric; dioicous. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, BSCR, CANY, LARO, LPIB, TKCR. **Representative Specimen(s):** DAK 1648, 1854, 2167; PVR 246, 464, 779.

Keys and Species Descriptions - Marchantiophyta

1	Plants thalloid	Group A
1.	Plants with distinct leaves	2
2(1).	Leaves filamentous, divided to, or nearly to, the base; plants less than 1.0 mm wide	Group B
2.	Leaves broad, entire or with notched or bidentate apices; plants wider than 1.0 mm	3
3(2).	Underleaves present	4
3.	Underleaves absent	5
4(3).	Lobules present	Group C
4.	Lobules absent	Group D
5(3).	Lobules present	Group E
5.	Lobules absent	Group F

Group A

1.	Plants oval to irregularly ovoid; sex organs enclosed in erect “bottle shaped” sheaths	*Sphaerocarpos*
1.	Plants linear or ovoid; sex organs not enclosed in bottle shaped sheaths	2
2(1).	Plants broad to narrowly linear; branched or unbranched;	

	thallus with distinct convex midrib visible from upper surface; thallus (except midrib) one cell thick	3
2.	Plants linear or ovoid; midrib not visible from upper surface or if midrib visible, then midrib incised or concave; thallus several cell layers thick except at margin..................................	4
3(2).	Margins of thallus with elongated hair-like projections; plants corticulous	*Metzgeria*
3.	Margins of thallus entire; plants terrestrial	*Pallavicinia*
4(2).	Thallus wings highly undulate to appear somewhat leaf-like	*Petalophyllum*
4.	Thallus wings plane to slightly undulate or wavy.....................	5
5(4).	Thallus with an incised longitudinal groove; plants in loose rosettes	6
5.	Thallus without an incised longitudinal groove.........................	7
6(5).	Thallus linear, thin, and repeatedly branched; ventral scales absent or minute and not sword-shaped; plants terrestrial	*Riccia* (in part)
6.	Thallus broad, triangular wedge shaped to cordate; unbranched; ventral scales sword-shaped; plants floating aquatic or occasionally stranded on soil	*Ricciocarpos*
7(5).	Upper surface of thallus with an incised pattern surrounding individual pores	8
7.	Upper surface of thallus without an incised pattern or pores	9
8(7).	Air pores with several concentric rings of cells surrounding pore opening; epidermal cells with large trigones	*Reboulia*

8. Air pores without concentric rings of cells surrounding pore opening; epidermal cells without trigones, or trigones very small .... *Asterella*

9(7). Plants opaque; thallus with a midrib; ventral surface with dense covering of rhizoids .... *Dumortiera*

9. Plants somewhat translucent; thallus without a midrib; ventral surface with sparsely scattered rhizoids 10

10(9). Thallus wide (3-10 mm); thallus with few branches .... *Aneura*

10. Thallus narrower (<3 mm); thallus usually generously branched .... *Riccardia*

Group B

1. Leaves divided to the base into 2-3 filaments .... *Telaranea*

1. Leaves divided to within 2-3 cells of the base; broader.......... *Microlepidozia*

Group C

1. Apices of underleaves obtuse and entire .... *Porella*

1. Apices of underleaves obtuse to acute; cleft, bidentate, or toothed 2

2(1). Lobules, on at least some leaves, like an inverted cup attached to the leaf base by a short stalk .... *Frullania*

2. Lobules consisting of a short to long fold on the posterior margin of the leaf, without a short stalk 3

3(2). Leaves with 2-3 ocelli arranged side by side near the base of the leaf .... *Ceratolejeunea*

3. Leaves without ocelli 4

4(3).	Leaf cells with a single large oil body occupying much of the lumen	*Leucolejeunea*
4.	Leaf cells with multiple oil bodies per cell, or if single then not occupying much of the lumen	5
5(4).	Leaf cells with numerous (>25) small oil bodies	*Lejeunea*
5.	Leaf cells with fewer (<5) small or large oil bodies	6
6(5).	Oil bodies small and spherical	*Rectolejeunea*
6.	Oil bodies larger and botryoidal	*Cheilolejeunea*

Group D

1.	Leaf apices obtuse to rounded; margins entire	*Odontoschisma*
1.	Leaf apices acute to truncate or variously notched; margins toothed	2
2(1).	Leaves ligulate with numerous marginal teeth	*Plagiochila*
2.	Leaves ovate, orbicular, or quadrate but without marginal teeth	3
3(2).	Leaves distant to adjacent	*Cephaloziella*
3.	Leaves overlapping	4
4(3).	Leaf apices acute, shortly bidentate; underleaves bidentate to shortly toothed	*Calypogeia*
4.	Leaf apices truncate or shallowly retuse; underleaves long ciliate or vestigial	5
5(4).	Underleaves long ciliate; present along much of the stem	*Lophocolea*
5.	Underleaves minute or absent, occasionally present near the gynoecia	*Jamesoniella*

Group E

1.	Leaves with lobules on dorsal surface	*Scapania*
1.	Leaves with lobules on ventral surface	2
2(1).	Lobules rectangular to quadrate; plants epapillose	*Radula*
2.	Lobules ovate; some plants with papilla	*Cololejeunea*

Group F

1.	Plants with a ruffled appearance, stems with leaves crowded into a rosette; rhizoids deep purple	*Fossombronia*
1.	Plants with obvious stems and leaves more or less prostrate; rhizoids light brown, pink, or colorless	2
2(1).	Leaf apices obtuse to rounded	*Odontoschisma*
2.	Leaf apices acute, truncate, retuse, or toothed	3
3(2).	Leaves ligulate with marginal teeth	*Plagiochila*
3.	Leaves ovate, orbicular, or quadrate but without marginal teeth	4
4(3).	Leaves distant to adjacent	5
4.	Leaves overlapping	6
5(4).	Leaves strongly obliquely inserted, concave, longer than wide; leaves somewhat decurrent on stems	*Cephaloziella*
5.	Leaves obliquely to horizontally inserted, flat to slightly concave, about as long as wide; leaves not decurrent on stems	*Cylindrocolea*
6(4).	Cells without oil bodies	*Cephalozia*
6.	Cells with oil bodies present	7

7(6). Cells with few oil bodies (2-3) .... *Solenostoma*

7. Cells with several oil bodies (7-12) .... *Jamesoniella*

Keys to Species and Species Descriptions

ADELANTHACEAE

Odontoschisma (Dumortier) Dumortier, Recueil Observ. Jungerm. 19. 1835. **Etymology:** *odonto* (tooth) and *schisma* (split), in reference to the toothed mouth of the perianth.

Key to the Species of *Odontoschisma*

1. Plants with erect gemmiparous shoots present; marginal cells of leaves not differentiated (leaves not bordered) .... *O. denudatum*

1. Plants without erect gemmiparous shoots; marginal cells of leaves subquadrate to rectangular (leaves bordered) .... *O. prostratum*

Odontoschisma denudatum (Nees) Dumortier, Recueil Observ. Jungerm. 19. 1835.

Etymology: *denudare* (to strip or bare) referring to the denuded stem tips. **Synonym(s):** *Jungermannia denudata* Nees, *Jungermannia scalaris* var. *denudata* Martius, *Odontoschisma cavifolium* Stephani, *Odontoschisma guadalupense* Stephani, *Odontoschisma huebenerianum* Austin, *Odontoschisma sphagni* var. *denudatum* Massalongo, *Odontoschisma sphagni* var. *macrior* Meylan, *Odontoschisma subrotundifolium* Stephani, *Pleuroschisma denudatum*

Dumortier, *Sphagnoecetis communis* var. *macrior* Nees, *Sphangoecetis huebenaria* Rabenhorst. MATCHSTICK FLAPWORT.

Plants: leafy, yellow green to reddish brown, shoots 1.0-1.5 mm wide, often with erect gemmiparous shoots; leaves succubous, entire, ovate to circular, as wide as long, cells with large trigones; oil bodies large, granular, 2-3 per cell; underleaves absent or vestigial at stem apices; antheridia small, compact, arising from ventral stem; gynoecia on a short ventral branch. **Substrate:** decayed logs, organic soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** DM 7297.

Odontoschisma prostratum (Swartz) Trevisan, Mem. Reale Ist. Lombardo Sci., Ser. 3, Cl. Sci. Mat. 4: 419. 1877.

Etymology: *prostratus* (prostrate) presumably in reference to the growth form of the leafy shoots. **Synonym(s):** *Jungermannia prostrata* Swartz, *Pleuroschisma prostratum* (Swartz) Mitten, *Sphagnoecetis prostrata* (Swartz) Nees. PROSTRATE FLAPWORT.

Plants: leafy, in dark green, sparingly branched mats, shoots 1.5-2.0 mm wide; leaves succubous, slightly overlapping to imbricate, entire with a distinct border of subquadrate to rectangular cells that differ from the rounded intramarginal cells formed as a result of the thick walled trigones; oil bodies large, 2-4 per cell; underleaves absent or vestigial as slime papilla; rhizoids scattered along lower parts of the stem; antheridia on short ventral branches, bracts bilobed, closely overlapping in 7-12 pairs; archegonia short, ventral, bracts bilobed with a single lobe-like tooth on outer margin; perianth cylindrical-ovate and slightly contracted at apices, 3-

keeled, short ciliate at the mouth. **Substrate(s):** peaty soil, moist sand, rotten logs, and tree bases above the water line. **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, MECR, NBJG, TKCR, VCRC**. Representative Specimen(s):** DAK 1826, 1871, 2160, 2209, 2511; PVR 113, 134, 269, 330, 571, 766.

ANEURACEAE

Aneura Dumortier, Comment. Bot. 115. 1822. **Etymology:** *an* (lacking) and *neuron* (nerve) alluding to the lack of a midrib in the thallus.

Aneura pinguis (Linnaeus) Dumortier, Comment. Bot. 115. 1822.

Etymology: *pinguis* (fat), referring to the greasy appearance of the thallus. S**ynonym(s):** *Aneura sessilis* Sprengel, *Gymnomitrium pingue* Hüebener, *Gymnomitrium pingue* var. *angustum* Hüebener, *Jungermannia pinguis* Linnaeus, *Jungermannia pinguis* var. *angustior* Hooker, *Jungermannia rigida* Wallroth, *Metzgeria pinguis* Corda, *Riccardia blasiodes* Horikawa, *Riccardia fuscovirens* Lindenberg, *Riccardia pinguis* S. Gray, *Roemeria pinguis* var. *major* Raddi, *Roemeria pinguis* var. *media* Raddi, *Roemeria pinguis* var. *minor* Raddi, *Trichostylium affine* Corda in Sturm, *Trichostylium aneurium* Meyen in Muller, *Trichstylium pinguis* R.M. Schuster. GREASEWORT.

Plants: thalloid, opaque, green to yellow-green, flat, sparingly branched mats with a strong "greasy" luster, 0.5-1.5 cm wide and 5 cm long, without a midrib; margins crisp to undulate; thalli 10-15 cells thick medially, laterally 1-3 cells thick; rhizoids short and numerous on lower surface, colorless; dioecious, elongate, single or clustered, antheridial branches arise from beneath thallus margins, gynoecia arise from beneath the thallus margin on a short fleshy branch with archegonia embedded in the apices. **Substrate(s):** humus, organic soil, wet logs and branches. **BITH Distribution:** BSCR, CANY, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1821; PVR 802, 634, 350, 442. **Comments:** Typically closely attached to the substrate in dryer conditions and loosely in wetter sites. The fleshy texture, lack of a midrib, and opaque greasy sheen are good field indicators. This species exhibits a broad ecological amplitude as evidenced by its nearly cosmopolitan distribution, and the wide variety of habitats in which it occurs (Schuster 1992).

Riccardia S. Gray, Nat. Arr. Brit. Pl. 1: 679. 1821. **Etymology:** Most likely after Octavius Riccardi of Florence, who paid for the printing of Micheli's *Novum Plantarum Genera*.

Key to the Species of *Riccardia*

1.	Epidermal cells with 2 or more oil bodies; thallus cross-section flat dorsally	*R. jugata*
1.	Epidermal cells with no oil bodies, or 1-2 large oil bodies; thallus cross-section flat, plano-convex, or biconvex	2
2(1).	Plants monecious; ultimate branches of thallus broad (over 500 µm wide), 2-3 pinnately branched; thallus margins unistratose for 1(2) cells	*R. latifrons*

2.	Plants synoecious; ultimate branches of thallus narrower (250-550 µm wide), palmately branched; thallus margins unistratose for 2-3(4) cells	*R. multifida* subsp. *synoica*

Riccardia cf. ***jugata*** R.M. Schuster, J. Hattori Bot. Lab. 62: 305. 1987.

Plants: thalloid, 0.5-1.0 mm wide, more or less evenly thick to the margin, green to slightly yellow-green, prostrate, and irregularly pinnate; oil bodies 2-4, brown; green, ovoid gemmae produced at shoot tips; monoecious, antheridia embedded on the branch posterior to the archegonia. **Substrate(s):** wet wood and humus usually in very moist sites. **BITH Distribution:** BSCR, CANY, NBJG. **Representative Specimen(s):** DAK 1605, 1828, 1877.

Riccardia latifrons (Lindberg) Lindberg, Acta Soc. Sci. Fenn. 10: 513. 1875.

Synonym(s): *Aneura latifrons* Lindberg, *Aneura palmata* Hartman, *Aneura palmata* var. *major* Nees, *Riccardia japonica* Hattori.

Plants: thalloid, opaque, dark green segments, 0.8-1.2 mm wide and 5-8 mm long or more, ca. 0.2 mm thick, irregularly 1-2 pinnate and distally semi-palmately branched; margins unistratose for 1(2) cells; monoecious, androecia small and inconspicuous, with 2-4 pairs of antheridia sunken in discrete pits on the thallus surface, archegonia at the apices of short branches closely juxtaposed to antheridia. **Substrate(s):** organic substrates, typically decaying logs and cut ends of logs in sites where moisture is fairly constant (Schuster 1992). **BITH**

Distribution: TKCR. **Representative Specimen(s):** EB 1037. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Riccardia multifida subsp. ***synoica*** R.M. Schuster, J. Hattori Bot. Lab. 62: 319. 1987.

Etymology: the subspecies name clearly refers to the synoecious sexual condition. **Common Name(s):** MANY LOBED JUNGERMANNIA, COMB TOOTHED STRIPED LIVERWORT, PLUME BRANCH FLAT-LEAF LIVERWORT.

Plants: thalloid, green, prostrate to ascending, irregularly 1-2 pinnate to irregularly subpalmately branched; main branches slightly biconvex to flat above, 4-5 cells thick, 0.5-0.64 mm thick, margins rounded, pluristratose or occasionally unistratose for 2-3(4) cells; oil bodies lacking in epidermal cells, occasionally 1-2, opaque, orbicular to short-ovoid in hypodermal cells; gemmae infrequent, 2 celled; synoicous. **Substrate(s):** decayed tree stump. **BITH Distribution:** NBJG. **Representative Specimen(s):** DAK 1669.

AYTONIACEAE

Asterella P. Beauvois, Dict. Sci. Nat. 3: 257. 1805. **Etymology:** diminutive *astrum* (star), referring to the star-like shape of the archegoniophores when seen from above.

Asterella tenella (Linnaeus) P. Beauvois, Dict. Sci. Nat. 3: 258. 1805.

Synonym(s): *Fimbriaria mollis* Taylor, *Fimbriaria nigripes* Bischoff in Lehmann, *Fimbriaria tenella* Nees, *Fimbriaria tenella* var. *brachypus* Gottsche, Lindenberg, & Nees, *Fimbriaria tenella* var. *porphyrocephala* Bischoff, *Hypenantron molle* Trevisan, *Hypenantron tenellum* Trevisan, *Marchantia tenella* Linnaeus.

Plants: thalloid, prostrate, opaque green upper surface with purplish undersides and margins, 1.5-4.0 mm wide and 0.7-2.0 cm long, flattened when wet, the margins involute when dry exposing the purple undersides, margins slightly undulate; air pores open, on upper surface and surrounded by 2 concentric rings of cells; purple ventral scales present with 1-2 broad ovate appendages; rhizoids abundant, smooth and pegged forms; monoecious, antheridia embedded in the thallus as a small cluster posterior to the carpocephalum which arises from an apical notch of the thallus and is elevated on a stalk ca. 2 cm long, hemispheric to blunt conical, 1-4 lobed, upper surface smooth to slightly rugose. **Substrate(s):** mineral soil. **BITH Distribution:** LARO. **Representative Specimen(s):** GS 0816. **Comments:** The species was cited by both Bazan (1980) and Mueller (undated), however a voucher from either collector was not located. One voucher for the BITH was located in TAMU as referenced above.

Reboulia Raddi, Opusc. Sci. 2: 357. 1818. **Etymology:** Eugene de Reboul (1781-1851), Italian botanist in Florence.

Reboulia hemisphaerica (Linnaeus) Raddi, Opusc. Sci. 2(6):357. 1818.

Etymology: *hemisphaerii* (half-globe) presumably in reference to the hemispheric carpocephalum. **Synonym(s):** *Achiton quadratum* Corda, *Asterella fasciata* Trevisan, *Asterella hemisphaerica* P. Beauvois, *Asterella hemisphaerica* var. *fasciata* Lindberg, *Asterella javanica* Trevisan, *Asterella longipes* Mitten, *Asterella microcephala* Trevisan, *Fegatella hemisphaerica* Taylor, *Fegatella microcephala* Taylor, *Grimaldia hemisphaerica* Lindenberg, *Grimaldia madeirensis* Lindenberg, *Grimaldia ventricosa* Wallroth, *Marchantia barbata* Link in Weber, *Marchantia crinita* Michaux, *Marchantia fasciata* Myrin in Lindenberg, *Marchantia hemisphaerica* Linnaeus, *Otiona crinita* Corda, *Plagiochasma bisetulum* Stephani, *Plagiochasma queenslandicum* Stephani, *Reboulia charrieri* Douin, *Reboulia fasciata* Nees, *Reboulia hemisphaerica* var. *javanica* Schiffner, *Reboulia hemisphaerica* var. *longilanata* Lindberg & Arnott, *Reboulia hemisphaerica* var. *macrocephala* Massalongo, *Reboulia hemisphaerica* var. *microspora* Schiffner, *Reboulia hemisphaerica* var. *paroica* Massalongo & Carestia in Massalongo, *Reboulia javanica* Nees, *Reboulia longipes* Sande Lacoste, *Reboulia microcephala* Nees, *Reboulia occidentalis* Douin, *Reboulia sullivantii* Lehmann, *Strozzus hemisphaerica* Raddi. HEMISPHAERIC LIVERWORT

Plants: thalloid, opaque, light green, with purplish margins in flat patches or rosettes, 4-6 mm wide and up to 3 cm long, margins thin and crenulate; air-pore with 5-6 concentric rings of cells; ventral scales lunate in 2 rows, each with 2 narrow linear appendages; rhizoids numerous, long and of two types, smooth and pegged; monoecious, antheridia purple in a thickened, reniform to lunate pad on upper surface posterior to the carpocephalum; arising from an apical notch of the thallus on a 1-2.5 cm stalk the carpocephalum is hemispheric, with 4-6 lobes.

Substrate(s): mineral soil. **BITH Distribution:** MECR, TKCR. **Representative Specimen(s):** PVR 198, 524.

CALYPOGEIACEAE

Calypogeia Raddi, Jungermanniogr. Etrusca 31. 1818. **Etymology:** *kalyx* (flower or fruit covering) and *hypogaea* (underground), referring to the buried marsupium.

Key to the Species of *Calypogeia*

1.	Leaves noticeably longer than wide, 0.9-1.0 mm long; apices entire to shallowly bidentate	*C. fissa*
1.	Leaves 1-1.3x as long as wide, 0.75-1.2 mm long; apices uniformly sharply bidentate	*C. sullivantii*

Calypogeia fissa (Linnaeus) Raddi, Jungermanniogr. Etrusca 33. 1818.

Etymology: *fissus* (split, cleave, divide), referring to the teeth on the leaf tips. **Synonym(s):** *Calypogeia trichomanis* fo. *fissa* Bernet, *Calypogeia trichomanis* var. *fissa* De Notaris, *Cincinnulus calypogeia* K. Müller, *Cincinnulus sprengelii* Dumortier, *Jungermannia calypogeia* Raddi, *Jungermannia fissa* Scopoli, *Jungermannia sprengelii* Philipp von Martius, *Kantia calypogeia* (Martius) Trevisan, *Kantia fissa* Lindberg, *Kantia trichomanis* var. *fissa* Lindberg, *Kantia trichomanis* var. *sprengelii* Howe, *Mnium fissum* Linnaeus. COMMON POUCHWORT.

Plants: leafy, pale green, in flat creeping mats, 1.8-2.5 mm wide; leaves incubous, approximate to overlapping, ovate, longer than wide, apices bidentate; oil bodies 4-10, botryoidal; underleaves bilobed, 1.5-2.0 times wider than the stem, with a single obtuse tooth on each side; monoecious; androecia small, arising from axil of an underleaf; perigynium originating from underleaf axil and remaining buried in the substrate. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, CANY, MECR, TKCR. **Representative Specimen(s):** DAK 1842, 1871; PVR 543, 606.

Calypogeia sullivantii Austin, Hepat. Bor.-Amer. Exsicc. 19. 1873.

Etymology: William Starling Sullivant (1803-1873) American businessman and bryologist who studied at Yale University and active as a surveyor, as well as a private scientist. **Synonym(s):** *Calypogeia arguta* Sharp, *Calypogeia arguta* var. *sullivantii* Frye & Clark, *Kantia sullivantii* Underwood. SULLIVANT'S POUCHWORT.

Plants: leafy, green to pale green, in thin mats, 1.2-1.8 mm wide; leaves ovate with a bidentate, contracted apex, teeth sharp and often divergent; oil bodies 6-10, smooth, spherical; underleaves distant, divided almost to base with a narrow tooth on each side; monoecious; androecia short and pale, arising from underleaf axils; perigynium pendulous, on a short branch. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, BSCR, CANY, MECR, NBJG. **Representative Specimen(s):** DAK 1838, 1881, 2194; PVR 421, 571.

CEPHALOZIACEAE

Cephalozia (Dumortier) Dumortier, Recueil Observ. Jungerm. 18. 1835. **Etymology:** derived from *kephale* (head, end) and *ozos* (bud), referring to the headlike shape formed by the enlarged bracts and bracteoles.

Key to the Species of *Cephalozia*

1.	Leaf cells large (30-50 µm); leaves bidentate with converging lobes	*C. connivens*
1.	Leaf cells small (12-15 µm); leaves bidentate, lobes not converging	2
2(1).	Leaves distinctly decurrent, distant to adjacent, essentially orbicular, obliquely inserted and appearing horizontal	*C. lunulifolia*
2.	Leaves not decurrent, distant, obliquely inserted, rotund-quadrate to orbicular	*C. catenulata*

Cephalozia catenulata (Hübener) Lindberg, Contr. Fl. Crypt. As. 262 [Acta Soc. Sci. Fenn. 10:] 1872.

Etymology: *catenula* (little, small, or light chain), presumably in reference to the appearance of the stems and leaves. **Synonym(s):** *Cephalozia media* var. *nipponica* (Hattori) Amakawa, *Cephalozia nipponica* Hattori, *Cephalozia reclusa* Dumortier, *Cephalozia serriflora* Lindberg, *Cephalozia virginiana* Spruce, *Jungermannia bicuspidata* var. *ericetorum* Gottsche, Lindenberg & Nees, *Jungermannia catenulata* Hübener.

Plants: leafy, green to brownish thin patches, 0.4-0.6 mm wide; leaves succubous, distant to contiguous, oblique, subcircular to subquadrate, bilobed ca. 0.5 of their length, slightly decurrent along stem; lobes triangular and slightly connivent; leaf cells 12-15(25) µm; oil bodies absent; underleaves absent; dioecious; antheridia in axils of leaves; perianth on a short ventral branch, long, cylindrical, with a ciliate mouth; bracts bilobed, lobes triangular and dentate. **Substrate(s):** decaying logs. **BITH Distribution:** BECR, BSCR, CANY, HCRS, LARO, LOBL, MECR, TKCR, VCRC. **Representative Specimen(s):** DAK 1838, 1885; PVR 1, 108, 133, 192, 330, 428, 766.

Cephalozia connivens (Dickson) Lindberg, Contr. Fl. Crypt. As. 238 [Acta Soc. Sci. Fenn. 10:] 1872.

Etymology: *connivere* (tightly closed), presumably in reference to the connivent apices of the leaves. **Synonym(s):** *Blepharostoma connivens* Dumortier, *Cephalozia compacta* Warnstorf, *Cephalozia connivens* var. *compacta* Nichols, *Cephalozia multiflora* Lindberg, *Eucephalozia connivens* Schiffner, *Jungermannia connivens* Dickson, *Trigonanthus connivens* Hartman. FORCIPATED PINCERWORT.

Plants: leafy, green to pale green in thin mats, 0.9-1.0 mm wide, sparingly branched; leaves distant to continuous, succubous, oblique to horizontal and decurrent along the stem, orbicular, bilobed 0.3-0.4 of their length, lobes connivent at the tips; leaf cells large, 30-50 µm; underleaves absent; rhizoids few; monoecious; male bracts in series of 3-5 pairs on a short ventral branch near the gynoecial branch; perianth cylindrical, long exserted with a ciliate mouth. **Substrate(s):** logs, wet organic soil. **BITH Distribution:** BECR, BSCR, CANY, HCRS, LARO, NBJG, TKCR. **Representative Specimen(s):** PVR 293, 329, 416, 458, 514, 522, 558.

Cephalozia lunulifolia (Dumortier) Dumortier, Recueil Observ. Jungerm. 18 1835.

Etymology: *lunaris* (lunar or moon), referring to the moon shaped leaves. **Synonym(s):** *Cephalozia catenulata* var. *pallida* Spruce, *Cephalozia lunulaefolia* Dumortier, *Cephalozia media* Lindberg, *Cephalozia multiflora* Spruce, *Cephalozia pallida* Pearson, *Cephalozia symbolica* Breidler, *Eucephalozia lunulifolia* Delonge, *Eucephalozia media* Schiffner, *Jungermannia connivens* fo. *symbolica* Gottsche in Gottsche & Rabenhorst, *Jungermannia lunulifolia* Dumortier. MOON-LEAVED PINCERWORT.

Plants: leafy, pale green, sparingly branched, 0.4-0.6 mm wide; leaves, circular, succubous, distant to contiguous, oblique to horizontally inserted, decurrent, bilobed 0.3-0.4 of their length; lobes triangular and connivent; leaf cells small, 13-15 cells wide; oil bodies absent, underleaves absent; dioecious; antheridia in axils of bracts intercalary or forming a spicate branch; perianth on very short branch, fusiform, and gradually contracted to a crenulate mouth. **Substrate(s):** organic soil, logs. **BITH Distribution:** TKCR. **Representative Specimen(s):** PVR 133.

CEPHALOZIELLACEAE

Cephaloziella (Spruce) Schiffner, Recueil Observ. Jungerm. 18. 1835. **Etymology:** diminutive of *Cephalozia*, alluding to the small size of the plants.

Cephaloziella hyalina Douin, Mém. Soc. Bot. France 29: 77. 1920.

Etymology: *hyalinus* (glassy, hyaline, glassy-green) presumably in reference to the color of the plants. **Synonym(s):** *Cephaloziella gracillima* Douin, *Cephaloziella rambolitanensis* Douin.

Plants: leafy, light green, 0.3-0.5 mm wide; leaves remote to contiguous, widely spreading, transverse-succubous, bilobed over ½ of their length, lobes obtuse, 4-6 cells wide at the base, about as wide as the stem; oil bodies granular, 6-8 per cell; underleaves vestigial; monoecious. **Substrate(s):** mineral (sandy) soil. **BITH Distribution:** BEAU, BSCR, HCRS, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1822, 2209; PVR 118, 410, 437, 550. **Comments:**

Cylindrocolea R.M. Schuster, Bull. Natl. Sci. Mus. 12: 666. 1969.

Key to the Species of *Cylindrocolea*

1. Leaves horizontally inserted, remote to contiguous, bidentate, lobes suberect to weakly divergent, slightly unequal .... *C. obliqua*
1. Leaves obliquely inserted (45-60˚), distant to approximate, bidentate, lobes acute with an open to somewhat obtuse sinus ...... *C. rhizantha*

Cylindrocolea obliqua (Douin) R.M. Schuster, Nova Hedwigia 22: 167. 1971.

Synonym(s): *Cephalozia obliqua* Douin.

Plants: leafy, green to yellowish-brown to brown, 0.65-0.85 mm wide; leaves horizontally inserted, remote to contiguous, strongly laterally patent, oblong-oval to subquadrate; oil bodies small, glistening, 7-13 per cell; underleaves absent or vestigial; androecia and gynoecia on short postical branches. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, MECR, TKCR. **Representative Specimen(s):** PVR 437, 514, 550.

Cylindrocolea rhizantha (Montagne) Schuster, Nova Hedwigia 22: 175. 1971.

Synonym(s): *Cephalozia rhizantha* Trevisan, *Cephaloziella ludoviciana* Douin, *Clasmatocolea exigua* Stephani, *Jungermannia rhizantha* Montagne.

Plants: leafy, green to violet-, purplish-brown, 0.35-0.5 mm wide; leaves succubous, distant to approximate, bidentate, suborbicular to orbicular; oil bodies 3-7 per cell; underleaves lanceolate, 3-8 cells long; androecia on short ventral branches; gynoecia terminal or occasionally on short branches. **Substrate(s):** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 980. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

FOSSOMBRONIACEAE

Fossombronia Raddi, Magyar Bir. Moh-fl. 20. 1885. **Etymology:** Conte Vittorio Fossombroni (1754-1844), minister to the Grand Dukes Pietro Leopoldo and Ferdinand III, distinguished for his efforts to improve the agriculture of Tuscany by drainage and irrigation.

Fossombronia brasiliensis Stephani, Sp. Hepat. 1: 382. 1900.

Synonym(s): *Fossombronia angulosa* Austin, *Fossombronia braziliensis* Frye & Clark, *Fossombronia salina* Lindberg, *Fossombronia texana* sensu Frye & Clark.

Plants: leafy, bright, pellucid green, 3.0-4.5 mm wide and 10-15 mm long; leaves contiguous to imbricate, 1.0-1.5 mm long quadrate to subquadrate, margins strongly crispate; oil bodies 23-30 per cell; rhizoids ventral, deep purple; antheridia and archegonia dorsal, scattered and intermingled. **Substrate(s):** mineral (sandy) soil, wet tree bases. **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, MECR, TKCR, VCRC. **Representative Specimen(s):** DAK 1834, 2173; PVR 109, 227, 317, 483, 735, 762, 782. **Comments:** A very common liverwort. The highly crisped leaves give the plants a rather tightly "ruffled" appearance.

Petalophyllum Nees & Gottsche ex Lehmann, Nov. Stirp. Pug. 8: 29. 1844. **Etymology:** *petalon* (petal, lamellum) and *phyllon* (leaf), alluding to the lamellate lobes of the thallus.

Petalophyllum ralfsii (Wilson) Nees & Gottsche ex Lehmann, Nov. Stirp. Pug. 8: 30. 1844.

Etymology: John Ralfs (1807-1890), a British surgeon (1832-1837) and after retiring for health reasons studied botany (phycology). **Synonym(s):** *Codonia ralfsii* Dumortier, *Diplolaena lyellii* fo. *lamellata* Nees, *Fossombronia corbulaeformis* Trabut, *Jungermannia ralfsii* Wilson, *Petalophyllum lamellatum* Lindberg. PETALWORT.

Plants: thalloid (appearing leafy), light green as individuals or in small patches, 5-7 mm wide and 5-10 mm long, forming a fan-shaped to obcordate frond ascending from a subterranean "tuber"; oil bodies abundant, minute, 45-72 per cell; rhizoids colorless. **Substrate(s):** mineral soil. **BITH Distribution:** LARO, LPIB. **Representative Specimen(s):** DM s.n. **Comments:** At first glance, this species has the appearance of a robust *Fossombronia* sp. However, the presence of a tuberous "stem" and colorless rhizoids would easily differentiate between the two species. This species was reported by Mueller (undated), as *P. lamellatum* Lindberg, from the Lance Rosier and Little Pine Island Bayou Corridor units. However a search of TAES/TAMU did not produce a specimen.

GEOCALYCACEAE

Lophocolea (Dumortier) Dumortier, Recueil Observ. Jungerm. 17. 1835. **Etymology:** *lophos* (crest) and *koleos* (shield), referring to the toothed perianth mouth.

Lophocolea heterophylla (Schrader) Dumortier, Recueil Observ. Jungerm. 17. 1835.

Etymology: *heteros* (varied, different) and *phyllon* (leaf), referring to the variability in leaf shape. **Synonym(s):** *Jungermannia heterophylla* Schrader, *Lophocolea angustiflora* Stephani, *Lophocolea austini* Lindberg, *Lophocolea fissicalyx* Stephani, *Lophocolea hallii* Austin, *Lophocolea incisa* Lindberg, *Lophocolea macounii* Austin, *Lophocolea minor* Austin, *Lophocolea profunda* Nees. VARIABLE LEAVED CRESTWORT, CREST LIVERWORT, WOOD PALE MOSS.

Plants: leafy, yellow-green in thin creeping mats, freely branched, 1.0-1.8 mm wide; leaves succubous, approximate to overlapping or imbricate, transversely inserted, leaf shape is variable (see note below), younger leaves bilobed and rectangular, older leaves ovate, entire to emarginated; oil bodies 4-6 per cell, granular; underleaves deeply bilobed with a lateral tooth on each side; antheridia beneath the gynoecia, perianth trigonous, terminal on short or long branches. **Substrate(s):** mineral (sandy) soil, tree bases (Hicks 1992). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1824, 2201; PVR 112, 134, 281, 341, 386, 550. **Comments:** As noted by Hicks (1992) leaf shape is quite variable and is influenced by numerous environmental factors (substrate, moisture, etc.).

JUBULACEAE

Frullania Raddi, Jungermanniogr. Etrusca: 9. 1818. **Etymology:** Leonardo Frullani (d. 1841), Florentine Privy Counselor and director of the Tuscan Treasury and a colleague of Fossombroni.

Key to the Species of *Frullania*

1.	Leaves erect and squarrose when wet	*F. ericoides*
1.	Leaves not squarrose when wet	2
2(1).	Underleaves not, or only slightly, wider than the stem	*F. inflata*
2.	Underleaves noticeably wider than the stem	3
3(2).	Underleaves distant, not overlapping	*F. obcordata*
3.	Underleaves adjacent to somewhat overlapping-imbricate	4

4(3).	Outer margins of underleaves with 1-3 well defined angles or teeth	*F. brittoniae*
4.	Outer margins of underleaves entire, evenly rounded to slightly one-angled	5
5(4).	Lobules longer than wide	*F. kunzei*
5.	Lobules about as wide as long	*F. eboracensis*

Frullania brittoniae Evans, Trans. Connecticut Acad. Arts 10: 15. 1897.

Etymology: Elizabeth Gertrude Knight Britton (1857-1934) the first bryologist at the New York Botanical Garden, and wife of Nathaniel Lord Britton (1859-1934), both co-founders of the New York Botanical Garden. **Synonym(s):** *Frullania dilatata* Underwood.

Plants: leafy, dark green to brownish green, 0.8-1.5 mm wide; leaves imbricate, suborbicular, cordate to auriculate at base; lobules more or less as long as wide, galeate, as long as wide, close to the stem and partly hidden by the underleaves; stylus subulate, 2-6 cells long; underleaves distant, orbicular to obovate, bilobed to ca. ⅓ of their length, with lateral teeth; oil bodies (4-7) smaller in marginal cells and larger toward intramarginal cells; cell walls with trigones and intermediate thickenings; gynoecium on principal stem, androecium on short branches forming oblong spikes. **Substrate(s):** tree trunks (*Liquidambar*). **BITH Distribution:** LPIB, TKCR. **Representative Specimen(s):** EB 1093; DM s.n. **Comments:** Reported in the Little Pine Island Bayou Corridor by Mueller (undated), and was collected only once in the Turkey Creek Unit by Bazan (1980), however a voucher from neither collector was located.

Frullania eboracensis Gottsche, Nov. Stirp. Pug. 8: 14. 1844.

Etymology: *Eboraci* (York), referring to New York, the location of the first collection by Asa Gray. **Synonym(s):** *Frullania caucasica* Stephani, *Frullania dilatata* fo. *decidua* Grolle, *Frullania laeviscypha* Taylor, *Frullania microscypha* Taylor, *Frullania muscicola* Stephani, *Frullania nana* Taylor, *Frullania parvistipula* Stephani, *Frullania saxatilis* Lindenberg, *Frullania sullivantii* Austin, *Frullania virginica* Gottsche. COMMON FRULLANIA

Plants: leafy, dark green to dark reddish-brown, 0.8-1.0 mm wide; leaves distant to approximate, ovate-orbicular with a cordate base; lobule galeate, about as long as wide to somewhat longer; stylus short, lanceolate, 2-6 cells long; cell walls with trigones and thickenings; oil bodies 2-4 per cell; underleaves bilobed, distant, 1.0-1.5 times stem width, slightly longer than wide, occasionally with a lateral tooth; antheridia on spicate branches; archegonia obpyriform on main stems. **Substrate(s):** tree trunks (*Carpinus, Celtis, Cornus, Platanus, Quercus*) and woody vines (*Vitis*). **BITH Distribution:** BECR, HCRS, LARO, LNRC, MECR. **Representative Specimen(s):** PVR 122, 152, 207, 268, 593.

Frullania ericoides (Nees) Nees, Ann. Sci. Nat., Bot., sér. 2 12: 51. 1839.

Synonym(s): *Frullania aeolotis* var. *squarrosa* Montagne & Nees, *Frullania caledonica* Gottsche ex Stephani, *Frullania ericoides* var. *squarrosa* Montagne, *Frullania feana* Stephani, *Frullania laciniosa* Lehmann, *Frullania longispica* Stephani, *Frullania luzonensis* Stephani, *Frullania silvestris* Stephani, *Frullania squarrosa* Dumortier, *Frullania squarrosa* var. *ericoides*

Schiffner, *Frullania symmetrica* Stephani, *Frullania vesciculosa* Stephani, *Jungermannia ericoides* Nees, *Jungermannia squarrosa* Reinwardt, *Jungermannia tuberculata* Lehmann & Lindenberg,

Plants: leafy, dark green to reddish brown, 1.0-1.8 mm wide, leaves imbricate, clasping stems when wet and distinctly squarrose when wet; leaves orbicular to reniform; lobules galeate, separated about ¼ of their width from the stem; styus inconspicuous, 2-5 cells long; underleaves distant to slightly overlapping, 2.5-3.0 times wider than the stem, suborbicular, bilobed to about ⅓ their length, with or without an obtuse lateral tooth; leaf cells with trigones and intermediate thickenings; oil bodies 3-5 per cell; dioecious, gynoecia on short lateral branches; androecia elongate on short branches. **Substrate(s):** tree trunks (*Carpinus, Fagus, Liquidambar, Magnolia, Quercus, Triadica, Ulmus*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LNRC, LPIB, LOBL, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1850, 1875; PVR 154, 310, 367, 430, 482, 561, 587, 600, 663, 675. **Comments:** When the plants are wet the leaves are distinctly squarrose, an easily observed condition in the field.

Frullania inflata Gottsche, Syn. Hepat. 424. 1845.

Synonym(s): *Frullania catalinae* Evans, *Frullania cleistostoma* Schiffner & Wollny, *Frullania illyrica* Grolle, *Frullania mayebarae* Hattori, *Frullania mexicana* Lindenberg, *Frullania rappii* Evans, *Frullania saxicola* Austin, *Frullania virginica* Evans.

Plants: leafy, dark green to brownish green, 0.8-1.3 mm wide; leaves imbricate, orbicular, not cordate at base; lobules galeate, inflated, about as long as wide; stylus small;

underleaves 1.5-2.5 times as wide as the stem, about as long as wide, bilobed about ⅓, entire; leaf cells thick walled with trigones, intermediate thickenings absent; oil bodies 3-5 per cell; monecious; perianth on short to long branches; androecia on short branches below the perianth. **Substrate(s):** tree trunks (*Acer*, *Betula, Carpinus, Crataegus*, *Ilex, Nyssa, Pinus, Prunus, Quercus*, *Triadica*) and woody vines (*Berchemia*). **BITH Distribution:** BEAU, BECR, BSCR, LARO, LNRC, LPIB, MECR, NBJG, UNRC, VCRC. **Representative Specimen(s):** PVR 14, 167, 186, 209, 328, 340, 588, 663, 670, 789.

Frullania kunzei (Lehmann & Lindenberg) Lehmann & Lindenberg, Syn. Hepat. 449. 1845.

Synonym(s): *Frullania drummondii* Taylor, *Jungermannia kunzei* Lehmann & Lindenberg.

Plants: leafy, green to reddish brown or dark red brown, 0.8-1.0 mm wide; leaves imbricate, ovate-orbicular, not cordate at base; lobules inflated, cylindrical, longer than wide; stylus minute, 2-4 cells long; leaf cells with trigones, intermediate thickenings absent; oil bodies 3-4 per cell; underleaves distant, as wide as the stem or slightly wider, bilobed to ⅓, without lateral teeth; monoecious, male branches short and globose, perianth oblong. **Substrate(s):** tree trunks (*Acer, Betula, Carpinus, Crataegus, Ilex, Nyssa, Quercus, Taxodium, Triadica*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1849, 1875, 2211; PVR 3, 103, 144, 173, 339, 444, 574, 604, 770.

Frullania obcordata (Lehmann & Lindenberg) Lehmann & Lindenberg, Syn. Hepat. 447. 1845.

Synonym(s): *Frullania brunnea* Austin, *Frullania caroliniana* Sullivant, *Frullania caulisequa* Nees, *Frullania compsoptera* Spruce, *Frullania martiana* Gottsche, *Jungermannia caulisequa* Nees, *Jungermannia obcordata* Lehmann & Lindenberg.

Plants: leafy, red to green-brown, 0.8-1.2 mm wide; leaves imbricate, ovate; lobules inflated cylindrical, longer than wide; stylus small, triangular; underleaves distant to contiguous, divided about ½ of their length, margins entire; leaf cells with small trigones and a few intermediate thickenings; monoecious; androecium globose on short branches and located near and below gynoecia. **Substrate(s):** tree trunks (*Acer*, *Betula*, *Carpinus*, *Cornus*, *Crataegus*, *Ilex*, *Pinus*, *Quercus*, *Triadica)* and woody vines (*Berchemia*). **BITH Distribution:** BEAU, BECR, CANY, HCRS, LARO, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1882, 2211; PVR 105, 126, 173, 265, 353, 476, 574, 709, 770.

JUNGERMANNIACEAE

Jamesoniella (Spruce) Carrington, London Cat. Brit. Moss. (ed. 2) 25. 1881. **Etymology:** after the fern genus *Jamesonia* Hooker and Greville, which the plants resemble. *Jamesonia* was named after William Jameson (1796-1873) a Scottish physician and botanist who collected in South America (Ecuador).

Jamesoniella autumnalis (DeCandolle) Stephani, Sp. Hepat. 2: 92. 1901.

Etymology: *autumnus* (autumn), refers to the spores maturing in the fall. **Synonym(s):** *Aplozia autumnalis* Heeg, *Aplozia schraderi* Dumortier, *Aplozia subapicalis* Dumortier, *Jamesoniella autumnalis* Stephani, *Jamesoniella autumnalis* var. *nipponica* Hattori, *Jamesoniella nipponica* Hattori, *Jamesoniella subapicalis* Schiffiner, *Jungermannia autumnalis* DeCandole, *Jungermannia laevifolia* Lindberg, *Jungermannia moriokensis* Stephani, *Jungermannia raviana* Stephani, *Jungermannia subapicalis* Nees, *Jungermannia variablis* Stephani. AUTUMN ROUND LEAF LIVERWORT, AUTUMN EAR MOSS.

Plants: leafy, deep green, 2.0-3.5 mm wide; leaves obliquely inserted, succubous, imbricate, unlobed, entire, circular to sub-orbicular; leaf cells with trigones; oil bodies numerous (8-15 per cell); underleaves absent; rhizoids numerous on ventral surface of the stem; dioecious, androecia are spicate, gynoecia are terminal on the leading shoot. **Substrate(s):** mineral soil. **BITH Distribution:** CANY. **Representative Specimen(s):** PVR 318.

Solenostoma Mitten, J. Proc. Linn. Soc., Bot. 8: 51. 1865. **Etymology:** *solen* (pipe) and *stoma* (mouth), referring to the shape of the perianth mouth.

Key to the Species of *Solenostoma*

1. Marginal leaf cells differentiated (twice the size of adjacent cells); stems 0.9-1.3 mm wide; leaves orbicular, decurrent .... *S. gracillimum*

1. Marginal leaf cells not differentiated (about the same size as adjacent cells); stems 1.5-2.0 mm wide; leaves as wide as long or

longer, decurrent .... *S. hyalinum*

Solenostoma gracillimum (Smith) R.M. Schuster, Hepat. Anthocerotae N. Amer. 2: 972. 1969.

Synonym(s): *Aplozia crenulata* Dumortier, *Aplozia cristulata* Dumortier, *Aplozia gracillima* Dumortier, *Eucalyx crenulatus* Loeske, *Haplozia crenulata* fo. *gracillima* K. Müller, *Haplozia crenulata* K. Müller, *Jungermannia crenulata* Smith, *Jungermannia crenulata* var. *gracillima* Hooker, *Jungermannia genthiana* Hübener, *Jungermannia gracillima* Smith, *Mesophylla crenulata* Corbiere, *Nardia crenulata* Lindberg, *Nardia crenulata* var. *gracillima* Lindberg, *Nardia gracillima* Lindberg, *Plectocolea crenulata* Buch, Evans & Verdoorn, *Plectocolea crenulata* var. *gracillima* Frye & Clark, *Solemostoma crenulatum* Mitten, *Solenostoma crenulatum* R.M. Schuster, *Southbya crenulata* Bernet. BORDER LADLE MOSS.

Plants: leafy, pale green to reddish, 0.9-1.3 mm wide; leaves contiguous to imbricate, orbicular, not decurrent, with a distinct border of larger cells; oil bodies 2-3 per cell; underleaves absent; dioecious, androecium spicate, becoming intercalary, gynoecia terminal on stems and exserted above bracts. **Substrate(s):** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 552. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, as *Jungermannia gracillima* Smith, however a voucher was not located.

Solenostoma hyalinum (Lyell in Hooker) Mitten, Nat. Hist. Azores 319. 1870.

Synonym(s): *Aplozia hyalina* Dumortier, *Eucalyx hyalinus* Breidl, *Jungermannia biformis* Austin, *Jungermannia hyalina* Lyell, *Jungermannia schideliana* Hübener, *Mesophylla* *hyalina* Corbiere, *Nardia biformis* Lindberg, *Nardia hyalina* Carr, *Nardia muelleriana* Schiffiner, *Plectocolea hyalina* Mitten, *Solenostoma hyalinum* Mitten, *Solenostoma hyalinum* R.M. Schuster, *Southbya biformis* Austin, *Southbya hyalina* Husnot. SEASHORE LADLE MOSS.

Plants: leafy, pale to deep green or yellow-green, 1.5-2.0 mm wide; leaves imbricate, succubous, entire, as wide as long, orbicular to sub-reniform, marginal cells about the same size as intramarginal cells; leaf cells with trigones; oil bodies large, granular, 2-5 per cell; underleaves absent; dioecious, androecia intercalary, gynoecia terminal on stem. **Substrate(s):** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 983. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

LEJEUNEACEAE

Ceratolejeunea (Spruce) Schiffner, Hepat. (Engl.-Prantl) 118, 125. 1893. **Etymology:** *keratos* (horned) and the genus *Lejeunea*, alluding to the horn-like extensions of the keels of the perianth.

Ceratolejeunea laetefusca (Austin) R.M. Schuster, J. Elisha Mitchell Sci. Soc. 72: 306. 1956.

Synonym(s): *Ceratolejeunea guianensis* Fulford, *Ceratolejeunea integrifolia* Evans, *Lejeunea laete-fusca* Austin.

Plants: leafy, yellow-brown to olive brown, 0.78-1.1 mm wide; leaves contiguous to imbricate, ovate, entire, apices somewhat deflexed, ocelli 2-3 and side by side; lobules along postical margin of leaf, strongly inflated, with a short tooth; underleaves distant, obovate to orbicular, bilobed to ½ of their length; oil bodies 4-5 per cell; dioecious. **Substrate(s):** decayed logs. **BITH Distribution:** BECR, CANY. **Representative Specimen(s):** PVR 282, 523.

Cheilolejeunea (Spruce) Schiffner, Hepat. (Engl.-Prantl) 124. 1893. **Etymology:** *cheilos* (lip, edge) and the genus *Lejeunea*, referring to the fact that the perianth often becomes two-lipped upon the extrusion of the capsule at maturity.

Cheilolejeunea rigidula (Montagne) R.M. Schuster, Castanea 36: 102. 1971.

Synonym(s): *Ceratolejeunea rigidula* Stephani, *Cheilolejeunea duriuscula* Schiffner, *Cheilolejeunea madagassa* Stephani, *Cheilolejeunea principensis* Stephani, *Euosmolejeunea duriuscula* Evans, *Jungermannia serpyllifolia* Wilson & Hooker, *Lejeunea* (Cheilo-Lejeunea) *duriuscula* Spruce, *Lejeunea* (Eu-Lejeunea) *underwoodii* Stephani, *Lejeunea* (Euosmolejeunea) *duriuscula* Stephani, *Lejeunia austini* Lindberg, *Lejeunia duriuscula* Nees, *Lejeunia flexuosa* Lindenberg, *Lejeunia rigidula* Montagne, *Lejeunia sullivantiae* Austin.

Plants: leafy, olive to brownish green, 0.7-1.0 mm wide; leaves contiguous to slightly overlapping, broadly ovate, incubous; lobules on postical margin of leaf, small, inflated, less than half the size of the associated leaf, with an indistinct apical tooth; oil bodies large, botryoidal, 2-3 per cell; underleaves large, 3-4 times as wide as stem, bilobed to ⅓ of length, entire; dioecious. **Substrate(s):** decayed logs, tree bases and trunks (*Acer, Fagus, Liquidambar* *styraciflua, Magnolia grandiflora, Magnolia virginiana, Nyssa sylvatica, Persea borbonia, Quercus nigra*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 2178, 2811; PVR 128, 151, 610, 635, 652, 734.

Cololejeunea (Spruce) Schiffner, Hepat. (Engl.-Prantl) 121. 1893. **Etymology:** *kolos* (with parts missing, maimed) and the genus *Lejeunea*, alluding to the lack of underleaves.

Key to the Species of *Cololejeunea*

1.	Lobules crenulate on margins due to conically elevated cells	2
1.	Lobule not crennulate margined	3
2(1).	Lobules monomorphic, ovate	*C. biddlecomiae*
2.	Lobules dimorphic, some vestigial, some ovate	*C. contractiloba*
3(1).	Leaf apices tipped with hyaline “finger-like” cells	*C. cardiocarpa*
3.	Leaf apices without hyaline cells	4
4 (3).	Lobules vestigial, reduced to a linear fold along the base of the leaf	*C. setiloba*
4.	Lobules strongly inflated	*C. minutissima*

Cololejeunea biddlecomiae (Austin) Evans, Mem. Torrey Bot. Club 8: 168. 1902.

Synonym(s): *Cololejeunea biddlecomiae* Evans, *Lejeunea biddlecomiae* Austin ex Pearson, *Lejeunea calcarea* Sullivant, *Lejeunea echinata* Austin, *Physocolea biddlecomiae* Stephani.

Plants: leafy, yellow-green, 0.5-0.7 mm wide; leaves distant to contiguous, ovate with an acute to subacute apices, outer cells papillate; lobules large, inflated, ¼ the length of the associated leaf, apical teeth 1-2, cells with papilla; oil bodies 4-8 per cell; underleaves absent; monoecious. **Substrate(s):** tree bases (*Magnolia, Carpinus*). **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 914. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Cololejeunea cardiocarpa (Montagne) R.M. Schuster, Hedwigia 29: 91. 1890.

Synonym(s): *Cololejeunea jooriana* Evans, *Lejeunea jooriana* Stephani, *Lejeunea cardiocarpa* Spruce, *Lejeunea jooriana* Austin, *Lejeunia cardiocarpa* Montagne, *Leptocolea cardiocarpa* Evans, *Leptocolea jooriana* Evans.

Plants: leafy, yellow-green to light green, 0.6-1.0 mm wide; leaves incubous, imbricate, ovate with subacute apices that end in 1-several hyaline "finger-like" cells; lobules ovate ending in a subapical tooth 2 cells long; oil bodies granular, 5-6 per cell; underleaves absent; monoecious. **Substrate(s):** decayed logs, tree trunks, and bases (*Betula nigra, Carpinus caroliniana*), woody vines (*Berchemia scandens, Vitis*). **BITH Distribution:** BEAU, BECR, CANY, LARO, LOBL, LPIB, MECR, NBJG, TKCR. **Representative Specimen(s):** PVR 148, 209, 256, 268, 343, 388, 445, 663, 677.

Cololejeunea contractiloba Evans, Amer. J. Bot. 5: 131. 1918.

Plants: leafy, yellow-green to pale green, 0.2-0.4 mm wide; leaves distant to contiguous, ovate to ovate lanceolate, obliquely to wide spreading, sharply papillose on margins due to conically elevated cells; lobules dimorphic, vestigial (as a 2-celled basal fold) or inflated, ovate to broadly oblong, with an inconspicuous 1 celled apical tooth; oil bodies fusiform to sublinear, 3-5 per cell; autoicous. **Substrate(s):** tree bases (*Nyssa*). BITH **Distribution:** TKCR. **Representative Specimen(s):** PVR 136.

Cololejeunea minutissima (Smith) Schiffner, Hepat. (Engl.-Prantl) 122. 1893.

Synonym(s): *Aphanolejeunea minutissima* Horikawa,*Cololejeunea microlejeuneoides* Hattori, *Cololejeunea minutissima* Schiffner, *Cololejeunea orbiculata* Hattori, *Jungermannia minutissima* Smith, *Lejeunea heteromorpha* Spruce, *Lejeunia epiphyta* Gottsche, *Leptocolea microlejeuneoides* Horikawa, *Physocolea orbiculata* Herzog. MINUTE POUNCEWORT.

Plants: leafy, yellow-green, 0.25-0.5 mm wide; leaves distant to contiguous, incubous, ovate; lobule large and ovate, almost as large as the associated leaf, with a short apical tooth and prominent 2-celled subapical tooth; oil bodies3-5 per cell; underleaves absent; monoecious. **Substrate(s):** tree trunks and bases (*Betula nigra, Carpinus caroliniana, Pinus, Quercus nigra, Triadica sebifera*) and woody vines (*Berchemia scandens*). **BITH Distribution:** BEAU, BECR, CANY, LARO, LNRC, LPIB, MECR, NBJG. **Representative Specimen(s):** PVR 148, 210, 268, 388, 409, 592, 689, 670.

Cololejeunea setiloba Evans, Bryologist 16: 51. 1913.

Plants: leafy, yellowish to occasionally dark green, 0.5-0.7 mm wide; leaves distant to barely contiguous, ovate with a obtuse or narrowly rounded apices, margins regularly crenulate from projecting cells; lobules vestigial, reduced to a short linear fold 2-3 cells wide and 2-3 cells high, the free margin terminating in a single tooth 2-4 cells long; oil bodies 4-8 per cell; underleaves absent; autoecious. **Substrate(s):** tree trunks and bases (*Betula nigra, Quercus, Taxodium distichum*). **BITH Distribution**: LARO, MECR, TKCR**. Representative Specimen(s):** PVR 158, 258, 757.

Lejeunea Libert, Ann. Gén. Sci. Phys. 6: 372. 1820. **Etymology:** Alexandre Louis Simon Lejeune (1779-1858), a French physician and botanist in Verviers, author of *Flora des Environs de Spa*.

Key to the Species of *Lejeunea*

1.	Lobules large, covering ½ or more of the associated leaf	*L. ulicina*
1.	Lobules small, covering < ½ of the associated leaf	2
2(1).	Underleaves distant, intervals between underleaves 1-3 times the length of the underleaf	*L. cladogyna*
2.	Underleaves adjacent to distant, intervals between underleaves less than the length of the underleaf	3
3(2).	Under-leaves large (225-255 µm wide x 230 µm long), margins rounded; underleaf lobes 8-10 cells wide at base of sinus	*L. flava*
3.	Underleaves smaller (90-110 µm wide x 108-140 µm long),	

margins rounded to sharply unidentate; underleaf lobes 3-4 cells wide at base of sinus .... *L. laetivirens*

Lejeunea cladogyna Evans, Amer. J. Bot. 5: 134. 1918.

Plants: leafy, pale green, 0.5-0.8 mm wide; leaves slightly distant to loosely imbricate, broadly rotund-ovate to obovate or broadly obovate, longer than wide; lobules dimorphic vestigial (as a minute linear fold of 3-8 cells) or well developed (as small, inflated, broadly ovoid sac with a single, 1-celled, apical tooth); oil bodies 7-8 per cell; underleaves distant, intervals 1-3 times underleaf length, longer than broad, ovate to ovate orbicular, bilobed to ½ length; autoecious. **Substrate(s):** mineral soil and tree bases (*Persea borbonia*, *Pinus*). **BITH Distribution:** BSCR, CANY, MECR, TKCR. **Representative Specimen(s):** DAK 1829, 1862; PVR 547, 748.

Lejeunea flava (Swartz) Nees, Naturgesch. Eur. Leberm. 3: 277. 1838.

Synonym(s): *Eulejeunea flava* Schiffner, *Jungermannia flava* Swartz, *Jungermannia serpyllifolia* Sullivant, *Jungermannia tabularis* Sprengel, *Lejeunea americana* Evans, *Lejeunea cavifolia* Austin, *Lejeunea cavifolia* Frye & Clark, *Lejeunea expansa* Stephani, *Lejeunea flava* Spruce, *Lejeunea flava* subsp. *albida* Spruce, *Lejeunea flava* var. *convexiuscula* Pearson, *Lejeunea flava* subsp. *tabularis* (Sprengel) S.W. Arnell, *Lejeunea isomorpha* Gottsche, *Lejeunea serpyllifolia* var. *americana* Lindberg, *Lejeunea moorei* Lindberg, *Lejeunia flava* Nees, *Lejeunia tabularis* Sprengel, *Lejeunia thymifolia* Gottsche.

Plants: leafy, pale green to yellow-green, 0.9-1.3 mm wide; leaves incubous, more or less imbricate, ovate; lobules inflated, ovate with acute angulation at the apices, oil bodies 4-14 per cell; underleaves contiguous to imbricate, ovate to orbicular, bilobed to ½ of their length, rounded to the base, entire; monoecious. **Substrate(s):** soil, decayed logs, tree bases and trunks (*Betula nigra, Carpinus caroliniana, Fagus grandifolia*, *Ilex opaca, Magnolia grandiflora, Nyssa*, *Pinus taeda, Platanus occidentalis*, *Quercus alba, Quercus nigra, Taxodium distichum, Triadica sebifera*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LOBL, MECR, NBJG, TKCR, UNRC. **Representative Specimen(s):** DAK 1818, 1874, 2179, 2208; PVR 15, 225, 409, 427, 545, 600, 643.

Lejeunea laetivirens Nees et Montagne, Hist. Phys. Cuba, Bot., Pl. Cell. 469. 1842.

Synonym(s): *Eulejeunea laetevirens* Stephani, *Eulejeunea lucens* Stephani, *Microlejeunea laetevirens* R.M. Schuster, *Microlejeunea lucens* Spruce, *Microlejeunea lucens* Stephani, *Lejeunia cucullata* Sullivant, *Lejeunia glaucophylla* Gottsche, *Lejeunia laetevirens* Nees & Montagne, *Lejeunia lucens* Taylor, *Microlejeunea laetevirens* Evans, *Microlejeunea lucens* Evans.

Plants: leafy, dull green to whitish green, 0.3-0.5 mm wide; leaves incubous, distant to slightly imbricate, ovate with obtuse apices; lobules inflated, ovate, ⅓ to ½ the size of the associated leaf, with an obscure, single apical tooth; oil bodies granular, 4-10 per cell; underleaves ovate with narrow, acute to acuminate apices, often with a single lateral apiculation on each side; dioecious. **Substrate(s):** tree trunks (*Fagus grandifolia, Liquidambar styraciflua, Magnolia grandiflora, Quercus*). **BITH Distribution:** BSCR, CANY, LNRC, LOBL, LPIB, NBJG, TKCR. **Representative Specimen(s):** EB 929; PVR 314, 371, 457, 592, 720, 777. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Lejeunea ulicina (Taylor) Gottsche, Syn. Hepat. 387. 1845.

Synonym(s): *Jungermannia ulicina* Taylor, *Lejeunea ulicina* subsp. *ocellifera* R.M. Schuster, *Lejeunia bullata* Taylor, *Lejeunia punctiformis* Taylor, *Lejeunia ulicina* Taylor, *Microlejeunea africana* Stephani, *Microlejeunea ocellifera* S.W. Arnell, *Microlejeunea punctiformis* Stephani, *Microlejeunea ulicina* Evans.

Plants: leafy, pale green to yellowish, 0.25-0.35 mm wide; leaves incubous, distant, ovate; lobules strongly inflated, almost the same size as the associated leaf, with a single, 1-celled, elongate tooth; oil bodies granular, 2-3 per cell; underleaves remote, divided near to the base; dioecious. **Substrate(s):** tree trunks. **BITH Distribution:** NBJG. **Representative Specimen(s):** PVR 356.

Leucolejeunea Evans, Torreya 7: 225. 1907. **Etymology:** *leukon* (white) and *Lejeunea*, alluding to the pale color of the plants.

Key to the Species of *Leucolejeunea*

1.	Lobules short, less than ½ the length of the associated leaf; recurved lobule and leaf margins discontinuous	2
1.	Lobules long, greater than ½ the length of the associated leaf;	3

recurved lobule and leaf margins more or less continuous ....

2(1). Lobule apex blunt with a single, one celled tooth .... *L. clypeata*

2. Lobule apex sharp with a single, 3-8 celled tooth .... *L. unciloba*

3(1). Leaves strongly and continuously recurved from the tip and along the posterior margin; lobules continuous with recurved leaf margin; apical tooth short to long but not recurved and touching the keel .... *L. xanthocarpa*

3. Leaves less strongly recurved but continuous with lobules; apical tooth long, recurved and often touching the keel .... *L. conchifolia*

Leucolejeunea clypeata (Schweinitz) Evans, Torreya 7: 227. 1907.

Synonym(s): *Archilejeunea clypeata* Schiffner, *Jungermannia clypeata* Schweinitz, *Jungermannia transversalis* Schweinitz, *Lejeunea* (Archi-Lejeunea) *clypeata* Spruce, *Lejeunia calyculata* Taylor, *Lejeunia carolinensis* Montagne, *Lejeunia clypeata* Sullivant, *Lejeunia dorotheae* Lehmann, *Leucolejeunea clypeata* Evans, *Phragmicoma clypeata* Nees, *Symbiezidium calyculatum* Trevisan.

Plants: leafy, glaucous green, 0.8-1.2 mm wide; leaves overlapping to imbricate, incubous, ovate-oblong and slightly falcate; lobules ovate to triangular-ovate, attached for less than ½ of its length; oil bodies large, granular, 1 per cell and occupying much of the lumen; underleaves distant to imbricate, circular to slightly obovate, entire; monoecious.

Substrate(s): soil, tree trunks and bases (*Acer rubra, Betula nigra, Carpinus caroliniana, Crataegus viridis, Fagus grandifolia, Ilex opaca, Ilex vomitoria, Liquidambar styraciflua,* *Magnolia grandiflora, Magnolia virginiana, Nyssa sylvatica, Pinus, Quercus alba, Quercus nigra, Taxodium distichum, Triadica sebifera*), woody vines (*Berchemia scandens*). **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, LOBL, LPIB, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1620, 1654, 1875; PVR 110, 129, 146, 173, 338, 431, 695, 669, 757.

Leucolejeunea conchifolia (Evans) Evans, Torreya 7: 229. 1907.

Synonym(s): *Archilejeunea conchifolia* Evans.

Plants: leafy, glaucous to whitish green, 0.9-1.2 mm wide; leaves incubous, imbricate, ovate, margin inrolled and continuous with the lobules; lobules elongate-ovate, with a downcurved, 3-6 celled tooth at the apices; oil bodies large, botryoidal, 1 per cell; underleaves circular to slightly reniform, contiguous to overlapping-imbriacte; monoecious. **Substrate(s):** tree bases and trunks (*Acer, Carpinus caroliniana, Cyrilla racemiflora, Fagus grandifolia, Ilex opaca, Ilex vomitoria, Liquidambar styraciflua, Magnolia grandiflora, Pinus, Quercus nigra, Taxodium distichum, Triadica sebifera*). **BITH Distribution:** BEAU, BSCR, CANY, HCRS, LARO, LOBL, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1849, 1890; PVR 119, 143, 250, 353, 569, 689, 711.

Leucolejeunea unciloba (Lindenberg) Evans, Torreya 7: 228. 1907.

Synonym(s): *Archilejeunea sellowiana* Stephani, *Archilejeunea unciloba* Schiffner, *Lejeunea* (Archilejeunea) *florentissima* Spruce, *Lejeunea* (Archilejeunea) *unciloba* Spruce, *Lejeunia unciloba* Lindenberg, *Leucolejeunea knysnana* S. Arnell, *Leucolejeunea sellowiana* Stephani, *Leucolejeunea unciloba* Evans.

Plants: leafy, glaucous green, 1.5-2.2 mm wide; leaves overlapping to imbricate, incubous, ovate; lobule ovate-lanceolate, inrolled, with a broad attachment, slightly falcate, ending in a downcurved, 2-3 celled tooth; oil bodies large, botryoidal, 1 per cell; underleaves circular to slightly ovate, contiguous to imbricate; monoecious. **Substrate(s):** mineral soil, tree trunks and bases (*Carpinus caroliniana, Carya aquatica, Crataegus viridis, Fagus grandifolia, Ilex opaca, Magnolia grandiflora, Magnolia virginica, Nyssa, Quercus alba, Triadica sebifera*) woody vines (*Berchemia scandens*). **BITH Distribution:** BEAU, BSCR, CANY, LIPB, LNRC, LOBL, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1847, 1884, 2211; PVR 127, 178, 375, 434, 585, 588, 771.

Leucolejeunea xanthocarpa (Lehmann & Lindenberg.) Evans, Torreya 7: 229. 1907.

Synonym(s): *Jungermannia xanthocarpa* Lehmann & Lindenberg, *Lejeunia xanthocarpa* Lehmann & Lindenberg, *Lejeunea* (Archi-Lejeunea) *xanthocarpa* Pearson, *Archilejeunea xanthocarpa* Schiffner, *Leucolejeunea xanthocarpa* Evans, *Leucolejeunea capensis* S. Arnell. COMMON WHITE-SCALE LIVERWORT

Plants: leafy, opaque gray-green, 1.0-1.7 mm wide; leaves imbricate, incubous, broadly ovate to oblong-ovate, strongly revolute; lobules, ovoid to fusiform, apical tooth variable from bluntly pointed to acuminate-falcate (3-5 cells long) with the apices often not visible due to the involute margin; oil bodies large, 1 per cell; underleaves imbricate, wider than long, orbicular to reniform, entire, rounded to broadly truncate-retuse at the apices; autoecious. **Substrate(s):** tree trunks (Schuster 1980). **BITH Distribution:** MECR. **Representative Specimen(s):** CG 342.

Rectolejeunea Evans, Bull. Torrey Bot. Club 33: 8. 1906. **Etymology:** *rectus* (fragile) and *Lejeunea*, in reference to the fact that the leaves in most of the species easily become broken off.

Rectolejeunea maxonii Evans, Bull. Torrey Bot. Club 39: 609. pl. 45: f. 17–27. 1912.

Plants: leafy, pale green to yellow-green, 0.5-0.7 mm wide; upright microphyllous branches commonly with many leaves missing; leaves distant to approximate, ovate to ovate-orbicular, narrowed at the insertion; lobules inflated, ovate, less than half the associated leaf length; oil bodies granular, 2-4 per cell; underleaves distant, small, bilobed, the lobes 2-4 cells wide and ending in a single distal cell; dioecious. **Substrate(s):** tree trunks and bases (*Carpinus caroliniana, Magnolia grandiflora, Magnolia virginiana, Nyssa sylvatica, Quercus*). **BITH Distribution:** BECR, BSCR, CANY, LARO, LOBL, NBJG, TKCR. **Representative Specimen(s):** PVR 224, 254, 268, 430, 629, 657, 794.

LEPIDOZIACEAE

Microlepidozia (Spruce) Jörgenson, Bergens Mus. Skr. 16: 303. 1835.

Microlepidozia sylvatica (Evans) Jörgensen, Bergens Mus. Skr. 16: 305. 1934.

Synonym(s): *Kurzia makinoana* Grolle, *Lepidozia exigua* Stephani, *Lepidozia silvatica* K. Muller, *Lepidozia sylvatica* Evans, *Microlepidozia makinoana* Hattori & Mizutani, *Mirolepidozia sylvatica* Jöergenson, *Telaranea silvatica* K. Muller. WOOD FINGERWORT.

Plants: leafy, dark green, 0.3-0.6 mm wide; leaves approximate to slightly imbricate, transverse-incubous, 3-4 lobed, divided nearly to the base (within 2-3 cells); lobes 2 cells wide at base and ending in a single cell distally; oil bodies absent; underleaves similar to leaves but smaller with 3 lobes; dioecious. **Substrate(s):** mineral soil. **BITH Distribution:** BSCR, HCRS. **Representative Specimen(s):** PVR 608, 621.

Telaranea Spruce ex Schiffner, Hepat. (Engl.-Prantl) 103. 1893. **Etymology:** *tela* (web) and *aranea* (spider or spider's web), alluding to the delicate cobweb-like appearance of the plants.

Telaranea nematodes (Gottsche ex Austin) M. A. Howe, Bull. Torrey Bot. Club 29: 284. 1902.

Synonym(s): *Blepharostoma antillarum* Bescherelle & Spruce, *Blepharostoma nematodes* Underwood, *Cephalozia nematodes* Austin, *Jungermannia nematodes* Gottsche, *Lepidozia chaetophylla* Spruce, *Lepidozia chaetophylla* var. *tenuis* Pearson, *Lepidozia nematodes* Spruce, *Telaranea chaetophylla* Spruce, *Telaranea nematodes* var. *antillarum* Howe, *Telaranea nematodes* Howe, *Telaranea nematodes* var. *longifolia* Howe. IRISH THREADWORT.

Plants: leafy, pale green to almost translucent, very delicate, 0.3-0.45 mm wide; leaves distant, filamentous, transverse-incubous, widespreading, divided to the base into 3-4 lobes;

lobes 2 celled at base and above base, uniserate for 4-8 cells; oil bodies few per cell; underleaves smaller than leaves, 2-3 lobed, lobes 2-3 cells long; monoecious. **Substrate(s):** mineral soil. **BITH Distribution:** BECR, BSCR, CANY, HCRS, LARO, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1824, 1879, 2194; PVR 108, 244, 329, 421, 571.

MARCHANTIACEAE

Dumortiera Nees, Edinburgh J. Bot. 63: 260. 2006. **Etymology:** Bathélemy (Charles Joseph) Dumortier (1797-1878) Belgian botanist and bryologist, an early champion of the classification of plants into natural orders. He was also a member of the Belgian Parliament.

Dumortiera hirsuta (Swartz) Nees s.l., Fl. Bras. Enum. Pl. 1: 307. 1833.

Synonym(s): *Dumortiera calcicola* Campbell, *Dumortiera hirsuta* var. *latior* Gottsche, Lindenberg, & Nees, *Dumortiera hirsuta* var. *trichopus* Spruce, *Dumortiera nepalensis* Nees, *Dumortiera trichocephala* Nees, *Dumortiera velutina* Schiffner, *Hygrophylla nepalensis* Taylor, *Marchantia trichocephala* Hooker. DUMORTIER'S LIVERWORT.

Plants: thalloid, dark green with a shiny, greasy appearance, 1-2 cm wide and up to 20 cm long, 0.5-0.6 mm thick, dichotomously branched, 10(+) cells thick; margins entire, with whitish hair-like scales; apices rounded and notched; air chambers absent; monoecious or (dioecious?). **Substrate(s):** mineral soil. **BITH Distribution:** CANY. **Representative Specimen(s):** DAK 2528.

METZGERIACEAE

Metzgeria Raddi, Jungermanniogr. Etrusca 34. 1818. **Etymology:** Johann Metzger (1771-1844), German copper engraver and art restorer from Staufen, Breisgau (Baden-Wurttemberg), a friend of Raddi.

Key to the Species of *Metzgeria*

1.	Thallus narrow (600-1000 µm wide); marginal hairs solitary, flexuous to straight, long (125-175 µm)	*M. furcata*
1.	Thallus broader (750-1200 µm wide); marginal hairs solitary, straight and often hooked distally, short (50-70 µm)	*M. uncigera*

Metzgeria furcata (Linnaeus) Dumortier, Naturalientausch 12: 654. 1829.

Synonym(s): *Blasia furcata* Fries, *Echinogyna furcata* Dumortier, *Echinomitrion furcatum* Corda, *Fasciola furcata* Dumortier, *Herverus furcatus* S.F. Gray, *Jungermannia furcata* Linnaeus, *Metzgeria flavovirens* Colenso, *Metzgeria furcata* Dumortier, *Metzgeria glabra* Raddi, *Metzgeria planiuscula* Spruce. FORKED VEILWORT.

Plants: thalloid, green to yellow-green, shoots simple with few (1-2) dichotomies, 0.4-1.0 mm wide; midrib distinct, 2-3 cells above and 2-3 below; margins and ventral midrib with sparse, straight, single hairs; marginal gemmae strap-like with few to no hairs; dioecious. **Substrate(s):** tree trunks (*Betula nigra, Magnolia grandiflora, Magnolia virginiana, Taxodium distichum*). **BITH Distribution:** MECR, TKCR. **Representative Specimen(s):** PVR 525, 545.

Metzgeria uncigera Evans, Ann. Bot. (London) 2: 276. 1910.

Plants: thalloid, green to pale green or yellowish-green, 0.6-2.0 mm wide, with dichotomies forming new branches; lamina 1 cell thick and 15-20 cells wide; midribs with 2 large cells above and below; marginal hairs single, often hooked; gemmae on thallus margins or clustered near the shoot apices, elliptical or strap-shaped; dioecious. **Substrate(s):** tree trunks (*Carpinus, Betula, Fagus, Quercus*). **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 933. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

PALLAVICINIACEAE

Pallavicinia Gray, Nat. Arr. Brit. Pl. 1: 775. 1821. **Etymology:** Possibly for Lazarus Pallavicini (1719-1785), Italian botanist and archbishop of Genoa, although others in his family were also naturalists.

Pallavicinia lyellii (Hooker) Carruthers, Nat. Arr. Brit. Pl. 1: 685, 775. 1821.

Etymology: Charles Lyell (1797-1875), a Scottish geologist, who first found the species in Hampshire, England. **Synonym(s):** *Blyttia lyellii* Gottsche, Lindenberg, & Nees, *Dilaena lyelli* Dumortier, *Diplolaena lyellii* Dumortier, *Diplomitrion lyellii* Corda, *Gymnomitrion lyellii* Huebener, *Hollia lyellii* Sullivant, *Jungermannia lyellii* Hooker, *Jungermannia oblonga* Schweinitz, *Jungermannia sinuata* Schweinitz, *Pallavicinia pilifera* Stephani, *Pallavicinius* *lyellii* Carruthers, *Plagiochila husnotii* Stephani, *Steetzia lyellii* Lehmann, *Symphyogyna schweinitzii* Montagne & Nees. VEILWORT.

Plants: thalloid, pure green, 4-5 mm wide, 3-4 cm long or longer, occasional furcate branching from ventral midrib; midrib prominent on dorsal surface; middle of the thallus 12-14 cells thick, lateral wings rapidly thinning to 1-3 cells at margin; rhizoids along ventral midrib but absent on wings; dioecious, antheridia on dorsal surface in 2 longitudinal rows, one on each side of the midrib, archegonia in a small round involucre of scales on the dorsal surface. **Substrate(s):** soil. **BITH Distribution:** BEAU, BECR, BSCR, CANY, HCRS, LARO, MECR, NBJG, TKCR, VCRC. **Representative Specimen(s):** DAK 1609, 1655, 1879, 2164, 2561; PVR 107, 180, 329, 730, 731.

PLAGIOCHILACEAE

Plagiochila (Dumortier) Dumortier, Recueil Observ. Jungerm. 14. 1835. **Etymology:** *plagios* (sideways, slanting) and *cheilos* (lip, edge), alluding to the oblique mouth of the perianth.

Key to the Species of *Plagiochila*

1.	Underleaves absent or vestigial; leaves continuous to slightly overlapping	*P. dubia*
1.	Underleaves clearly visible; leaves overlapping to imbricate	2
2(1).	Postical leaf-base cells elongated, thick walled, formed by enlarged trigones; underleaf segments narrow, more or less ciliate, each 1-2 cells wide; leafy propagula often present on	

postical leaf surfaces .... *P. ludoviciana*

2. Postical leaf-base cells more or less isodiametric, thin walled; trigones triangular, distinctly separated; underleaf segments broader, each 4-6 cells wide; leafy propagula present, but less conspicuous .... *P. miradorensis*

Plagiochila dubia Lindenberg et Gottsche, Syn. Hepat. 630. 1847.

Synonym(s): *Plagiochila austini* Evans, *Plagiochila floridana* Evans.

Plants: leafy, olive green to dull brownish green, 3.0-3.5 mm wide; leaves contiguous to imbricate, succubous, ovate-elongate, ventral decurrencies narrow, dorsal decurrencies long, margins with short, irregular teeth; oil bodies granular, 5-8 per cell; underleaves absent or rudimentary; dioecious. **Substrate(s):** tree bases (*Fagus, Magnolia*). **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 918. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Plagiochila ludoviciana Sullivant, Amer. J. Sci. Arts, ser. 2 1: 73. 1846.

Synonym(s): *Plagiochila aliena* Gottsche, *Plagiochila plicata* Lindenberg & Gottsche, *Plagiochila punctualis* Gottsche, *Plagiochila schiedeana* Gottsche, *Plagiochila schlimiana* Gottsche, *Plagiochila subcristata* Gottsche, *Plagiochila tunarum* Stephani, *Plagiochila undulifolia* Herzog.

Plants: leafy, light green to olive green, 2.5-4.5 mm wide; leaves, imbricate, succubous, long decurrent, ovate-triangular, leaf margins with multiple, uneven teeth; leaves form a ventral channel that at least partially hides the stem; leaf cells with large trigones; oil bodies ovoid to linear-ellipsoidal, 4-9 per cell; underleaves sporadic, rudimentary but distinct, with two acuminate lobes; dioeceous. **Substrate(s):** tree bases. **BITH Distribution:** CANY. **Representative Specimen(s):** DAK 3251.

Plagiochila miradorensis Gottsche, Mexik. Leverm. 31. pl. 10: f. 1-10. 1863.

Synonym(s): *Plagiochila ludovicina* Evans.

Plants: leafy, green to olive green, 2.5-4.0 mm wide; leaves imbricate, succubous, ovate-rectangular (although quite variable), dorsally and ventrally decurrent, margins with teeth, leaves forming a channel along ventral stem; oil bodies granular, 5-8 per cell; underleaves sporadic, but distinct, of slender ciliate segments. **Substrate(s):** tree bases (*Fagus grandifolia*). **BITH Distribution:** CANY. **Representative Specimen(s):** DAK 2816.

PORELLACEAE

Porella Linnaeus, Sp. Pl. 2: 1106. 1753. **Etymology:** *porus* (pore), coined by Dillenius in his *Historia Muscorum* of 1741 (believing the plant to be a moss with capsules in which the spores were released through pores in the side). Linnaeus likewise classified it as a moss. Scottish nurseryman and botanist James Dickson, a founding member of the Linnean Society, was the first to recognize *Porella* was a liverwort.

Key to the Species of *Porella*

1. Underleaves wider than stem; lobules broad and overlapping; on tree bases not subject to flooding .... *P. platyphylla*
1. Underleaves not or only slightly wider than stem; lobules ligulate and distant; on substrates subject to frequent inundation .... *P. pinnata*

Porella pinnata Linnaeus, Sp. Pl. 1106. 1753.

Etymology: *pinnatus* (pinnate). **Synonym(s):** *Bellincinia porella* Kuntze; *Cavendishia porella* Carruthers, *Jungermannia distans* Schweinitz, *Jungermannia porella* Dickson, *Madotheca involuta* Hampe, *Madotheca microrhyncha* Taylor ex Stephani, *Madotheca porella* Nees, *Madotheca sullivantii* Austin, *Madotheca wataugensis* Sullivant, *Porella pinnis obtusis* Dillenius, *Porella sullivantii* Underwood, *Porella wataugensis* Underwood ex Howe. PINNATE SCALEWORT.

Plants: leafy, green to blackish-green, 3-5 mm wide; leaves distant to contiguous-overlapping, ovate to rectangular, entire; lobules small, lingulate, appressed to the stems, entire; oil bodies smooth, numerous (18-25) per cell; underleaves distant, oblong to oblong-ovate, scarcely wider than the stems, entire; dioecious. **Substrate(s):** tree bases and trunks (*Acer, Betula nigra, Carpinus caroliniana, Carya aquatica, Fagus, Foresteria, Liquidambar styraciflua, Nyssa, Quercus falcata, Quercus nigra, Quercus phellos, Salix nigra, Taxodium distichum, Triadica sebifera, Viburnum dentata*), woody vines, manmade structures (masonry). **BITH Distribution:** BEAU, BECR, BSCR, CANY, LARO, LNRC, LOBL, LPIB, NBJG, TKCR, UNRC, VCRC. **Representative Specimen(s):** DAK 1623, 1630, 1816, 2210, 3249, 3393; PVR 13, 165, 233, 337, 586, 672.

Porella platyphylla (Linnaeus) Pfeiffer, Fl. Niederhessen 2: 234. 1855.

Synonym(s): *Antoiria vulgaris* Raddi, *Bellincinia platyphylla* O. Kuntze, *Cavendishia platyphylla* S.F. Gray, *Jungermannia platyphylla* Linnaeus, *Lejeunea platyphylla* Corda, *Madotheca platyphylla* Dumortier, *Porella notarisii* Trevisan, *Porella porelloides* De Notaris, WALL SCALEWORT.

Plants: leafy, green to dark green, 2.0-3.5 mm wide; leaves overlapping to imbricate, broadly ovate; lobules ovate, parallel to the stem, overlapping both underleaves and the next lobule above; oil bodies small, numerous, 22-36 per cell; underleaves ovate, with a curved line of insertion and wide decurrencies down the stem; dioecious. **Substrate(s):** tree bases (*Magnolia*). **BITH Distribution:** BECR, CANY, LPIB. **Representative Specimen(s):** DAK 2368; AJN 851; GCS 813.

RADULACEAE

Radula Dumortier, Comment. Bot. 112. 1822. **Etymology:** *radula* (a scraper), universally understood to refer to the flattened and truncate perianth, very much like a scraper for removing paint.

Key to the Species of *Radula*

1. Plants dioecious; shoots 1.0-1.7 mm wide; gemmae frequent on

leaf margins; lobules attached for ¼ to ⅔ of its length .... *R. australis*

1. Plants monoecious; shoots 0.5-1.0 mm wide; gemmae absent; lobules attached for most of its length .... *R. obconica*

Radula australis Austin, Bot. Gaz. 1: 32. 1876.

Synonym(s): *Radula caloosiensis* Austin.

Plants: leafy, golden-green to bronze, 1.3-1.8 mm wide; leaves contiguous to overlapping, ovate; lobules rhombic with an acute, rounded apices, attached to the stem for about ¼ of its length, overlapping about ½ of the stem; oil bodies large, granular, 1(2) per cell; dioecious. **Substrate(s):** tree bases and trunks (*Carpinus caroliniana, Fagus grandifolia, Fraxinus pennsylvanica, Ilex opaca, Magnolia grandiflora, Magnolia virginiana, Nyssa sylvatica, Persea borbonia, Quercus, Taxodium distichum*)**. BITH Distribution:** CANY, LARO, LOBL, LPIB, MECR, NBJG, TKCR. **Representative Specimen(s):** DAK 1874; PVR 136, 156, 422, 430, 549, 671.

Radula obconica Sullivant, Manual (ed. 2) 700. pl. 8. 1856.

Plants: leafy, green to yellow-green, 0.8-1.5 mm wide; leaves contiguous, ovate, convex, auriculate at the base; lobule quadrate, attached to the stem for ½ of its length, acute to obtuse apex, not extending across stem; oil bodies large, granular, 1 per cell; monoecious. **Substrate(s):** tree bases (*Nyssa, Quercus nigra*). **BITH Distribution:** BECR, TKCR. **Representative Specimen(s):** PVR 281, 601.

RICCIACEAE

Riccia Linnaeus, Sp. Pl. 2: 1138. 1753. **Etymology:** Pietro Francesco Ricci or Ricco, Italian botanist and politician in Florence.

Key to the Species of *Riccia*

1.	Thallus surface white, calcified	*R. sorocarpa*
1.	Thallus surface various shades of green	2
2(1).	Spores remaining united in tetrads	*R. curtisii*
2.	Spores not in tetrads	3
3(2).	Thalli broader (in cross-section 8-12 times as wide as tall); spores spherical without lamellate margins	*R. membranacea*
3.	Thalli narrower (in cross-section 1.5-5 times as wide as tall); spores polar with conspicuous lamellate margins	4
4(3).	Spores 50-78 µm wide with 5-8 areolae across surface; plants terrestrial	*R. huebeneriana* subsp. *sullivantii*
4.	Spores 80-100 µm wide with 3-5 areolae across surface; plants terrestrial or aquatic	5
5(4).	Plants bisexual, freely producing sporophytes	*R. stenophylla*
5.	Plants unisexual or sterile	*R. fluitans*

Riccia curtisii (Austin) James, Bull. Torrey Bot. Club 6: 305. 1879.

Synonym(s): *Angiocarpus curtisii* Trevisan, *Cryptocarpus curtisii* Austin, *Riccia curtisii* T.P. James, *Riccia spegazziniana* Massalongo, *Riccia synspora* Schiffner, *Thallocarpus curtisii* Austin. SWAMP ANTELOPE.

Plants: thalloid, yellow to grass-green, crystalline, forming rosettes 1.5-2.0 cm in diameter, with 1-2 dichotomies, spongy, without a median groove; branches 2 mm wide, about 3 times wider than thick, lobes indistinctly separated; spores, brown to honey-brown, remaining in tetrads at maturity; dioecious. **Substrate(s):** mineral soil. **BITH Distribution:** TKCR. **Representative Specimen(s):** EB 1046. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Riccia fluitans Linnaeus, Sp. Pl. 1139. 1753.

Etymology: *fluito* (float), presumably in reference to the aquatic nature of the species. **Synonym(s):** *Riccia centrifuga* Arnott, *Riccia frankoniae* Lorbeer, *Riciella fluitans* A. Braun. FLOATING CRYSTALWORT.

Plants: thalloid, green to yellow-green, dichotomously branching, thin, narrow, floating masses, 0.5-0.8 mm wide, 1-5 cm long; upper surface firm and slightly notched at apices; stranded plants may produce ventrally bulging capsules; monoecious. **Substrate(s):** aquatic or soil. **BITH Distribution:** BEAU, TKCR. **Representative Specimen(s):** DM 7161, s.n.

Riccia huebeneriana subsp. ***sullivantii*** (Austin) R.M. Schuster, Hepat. Anthocerotae N. Amer. 6: 457. 1992.

Synonym(s): *Riccia fluitans* var. *sullivantii* Underwood, *Riccia fluitans* var. *terrestris* Austin, *Riccia huebeneriana* Underwood, *Riccia sullivantii* Austin, *Ricciella sullivantii* Evans. VIOLET CRYSTALWORT.

Plants: thalloid, light to pure green, rosettes 8-20 mm in diameter, branches 0.5-1.5 mm wide, without surface markings, apices obtuse to emarginate with a short dorsal groove; spores clear brown, separating into individual units; monoecious. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, LARO, LNRC, MECR, TKCR, VCRC. **Representative Specimen(s):** EB 1046a; PVR 166, 196, 589, 739, 781. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Riccia membranacea Gottsche et Lindenberg, Syn. Hepat. 608. 1846.

Synonym(s): *Riccia tenuis* Austin, *Riccia welwitschii* Stephani, *Ricciella membranacea* Evans.

Plants: thalloid, clear-green to yellow green, rosettes 2-3 mm wide and 3-5 mm long, with 1-2 dichotomies; surface firm, branches broad 10-12 times wider than thick, margins unistratose for 1-5 cells, dorsal groove absent; monoecious, spores rust to orange-red. **Substrate(s):** mineral soil. **BITH Distribution:** MECR, TKCR. **Representative Specimen(s):** PVR 201, 441.

Riccia sorocarpa Bischoff, Nov. Actorum Acad. Caes. Leop.-Carol. German. Nat. Cur. 17: 1053. 1835.

Synonym(s): *Riccia epicarpa* Wallroth, *Riccia heegii* Schiffner, *Riccia insularis* Levier, *Riccia lindenbergiana* Sauter, *Riccia minima* Linnaeus, *Riccia panormitana* Levier, *Riccia raddiana* Jack et Levier. COMMON CRYSTALWORT.

Plants: thalloid, light to glaucous green, rosettes usually >15 mm in diameter, with 1-3 dichotomies, surface faintly reticulate; branches 1-2 mm wide and 4-6 mm long, deeply furrowed at branch apices; monoecious, spores dark brown. **Substrate(s):** mineral soil. **BITH Distribution:** CANY, MECR, NBJG, TKCR, UNRC. **Representative Specimen(s):** PVR 17, 435, 450, 483, 747.

Riccia stenophylla Spruce, Bull. Soc. Bot. France 36: 195. 1889.

Synonym(s): *Riccia hosseusii* Herzog.

Plants: thalloid, light yellow-green to clear green, repeatedly dichotomous 0.3-0.5 mm wide and 3-9 mm long, segments usually equal, without dorsal furrow; monoecious, spores brown. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, LARO, MECR, TKCR. **Representative Specimen(s):** PVR 439, 489, 667, 738.

Ricciocarpos Corda, Naturalientausch 12 (Beitr. Naturg. 1): 651. 1829. **Etymology:** *Riccia* and *karpos* (fruit), alluding to the sporophytes which resemble those of *Riccia*.

Ricciocarpos natans (Linnaeus) Corda, Naturalientausch 12: 651. 1829.

Etymology: *natans* (swimming or floating on, or under, the surface of the water), presumably referring to the floating thallus. **Synonym(s):** *Riccia capillata* Schmidel, *Riccia lutescens* Schweinitz, *Riccia natans* Linnaeus, *Riccia velutina* Wilson, *Ricciocarpus velutinus* Stephani. FRINGED HEARTWORT.

Plants: thalloid, green to deep green, in two forms (floating and terrestrial); aquatic forms 5-10 mm long with segments 4-8 mm wide at apex, in half rosettes, median furrow narrow, sharp, and distinct throughout, bifurcate at apices, numerous long, pendant, violet scales on ventral surface, rhizoids few; terrestrial forms yellow green, rosettes 20-35 mm in diameter, median furrow sharp, acute, well defined; ventral scales reduced, appressed, oblong-ligulate from a broadened base with many colorless rhizoids near their base; dioecious. **Substrate(s):** mineral soil. **BITH Distribution:** MECR. **Representative Specimen(s):** PVR 203.

SCAPANIACEAE

Scapania (Dumortier) Dumortier, Recueil Observ. Jungerm. 14. 1835. **Etymology:** *scapanion* (spade or hoe), alluding to the flattened, truncate perianth.

Key to the Species of *Scapania*

1. Marginal teeth 2-3 cells long; marginal cell walls not uniformly thickened .... *S. nemorosa*
1. Marginal teeth 1 cell long; marginal cell walls uniformly

thickened .... *S. nemorosa* fo. *whitehouseae*

Scapania nemorosa (Linnaeus) Dumortier, Recueil Observ. Jungerm. 14. 1835.

Synonym(s): *Jungermannia nemorea* Linnaeus, *Jungermannia nemorosa* Micheli, *Martinellia nemorosa* Lindberg, *Martinellius nemorosus* Bennet & Gray, *Plagiochila nemorosa* Montagne & Nees, *Radula nemorosa* Dumortier, *Scapania aconiensis* De Notaris, *Scapania amurensis* Warnstorf, *Scapania austini* Warnstorf, *Scapania breviflora* Taylor, *Scapania evansii* Bryhn, *Scapania jackii* Warnstorf, *Scapania joergensenii* Schiffner, *Scapania nemorosa* Dumortier, *Scapania recurvifolia* Warnstorf. GROVE EARWORT.

Plants: leafy, green to yellow-green or golden to deep brown, width variable 1.5-5.5 mm; leaves imbricate, orbicular, apices obtuse, margins denticulate with teeth 2-3 cells high, decurrent down stem; lobules suborbicular, apices obtuse, margins denticulate; leaves with thick cell walls and concave trigones; oil bodies large, granular, 3-5 per cell; dioecious, gemmae 1 celled, ovoid, rusty brown, numerous at shoot tips. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU, BECR, BSCR, CANY, LARO, MECR, VCRC. **Representative Specimen(s):** DAK 1624, 1824, 1871, 2209; PVR 532, 543, 766.

Scapania nemorosa fo. ***whitehouseae*** R.M. Schuster, Hepat. Anthocerotae N. Amer. 3: 590. f. 426: 2–3, 8–11. 1974.

Etymology: Eula Whitehouse (1892-1974) botanist (and bryologist), artist, and wildflower specialist at Southern Methodist University in Dallas, Texas, who’s east Texas collection was designated the type. **Synonym(s):** WHITEHOUSE'S EARWORT.

Plants: similar to *S. nemorosa* but with marginal cell walls strong and evenly thickened forming a distinct hyaline border, leaf margin dentation slight or vestigial, teeth typically 1-celled; mature gemmae often 2-celled. **Substrate(s):** mineral soil. **BITH Distribution:** BEAU. **Representative Specimen(s):** PVR 697.

SPHAEROCARPACEAE

Sphaerocarpos J.F. Gmelin, Def. Gen. Pl. (ed. 3) 501. 1760. **Etymology:** *sphaira* (sphere) and *karpos* (fruit), alluding to the sphere-like inflated involucres enclosing the capsules.

Sphaerocarpos texanus Austin, Bull. Torrey Bot. Club 6: 158. 1877.

Etymology: For the state of Texas, the type collection was made by Charles Wright near San Marcos in the central part of the state. **Synonym(s):** *Sphaerocarpus berterii* Austin, *Sphaerocarpus californicus* Austin, *Sphaerocarpus europaeus* Lorbeer, *Sphaerocarpus michelii californicus* Underwood, *Sphaerocarpus terrestris* Bischoff. TEXAS BALOONWORT.

Plants: thalloid, pale green to yellow-green, rosettes 8-12 mm in diameter, several cells thick in the center with 1-cell thick, highy ruffled, lateral wings; dioecious, antheridia and archegonia enclosed in bottle shaped involucres, male involucres in close proximity to female involucres, and much smaller than females. **Substrate(s):** mineral soil. **BITH Distribution:** LARO, MECR, TKCR. **Representative Specimen(s):** DAK 2284; EB 1087; PVR 484. **Comments:** Reported by Bazan (1980) from the Turkey Creek Unit, however a voucher was not located.

Excluded Species

Asterella echinella (Gottsche) Underwood, was reported in the BITH by Mueller (undated) but no voucher was located. A specimen from the Lance Rosier Unit was located in TAMU (Dean 24!) collected in 1977. However the original identification was incorrect and has been annotated as *A. tenella* (Linnaeus) Beauvois. Three additional TAMU records, all from the same location in Milam County (Dean 52!; Wolf s.n.!; Farwell 274!) were also incorrectly identified as *A. echinella*. A specimen from Jasper County (Miner s.n. BRIT), if correctly identified, would be the easternmost collection of this species in Texas. The remaining records obtained from the herbarium data search, suggest the Texas distribution for the species is primarily in the central part of the state; Bastrop County and farther west. Incidental Texas collections of *A. echinella* made by the author were usually from limestone rock, or soils derived from limestone rock, a substrate which is not present in the BITH.

Cololejeunea minutissima subsp. ***minutissima*** (Smith) Schiffner, and ***Cololejeunea minutissima*** subsp. ***myriocarpa*** (Nees & Montage) Schuster, were both reported in the Turkey Creek Unit by Bazan (1980). Schuster (1980) leaves the two subspecies as distinct, apparently with reservations, and states the two intergrade imperceptibly in a north-south cline. Therefore, these two species are maintained in this flora under *C. minutssima* without varietal status.

Atrichum undulatum (Hedwig) P. Beauvois, reported in four units of the BITH (BSCR, LNRC, MECR, TKCR) by Mueller (undated), however Smith-Merrill and Ireland (2007) excluded this species from Texas and suggest no species of *Atrichum* is more misunderstood. Introduced from Europe, the distribution of *A. undulatum* is limited to Canada in North America.

Herzogiella turfacea (Lindberg) Z. Iwatsuki, was reported from the Turkey Creek Unit by Mueller (undated). A voucher could not be located with a Mueller collection number. However, one voucher in TAMU (Gardner 306!) was located. The specimen was collected in 1976, about the time Mueller was conducting the initial BITH inventory. Upon examination, this specimen was determined to most likely be *Isopterygium tenerum* (Swartz) Mitten. Maps in Ireland (2014) show a northern United States and Canadian distribution for the species.

Isopterygium homomallifolium Redfearn (=*Pseudotaxiphyllum homomallifolium* (Redfern) Ireland), was reported from the Lance Rosier Unit by Mueller (undated) however a voucher could not be located. Although Ireland (2014a) lists Texas within the range of distribution, the only voucher for Texas, retrieved from the herbarium data search, was from the type location in Kimble County, far west of the BITH.

Leucobryum antillarum Bescherelle var. ***antillarum*** was reported in the BITH by Mueller (undated). However, Redfearn (2007) suggested that specimens from the Coastal Plain of the United States [and Texas?] show variability and inconsistency in the number of layers of leucocysts, which agrees with Crum and Anderson (1981). In addition, the coastal material does not show the prorate cells on the lateral wings of the lamina as present in the type material of *L.*

antillarum. The Encyclopedia of Life (2015) shows a distribution in southern Mexico, the Carribean, and south to Bolivia in South America.

Orthotrichum obtusifolium Bridel, was reported from the Beech Creek Unit by Mueller (undated), however no voucher could be located. Crum and Anderson (1981) suggested the species is "reported from western Texas." However, Vitt (2014) does not list the species for Texas.

Polytrichastrum ohioense (Renauld & Cardot) G. L. Smith, was reported from the Upper Neches River Corridor Unit (Mueller 7079! TAMU). The specimen was incorrectly identified and has been annotated by the author as *Pogonatum brachyphyllum* (Michaux) Beauvois.

Sphagnum imbricatum Russow, was reported in the Lance Rosier Unit by Mueller (undated) without a varietal designation. Anderson, et al. (2009) suggested *S. imbricatum* s.s., is restricted to eastern Asia, and maintain *S. imbricatum* s.l. as four distinct species (one of which is *Sphagnum affine* Renauld & Cardot, included in the current inventory). McQueen and Andrus (2007) suggest the distribution for *S. imbricatum* in North America is only in Alaska and reduce all varieties of *S. imbricatum* to synonomy.

Thuidium recognitum (Hedwig) Lindberg, was reported from the Big Sandy Creek Unit by Mueller (undated). A voucher could not be located with a Mueller collection number. However, one voucher in TAMU (Gardner 322!) was located. The specimen was collected in 1976, about the time Mueller was conducting the initial BITH inventory. Upon examination this specimen was determined to be *Thuidium delicatulum* (Hedwig) Schimper in Bruch, Schimper & Guembel. Crum (2014) shows Arkansas as the nearest state with a distribution for *T. recognitum.*

CHAPTER V

BIOGEOGRAPHIC AFFINITIES OF THE BRYOPHYTE FLORA

Biogeography, in its most basic form, is the study of the distribution of organisms over space and time. Within this discipline there are four recurring themes: 1) classifying geographic regions based on their biotas, 2) reconstructing the historical development of lineages and biota, 3) explaining differences in numbers as well as types of species among regions and gradients, and, 4) exploring geographic variation in the characteristics of individuals and populations (Lomolino et al. 2010). *Bryogeography* is obviously the application of these concepts to the non-vascular flora. The aim of this chapter is to examine the biogeographic affinities of the bryophyte flora of the BITH.

Based on the information provided in Theodor Herzog's *Geographie der Moose* (1926), Miller (1982) assembled a worldwide map of bryofloristic kingdoms. In this map, all of the United States, with the exception of the extreme southern tip of Florida, was placed in the Holarctic Kingdom. This also included Canada, Greenland, all of Europe, Russia, and parts of northern Asia. A decade later, Schofield (1992) adjusted the boundaries of these kingdoms based on additional data. This reorganization retained all of the United States and Canada in the Holarctic Kingdom, but moved the Neotropical boundary north, to include most of peninsular Florida and a narrow band along the Gulf Coast from Florida west to northern Mexico. The Holarctic Kingdom was then further subdivided into ten regions, four of which include the United States and Canada (Arctic, Boreal, Pacific North American, Eastern North American). The final map places Texas largely in the Holarctic-Boreal Region with an intrusion of the Holarctic-Eastern North American Region into east Texas and a Neotropical influence along the Gulf Coast. The BITH lies neatly at the junction of these three regions in southeast Texas.

Despite the general acceptance of the big thicket region as a biological crossroads, in recent years some have begun to question whether the region truly represents a convergence of biodiversity. Using vascular plant data, and a simple analysis (percentage of species in common), MacRoberts and MacRoberts (2004, 2007, 2008) suggested that the big thicket is phytogeographically most similar to the Louisiana flora, with overall affinities much closer allied to the southeastern United States than any of the other adjacent regions. Using the same methodology, they further suggested that within the state of Texas the big thicket is most similar to the eastern and central Texas floras. In their summary, MacRoberts and MacRoberts (2007) assert the big thicket region is not an ecotone or crossroads because the central and western Texas species that occur in the region are very rare, and typically associated with uncommon and specialized habitats. The species list developed by this inventory provides an additional layer of data for further investigating the biogeographic affinities of the regions extant flora.

To examine the bryofloristic affinities of the BITH bryophyte flora, each species from the BITH checklist was assigned to one of five biogeographic regions, or elements, based on distribution data taken from Crum and Anderson (1981), Schuster (1966, 1969, 1974, 1980, 1992, 1992a), Flora of North America Editorial Committee (1993+), and Ochyra, et al., (2008). These designations generally correspond to the kingdoms and regions as mapped by Schofield (1992) with the addition of a Widespread element. A list of species, assigned elements, and their worldwide distribution is in Appendix C.

Biogeographic Elements

Holarctic Element (HOL) - The species in this element show a wide distribution across North America and the northern hemisphere. The 41 species in this element account for 25% of the bryophyte flora in the BITH. Important components in this element include 5 of the 7

Sphagnum species found in the BITH. These 5 species comprise 12% of the total species in this element. *Sphagnum* species are important peat forming mosses in many of the eastern and northern regions in the northern hemisphere, as well as neotropical regions of the new world (Crum 1988; Gradstein et al, 2001). Historically, there have also been significant deposits of peat in east-central Texas along the exposed Queen City and Carizzo Sands in Gonzales, Lee, Leon, Milam, and Robertson Counties (Plummer 1941). Pending verification of identifications, three species in this element are reported as new to Texas: *Dumortiera hirsuta*, *Jamesoniella autumnalis, Lejeunea ulicina.* The species in the following list are components of the Holarctic Element.

Anacamptodon splachnoides
Anomodon attenuatus
Anomodon minor
Aspiromitus punctatus s.l.
Atrichum angustatum
Calypogeia fissa
Cephalozia connivens
Cephalozia lunulifolia
Clasmatodon parvulus
Climacium americanum
Cololejeunea minutissima s.l.
Ctenidium molluscum
Dicranella heteromalla
Ditrichum pallidum
Dumortiera hirsuta s.l.
Ephemerum spinulosum
Fissidens dubius
Fissidens fontanus
Fontinalis sullivantii
Homomallium adnatum
Hypnum lindbergii
Jamesoniella autumnalis
Lejeunea ulicina
Leucobryum glaucum
Lophocolea heterophylla
Metzgeria furcata
Microlepidozia sylvatica
Odontoschisma denudatum
Oxyrrhynchium hians
Porella platyphylla
Riccardia latifrons
Riccia sorocarpa
Scapania nemorosa
Solenostoma gracillimum
Solenostoma hyalinum
Sphaerocarpos texanus
Sphagnum affine
Sphagnum henryense
Sphagnum lescurii
Sphagnum molle
Sphagnum palustre
Thuidium delicatulum

Boreal Element (BOR) - This element is a subdivision of the Holarctic Kingdom but with a distribution limited to eastern and western Canada, Alaska, or a broadly mid-continental United States. The 13 species in this element account for 8% of the bryophyte flora in the BITH.

Brachythecium acuminatum
Calypogeia sullivantii
Cephalozia catenulata
Dicranum condensatum
Entodon seductrix
Fissidens subbasilaris
Funaria americana
Funaria flavicans
Leskea obscura
Plagiomnium ciliare
Pogonatum brachyphyllum
Riccia fluitans
Thelia lescurii

Eastern North American Element (ENA) - This element is also a subdivision of the Holarctic, but with a distribution limited to the southeastern and/or northeastern United States and eastern Canada. The 35 species in this element account for 21% of the bryophyte flora in the BITH. The only two near-endemic species found in the BITH, *Cylindrocolea obliqua* and *Leucolejeunea clypeata* are in this element. Schuster (1980) records *C. obliqua* as a Florida endemic. However, Eriksson (1967) reported the species as new to Texas from Cherokee County, northeast of Nacogdoches. The BITH voucher is the second known occurrence of the species in Texas. *Leucolejeunea clypeata* is a southeastern United States endemic. Pending verification of identifications, four species in this element are reported as new to Texas: *Cephaloziella hyalina*, *Cololejeunea contractiloba*, *Riccardia* cf. *jugata*, and *Riccardia multifida* subsp. *synoica.* The species in the following list are components of the Eastern North American Element.

Aspiromitus adscendens
Asterella tenella
Brotherella recurvans
Bruchia brevifolia
Bruchia drummondii
Bryoandersonia illecebra
Cephaloziella hyalina
Ceratolejeunea laetefusca
Cololejeunea biddlecomiae
Cololejeunea contractiloba
Cololejeunea setiloba
Cryphaea glomerata
Cylindrocolea obliqua
Fissidens bushii
Fontinalis novae-angliae
Frullania brittoniae
Frullania eboracensis
Funaria serrata
Leskea australis
Leskea gracilescens
Leucolejeunea clypeata
Leucolejeunea conchifolia
Plagiochila miradorensis
Pogonatum pensilvanicum
Ptychomitrium drummondii
Radula australis
Radula obconica
Riccardia cf. *jugata*

Riccardia multifida subsp. *synoica*
Riccia huebeneriana subsp. *sullivantii*
Scapania nemorosa fo. *whitehouseae*
Sphagnum macrophyllum
Syrrhopodon texanus
Thuidium alleniorum
Weissia ludoviciana

Tropical Element (TRO) - These species are neotropical or pantropical in distribution. The 29 species in this element account for 17% of the bryophyte flora in the BITH. The Lejeuneaceae family, with 5 genera and 7 species, represents 24 % of the species in this element. *Frullania* with 3 species (10% of the species in the element) is another important tropical genus. Dauphin et al. (2011) stress the importance of the Lejeuneaceae to the tropical element in Florida. The Lejeuneaceae comprise 34% of the liverwort flora in Florida, and includes 43% of the endemic species in the state. Pending verification of identifications, two species in this element are reported as new to Texas: *Cyrto-hypnum minutulum* and *Notothylas breutelii.* The species in the following list are components of the Tropical Element.

Cheilolejeunea rigidula
Cololejeunea cardiocarpa
Cylindrocolea rhizantha
Cyrto-hypnum minutulum
Entodon macropodus
Fissidens polypodioides
Fossombronia brasiliensis
Frullania ericoides
Frullania kunzei
Frullania obcordata
Lejeunea cladogyna
Lejeunea flava
Lejeunea laetivirens
Leucobryum albidum
Leucodon julaceus
Leucolejeunea xanthocarpa
Metzgeria uncigera
Notothylas breutelii
Odontoschisma prostratum
Petalophyllum ralfsii
Philonotis longiseta
Plagiochila dubia
Plagiochila ludoviciana
Porella pinnata
Rectolejeunea maxonii
Riccia membranacea
Schwetschkeopsis fabronia
Thelia hirtella
Trematodon longicollis

Widespread Element (WS) - The addition of a Widespread Element was included to account for species showing distributions that are either cosmopolitan or subcosmopolitan. This includes distributions across multiple continents in both the eastern and western hemispheres, to include Australia and/or Antarctica. The 47 species in this element account for 28% of the bryophyte flora in the BITH. This element is the greatest contributor to the bryophyte flora in the BITH. The widespread distribution of the species in this element suggests an ability to adapt to varied, and often extreme, environmental conditions. This ability is exemplified by the presence of four species, *Ceratodon purpureus, Dicranella varia, Funaria hygrometrica,* and *Ptychostomum pseudotriquetrum,* all of which are also found on the Antarctic Continent. One species, *Bryum argenteum* (Linnaeus) Hedwig s.l., which is a truly cosmopolitan species, was not collected in the BITH. Specimens collected in Anderson [Mahler 7030 (BRIT)], Harris [Gentry 108, 264, 281 (BRIT)], Houston [Dean 35!; Farwell 246a!; Wolf s.n.! (TAES)], and San Jacinto [Gentry 333 (BRIT)] Counties, suggest the species is very likely present in the BITH. Pending verification of identification, one species in this element is reported as new to Texas: *Micromitrium tenerum.* The species in the following list are components of the Widespread Element.

Amblystegium serpens
Aneura pinguis
Anthoceros laevis subsp. *carolinianus*
Barbula indica var. *indica*
Campyliadelphus chrysophyllus
Ceratodon purpureus
Dicranella varia
Fabronia ciliaris
Fissidens adianthoides
Fissidens bryoides
Fissidens elegans
Fissidens taxifolius
Forsstroemia trichomitria
Frullania inflata
Funaria hygrometrica
Gemmabryum radiculosum
Haplocladium microphyllum
Hygroamblystegium varium
Isopterygium tenerum
Leptodictyum riparium
Leskea polycarpa
Leucolejeunea unciloba
Micromitrium tenerum
Orthotrichum diaphanum
Pallavicinia lyellii
Physcomitrium immersum
Physcomitrium pyriforme
Plagiomnium ellipticum
Platygyrium repens
Polytrichum commune
Ptychostomum pseudotriquetrum
Reboulia hemisphaerica
Rhizomnium punctatum
Rhynchostegium serrulatum
Riccia curtisii
Riccia stenophylla
Ricciocarpos natans
Schlotheimia rugifolia
Sematophyllum adnatum
Sphagnum perichaetiale
Syntrichia fragilis
Syntrichia laevipila

Syrrhopodon parasiticus	*Tortella humilis*
Taxiphyllum taxirameum	*Weissia controversa*
Telaranea nematodes	

East-West Transition in Liverwort Growth Forms

Vanderpoorten and Goffinet (2009) stated a general preference for more open habitats and typically soil substrates by the Marchantiales (thalloid liverworts), and a preference for more shaded habitats and a broader range of substrates by the Jungemanniales (leafy liverworts). These preferences should correlate with an east to west transition in rainfall and general forest cover across Texas. McAllister et al. (1932) state the general ratio of thalloid to leafy growth forms statewide is as much as 2:1 based largely on studies in central and south central Texas. Whitehouse (1955) further suggested the Jungermaniales are more abundant in the eastern part of the state.

Castro-Mendoza (1978) conducted an inventory of fungi and bryophytes in the central mineral region of Texas (portions of Blanco, Burnet, Gillespie, Lampasas, Llano, Mason, and McCullough counties). This region is located in the northeast Edwards Plateau and extreme southern Blackland Prairie vegetation areas of Texas (Hatch et al. 1990). Annual precipitation in the region is 24 to 32 inches. The region is mostly rangeland with a forest cover composed primarily of *Quercus*, *Prosopsis*, and *Juniperus*. Liverwort genera in this study were primarily complex thalloids (e.g., *Asterella*, *Conocephalum*, *Reboulia*, *Riccia*) and only two genera of leafy liverworts (*Frullania, Porella*). Utilizing the checklist developed in the study, the ratio of thalloid to leafy growth forms was ca. 9:1.

A second study (Pierce-Huston 2007) was conducted in the Sabine and Angelina National Forests of east Texas. This region is located in the Pineywoods vegetation area of Texas (Hatch et al. 1990). Annual precipitation in the region is 48 to 52 inches. The region is composed of mixed *Quercus-Pinus* forests in the uplands and mixed hardwoods in the bottomlands. Leafy liverwort genera in this study were mixed with most species in the genera *Cephalozia* and *Frullania.* Thalloid liverworts were mixed as well and represented by the genera *Metzgeria, Pallavicinia, Riccardia,* and *Riccia.* Again, using the species list developed in this study, the ratio of <u>leafy</u> to <u>thalloid</u> growth forms was ca. 3:1.

Thalloid liverworts in the current study are primarily in the genera: *Aneura, Metzgeria, Pallivicinia, Riccardia,* and *Riccia.* Leafy genera are overwhelmingly represented by the Lejeuneaceae family (18 species) with smaller numbers in the genera *Cephalozia, Frullania,* and *Plagiochila*. Using the BITH checklist produced in this study, the ratio of <u>leafy</u> to <u>thalloid</u> liverworts is ca. 3:1. In conjunction with the Castro-Mendoza (1978) and Pierce-Huston (2007) studies, the ratio of leafy to thalloid liverworts in the BITH further supports the conclusions asserted by Whitehouse (1955).

Possible Origin of the Bryophyte Flora

Based on the collections made in the current study and the biogeographic element percentages; the widespread, holarctic, and eastern North American elements appear to have the greatest influence on the BITH bryophyte flora. The tropical element has made a notable contribution and boreal the least contribution. The relatively equal percentages of the Holarctic, eastern North American, tropical, and widespread elements suggest the region may indeed be a convergence of biodiversity. The contributions from the holarctic element suggests the potential for a large influence by that element following a post glacial retreat where the more northerly species remained in favorable habitats and/or dispersed from a refugium such as the interior highlands (sensu Redfearn 1986) and/or the Appalachians (sensu Crum 1972). The convergence of the boreal, eastern North American, and tropical elements as depicted by Schofield (1992) in southeast Texas provides an opportunity to examine the potential influence these sub-elements have on the extant composition of the BITH bryophyte flora. Using the species list provided herin, and the geographic affinities derived from that list, the possible origins of the BITH bryophyte flora are discussed.

The subset of biogeographic elements (eastern North American, tropical, boreal) comprise 77 species, or 46% of the total bryophyte flora. The Eastern North American element is the largest sub-component with 35 species and accounts for 45% of the total species in the subset, while the tropical and boreal elements account for 37% and 18% of the subset respectively.

Redfearn (1986) suggested the interior highlands of North America (northeast Arkansas, southeast Oklahoma, southern Missouri) served a refugium, and subsequent dispersal center, for bryophytes following the Pleistocene glaciation. In addition, the potential for a [northern] west to east dispersal route was suggested. Pursell and Reese (1970) concluded the bryophyte flora of the Gulf Coastal Plain is largely composed of species broadly representative of the eastern United States. They further state that a [southern] west to east (and vice-versa) migration is impossible due to the barrier imposed by an absence of suitable corticulous substrates and the dry conditions of the Coastal Plains in south Texas. Pursell and Reese (1970) and others (Buck 1990; Delgadillo 1993, 1995, 2000) examined the possibility of the Antillean Arc as a route for the migration of bryophytes (mosses).

Using the list of species in Redfearn's "boreal refugium" there are no species in common. Again using Redfearn's "temperate" and "austral/tropical" refugia lists, the numbers of species in common are 6 and 15 respectively. This would suggest the eastern North American element (via an interior highlands or an Appalachian refugium model) and tropical element have had a greater influence on the flora than the boreal element. Six species from the BITH are potentially new to the Texas bryophyte flora. These six species (*Cephaloziella hyalina,* *Cololejeunea contractiloba, Cyrto-hypnum minutulum, Notothylas breutelii, Riccardia* cf. *jugata, and Riccardia multifida* subsp. *synoica*) are all from either the eastern North American or Tropical elements. The tropical influence could represent a northerly progression, however as Pursell and Reese (1970) suggest many of the Gulf Coast tropical species are at their northern limits and are not in large numbers. They go on to suggest some of the tropical elements which are found along the Gulf Coast may have arrived by long distance dispersal via hurricanes which enter the Gulf of Mexico from the tropics. The tropical *Notothylus breutelii* reported on the North American Continent from Louisiana, and now Texas, could have very likely expanded its range via anthropogenic influences. The Louisiana collections were all from greenhouses and public parks. Delgadillo (1993, 1995, 2000) and Buck (1990) concluded that the Antillean bryophyte flora is a combination of southward migration of the post-glacial North American flora and to a larger degree the northward migration of the South American flora.

The possibility of a northern west to east corridor, as suggested by Redfearn (1986), does not appear to have had a measurable impact on the BITH bryophyte flora. Only one species from the list, *Orthotrichum diaphanum,* is present in the BITH. Three possible explanations for these absences are 1) there is no significant west to east corridor through the interior highlands to southeast Texas, 2) saxicolous substrate preferences by many of the species, or 3) more species are present, they have just not been documented. The substrate preference factor is easily demonstrated by *Pleurochaete luteola* (Besherelle) Theriot, which is in Redfearn's boreal list and also occurs in much of central and west Texas on limestone rock, or soils derived from limestone. A collection of this species by the author (Kruse 3827, TAES) from Gimes County, Texas is from an isolated limestone outcrop where other disjunct central Texas species have been known to occur. Two additional collections from Crockett (Redfearn 30607, MO) and Johnson (Whitehouse 18042, BRIT) counties were from east and northeast Texas locations. These were also collected from limestone substrates. This demonstrates species such as this are capable of persisting in the general southeast region of Texas, given the proper substrate.

The probability of a southern west to east corridor remains unclear. However, the possibility of an east to west corridor seems more plausible based on similarities between the BITH bryophyte flora and the limited collections reported from south Texas by Clover (1937), Galloway and Burandt (1993), and Galloway (1999). These reports represent about all that is known of south Texas bryology. In comparing the species reported, there are 13 in common. All but two of these are terricolous, and are species which typically colonize disturbed areas. The two corticulous species were collected near Corpus Christi from tree trunks or downed branches. Galloway (1999) notes that many of the 13 species represent first reports for south Texas and suggest they may be uncommon in the region. In the BITH region many of these species are more common. Pursell and Reese (1970) also noted an absence of many of the more common coastal plain species in the northern and eastern Mexico lowlands. This may indicate an incipient, or just weak, east to west corridor along the coastal prairie of Texas. Admitedly, these conclusions are based on extremely limited collections from the southern part of the state. Additional collections from all regions of Texas will greatly enhance our knowledge of the state's bryoflora and biogeography.

CHAPTER VI

CONCLUSION

The big thicket region of southeast Texas, has long been referred to as a region of high biodiversity due to the convergence of several Texas ecoregions in that part of the state. The Big Thicket National Preserve was created in 1974 with the expressed purpose to protect what remained of this biodiversity, after many decades of anthropogenic changes to the ecosystems of the region. Investigations into this diversity, in the form of inventories of organisms have been conducted in numerous organismal groups, including vascular plants. However one group, the bryophytes, has received minimal attention. Bryophytes are non-vascular plants in three phyla: Anthocerotophyta, Bryophyta, and Marchantiophyta.

The purpose of this inventory was to complete a comprehensive field and literature based inventory of these organisms within the boundaries of the preserve, construct dichotomous keys for identification of species in the region, and assess the biogeographic affinities of the extant bryophyte flora.

Field work was conducted from 2008 through 2011, and resulted in 1765 collections. In addition to field work, a search of regional herbaria added another 294 collections. A historical list of species was compiled from literature resources and resulted in a checklist of 99 species. The collections made as part of this inventory added another 67 species to the list. The current inventory includes 166 species (4 hornworts, 95 mosses, and 67 liverworts). This new checklist represents a 41% increase over the previous checklist. The new checklist includes 11 new families, and 24 new genera to the preserve. Tentatively, eight new species are added to the Texas bryoflora.

To aid in the identification of bryophytes in the preserve, and the region, a set of dichotomous keys were constructed, based on the checklist developed in the inventory. Keys to groups (Anthocerotophyta, Bryophyta, Marchantiophyta) were constructed, in addition to keys to genera within each of these groups. In genera with more than one species in the checklist a key to species was constructed. A species description, and preserve distribution was assembled for each species on the checklist.

An assessment of biogeographical affinities was made to determine which biogeographical elements have likely had the greatest influence on the extant bryoflora of the preserve. Overall, there is a relatively equal contribution by the holarctic, eastern North American, tropical, and widespread elements. A subset of elements, boreal, eastern North American and tropical, converge in the general region of the preserve. Of these three elements, the eastern North American and tropical regions appear to be the greatest contributors to the bryoflora. No west to east biogeographic connection within Texas could be established. This suggests that although the *big thicket region* is indeed a region of high biodiversity, the eastern North American and tropical elements have a greater influence than contributions from many other regions of Texas.

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APPENDIX A

HISTORICAL CHECKLIST OF BIG THICKET BRYOPHYTES

The following is a cumulative checklist of the bryophytes reported in the Big Thicket National Preserve prior to the completion of this inventory. The species included are from reports by Mueller (undated), Stoneburner and Wyatt (1979), Bazan (1980), and Lodwick and Snider (1980). Species names are listed as reported, current nomenclature is included in brackets. Reports listed as "sp." were not included. The source(s) of the species reports are indicated in superscripts as follows: (1) Bazan (1980), (2) Mueller (undated), (3) Lodwick and Snider (1980), (4) Stoneburner and Wyatt (1979).

ANTHOCEROTOPHYTA

ANTHOCEROTACEAE

Anthoceros adscendens Lehmann & Lindenberg [1]

[=*Aspiromitus adscendens* (Lehmannn & Lindenberg) R.M. Schuster]

Anthoceros punctatus Linnaeus[1]

[=*Aspiromitus punctatus* (Linnaeus) Schljakov]

Phaeoceros laevis subsp. *carolinianus* (Michaux) Prosker [1]

[=*Anthoceros laevis* subsp. *carolinianus* (Linnaeus) Schuster]

BRYOPHYTA

AMBLYSTEGIACEAE

Amblystegium serpens (Hedwig) Schimper in Bruch, Schimper & Guembel [2]

ANOMODONTACEAE

Anomodon attenuatus (Hedwig) Huebener [2]

BRACHYTHECIACEAE

Brachythecium biventrosum (Müller Halle) A. Jaeger [2] [4]

[= *Brachythecium acuminatum* (Hedwig) Austin]

Bryoandersonia illecebra (Hedwig) Robinson (4)

Clasmatodon parvulus (Hampe) Sullivant in A. Gray (2)

Rhynchostegium serrulatum (Hedwig) A. Jaeger (2)

BRUCHIACEAE

Trematodon longicollis Michaux (2)

CALYMPERACEAE

Syrrhopodon texanus Sullivant (4)

CRYPHAEACEAE

Cryphaea glomerata Schimper ex Sullivant in A. Gray (2)

DICRANACEAE

Dicranella heteromalla (Hedwig) Schimper (2)

Dicranella varia (Hedwig) Schimper (2)

Dicranum sabuletorum Renauld & Cardot (2)

[= *Dicranum condensatum* Hedwig]

DITRICHACEAE

Ceratodon purpureus (Hedwig) Bridel (2)

Ditrichum pallidum (Hedwig) Hampe (2)

ENTODONTACEAE

Entodon macropodus (Hedwig) Muller Halle (2)

Entodon seductrix (Hedwig) Muller Halle (2)

FISSIDENTACEAE

Fissidens bushii (Cardot & Thériot) Cardot & Thériot (2)

FONTINALACEAE

Fontinalis novae-angliae Sullivant (2) (4)

FUNARIACEAE

Funaria americana Lindberg (2)

Funaria hygrometrica Hedwig (2)

Funaria serrata Bridel (2)

Physcomitrium pyriforme (Hedwig) Hampe (2)

HYPNACEAE

Herzogiella turfacea (Lindberg) Z. Iwatsuki [see excluded species] [2]

Isopterygium homomallifolium Redfearn [see excluded species] [2]

Isopterygium tenerum (Swartz) Mitten [2]

Platygyrium repens (Bridel) Schimper in Bruch and Schimper [2] [4]

LEPTODONTACEAE

Forsstroemia trichomitria (Hedwig) Lindberg [2]

LEUCOBRYACEAE

Leucobryum albidum (P. Beauvois) Lindberg [2]

Leucobryum antillarum Schimper ex Bescherelle [see excluded species] [2]

LEUCODONTACEAE

Leucodon julaceus (Hedwig) Sullivant [2]

MNIACEAE

Mnium rugicum Laurer [2]

[= *Plagiomnium ellipticum* (Bridel) T.J. Koponen]

ORTHOTRICHACEAE

Orthotrichum diaphanum Schrader ex Bridel [2]

Orthotrichum obtusifolium Bridel [see excluded species] [2]

Schlotheimia rugifolia (Hooker) Schwägrichen [4]

POLYTRICHACEAE

Atrichum angustatum (Bridel) Bruch & Schimper [2]

Atrichum undulatum (Hedwig) Beauvois [see excluded species] [2]

Pogonatum brachyphyllum (Michaux) Beauvois [2]

Polytrichum ohioense Renauld & Cardot [see excluded species] [2]

POTTIACEAE

Tortula fragilis Taylor [2]

[=*Syntrichia fragilis* (Taylor) Ochyra]

Weissia controversa Hedwig [2]

SEMATOPHYLLACEAE

Brotherella recurvans (Michaux) M. Fleisher [4]

Sematophyllum adnatum (Michaux) E. Britton [(2)]

SPHAGNACEAE

Sphagnum imbricatum Russow [see excluded species] [(2) (4)]

Sphagnum macrophyllum Bernhardi ex Bridel [(3)]

Sphagnum palustre Linnaeus [(2) (4)]

Sphagnum perichaetiale Hampe [(4)]

THELIACEAE

Thelia hirtella (Hedwig) Sullivant in A. Gray [(2)]

THUIDACEAE

Thuidium allenii Austin [(2)]

[=*Thuidium alleniorum* Austin]

Thuidium delicatulum (Hedwig) Schimper in Bruch, Schimper & Guembel [(2)]

Thuidium recognitum (Hedwig) Lindberg [see excluded species] [(2)]

MARCHANTIOPHYTA

ADELANTHACEAE

Odontoschisma prostratum (Swartz) Trevisan [(1) (2)]

ANEURACEAE

Aneura pinguis (Linnaeus) Dumortier [(1) (2)]

Riccardia latifrons (Lindberg) Lindberg [(1)]

Riccardia multifida (Linnaeus) Gray [(2)]

AYTONIACEAE

Asterella echinella (Gottsche) Underwood [see excluded species] [(2)]

Asterella tenella (Linnaeus) Beauvois [(1) (2)]

CALYPOGEIACEAE

Calypogeia fissa (Linnaeus) Raddi [(1) (2)]

Calypogeia sullivantii Austin [(1)]

CEPHALOZIACEAE

Cephalozia catenulata (Hübener) Lindberg [(1) (2)]

Cephalozia connivens (Dickson) Lindberg [(1) (2)]

Cephalozia lunulifolia (Dumortier) Dumortier [(1)]

CEPHALOZIELLACEAE

Cylindrocolea obliqua (Douin) R.M. Schuster [(1)]

Cylindrocolea rhizantha (Montagne) R.M. Schuster [(1)]

FOSSOMBRONIACEAE

Fossombronia brasiliensis Stephani [(1)]

Petalophyllum lamellatum Lindberg [(2)]

[=*Petalophyllum ralfsii* (Wilson) Nees & Gottsche ex Lehmannn]

GEOCALYCACEAE

Lophocolea heterophylla (Schrader) Dumortier [(1)]

JUBULACEAE

Frullania brittoniae Evans [(1) (2)]

Frullania eboracensis Gottsche [(1) (2)]

Frullania inflata Gottsche [(1) (2)]

Frullania kunzei (Lehmann & Lindenberg) Lehmann & Lindenberg [(1) (2)]

Frullania obcordata (Lehmann & Lindenberg) Lehmann & Lindenberg [(1) (2)]

Frullania squarrosa Dumortier [(1) (2)]

[=*Frullania ericoides* (Nees) Nees]

JUNGERMANNIACEAE

Jungermannia gracillima Smith [(1)]

[=*Solenostoma gracillimum* (Smith) Schuster]

Jungermannia hyalina Lyell [(1)]

[=*Solenostoma hyalinum* (Lyell in Hooker) Mitten]

LEJEUNEACEAE

Ceratolejeunea laetefusca (Austin) R.M. Schuster [(1)]

Cheilolejeunea rigidula (Montagne) R.M. Schuster [(1)]

Cololejeunea biddlecomiae (Austin) Evans [(1)]

Cololejeunea cardiocarpa (Montagne) R.M. Schuster [(1)]

Cololejeunea minutissima (Smith) Schiffner subsp. *minutissima* [see excluded species] [(1)(2)]

Cololejeunea minutissima (Smith) Schiffner subsp. *myriocarpa* [see excluded species] (1)(2)

Cololejeunea setiloba Evans (1)

Lejeunea cladogyna Evans (1)

Lejeunea flava (Swartz) Nees (1)

Lejeunea laetivirens Nees et Montagne (1)

Leucolejeunea clypeata (Schweinitz) Evans (1)

Leucolejeunea conchifolia (Evans) Evans (1)

Leucolejeunea unciloba (Lindenberg) Evans (1) (2)

Leucolejeunea xanthocarpa (Lehmann & Lindenberg) Evans(2)

Rectolejeunea maxonii Evans (1)

LEPIDOZIACEAE

Kurzia sylvatica (Evans) Grolle (1)

[=*Microlepidozia sylvatica* (Evans) Jörgensen]

Telaranea nematodes (Gottsche ex Austin) Howe (1) (4)

METZGERIACEAE

Metzgeria furcata (Linnaeus) Dumortier (1) (2)

Metzgeria uncigera Evans (1)

PALLAVICINIACEAE

Pallavicinia lyellii (Hooker) Carruthers (1) (2)

PLAGIOCHILACEAE

Plagiochila dubia Lindenberg et Gottsche (1)

PORELLACEAE

Porella pinnata Linnaeus (1) (2)

Porella platyphylla (L.) Pfeiffer (1)

Porella platyphylla var. *platyphylloidea* (Schweinitz) Frye & Clark (2)

[= *Porella platyphylla* (L.) Pfeiffer]

RADULACEAE

Radula australis Austin (1)

Radula obconica Sullivant (1)

RICCIACEAE

Riccia curtisii (Austin) James [(1)]

Riccia fluitans Linnaeus [(2)]

Riccia sullivantii Austin [(1)]

[=*Riccia huebeneriana* subsp. *sullivantii* (Austin) R.M. Schuster]

SCAPANIACEAE

Scapania nemorosa (Linnaeus) Dumortier [(1)] [(2)]

SPHAEROCARPACEAE

Sphaerocarpos texanus Austin [(1)] [(2)]

APPENDIX B

BRYOPHYTE INVENTORY STATUS BY PRESERVE UNIT

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
ANTHOCEROTOPHYTA														
Anthoceros laevis subsp. *carolinianus*				x						x				
Aspiromitus adscendens												x		
Aspiromitus punctatus												x		
Notothylas breutelii										x				
BRYOPHYTA														
Amblystegium serpens						x			x					
Anacamptodon splachnoides			x			x								
Anomodon attenuatus	x	x	x	x		x	x	x	x	x	x	x		x
Anomodon minor										x				
Atrichum angustatum	x	x	x	x	x	x		x	x	x	x	x	x	
Barbula indica var. *indica*						x						x		
Brachythecium acuminatum								x						
Brotherella recurvans								x						
Bruchia brevifolia	x													
Bruchia drummondii						x								
Bryoandersonia illecebra	x		x	x		x			x	x	x	x		
Campyliadelphus chrysophyllus		x	x	x		x					x			
Ceratodon purpureus									x					

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Clasmatodon parvulus	x	x	x	x	x	x	x	x	x	x	x	x		x
Climacium americanum	x		x	x		x				x	x			x
Cryphaea glomerata	x		x		x	x	x	x	x	x		x		
Ctenidium molluscum				x										
Cyrto-hypnum minutulum	x			x							x			
Dicranella heteromalla			x									x		
Dicranella varia										x				
Dicranum condensatum									x					
Ditrichum pallidum	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Entodon macropodus		x		x		x		x			x	x		
Entodon seductrix	x	x	x		x	x	x	x	x	x	x	x		
Ephemerum spinulosum						x				x				
Fabronia ciliaris			x											
Fissidens adianthoides			x	x		x				x		x		
Fissidens bryoides				x						x	x			
Fissidens bushii		x	x	x		x				x	x	x		
Fissidens dubius		x	x	x		x		x		x	x	x		
Fissidens elegans	x		x									x		x
Fissidens fontanus	x													
Fissidens polypodioides		x	x							x		x		
Fissidens subbasilaris				x				x						
Fissidens taxifolius	x	x	x	x						x	x			
Fontinalis novae-angliae			x									x		x
Fontinalis sullivantii		x									x			
Forsstroemia trichomitria	x	x	x	x		x	x	x	x	x	x	x		x

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Funaria americana						x								
Funaria flavicans						x								
Funaria hygrometrica			x			x			x					
Funaria serrata		x				x				x				x
Gemmabryum radiculosum					x									
Haplocladium microphyllum	x					x				x				
Homomallium adnatum											x			
Hygroamblystegium varium		x		x						x		x		
Hypnum lindbergii	x	x					x			x		x		x
Isopterygium tenerum	x	x	x	x	x	x		x	x	x	x	x		x
Leptodictyum riparium	x			x	x	x					x			x
Leskea australis	x			x			x							
Leskea gracilescens														x
Leskea obscura	x					x					x			
Leskea polycarpa	x		x			x								
Leucobryum albidum	x	x	x	x	x	x	x	x	x	x	x	x		x
Leucobryum glaucum		x		x							x			
Leucodon julaceus	x	x	x	x	x	x				x	x	x		
Micromitrium tenerum										x				
Orthotrichum diaphanum						x								
Oxyrrhynchium hians			x	x		x								
Philonotis longiseta			x	x		x								
Physcomitrium immersum							x							
Physcomitrium pyriforme	x		x			x	x	x		x	x			
Plagiomnium ciliare				x										

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Plagiomnium ellipticum			x	x						x		x		
Platygyrium repens			x			x								
Pogonatum brachyphyllum			x	x							x			
Pogonatum pensilvanicum			x			x					x			
Polytrichum commune			x								x	x		
Ptychomitrium drummondii	x					x								x
Ptychostomum pseudotriquetrum						x								
Rhizomnium punctatum			x											
Rhynchostegium serrulatum	x	x	x	x		x				x	x	x		
Schlotheimia rugifolia		x	x	x		x				x	x	x		
Schwetschkeopsis fabronia			x		x	x				x	x	x		
Sematophyllum adnatum	x	x	x	x	x	x		x	x	x	x	x	x	
Sphagnum affine			x									x		
Sphagnum henryense												x		
Sphagnum lescurii		x	x	x	x	x					x	x		
Sphagnum macrophyllum					x	x						x		
Sphagnum molle					x									
Sphagnum palustre		x		x		x			x		x	x		
Sphagnum perichaetiale												x		
Syntrichia fragilis							x							
Syntrichia laevipila				x										
Syrrhopodon parasiticus			x	x				x						
Syrrhopodon texanus	x	x	x	x				x	x	x	x	x		
Taxiphyllum taxirameum												x		
Thelia hirtella	x	x	x	x		x		x		x	x	x		

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Thelia lescurii			x	x										
Thuidium alleniorum	x					x				x		x		
Thuidium delicatulum		x	x	x		x			x			x		
Tortella humilis				x		x								
Trematodon longicollis		x		x		x				x				
Weissia controversa	x	x	x	x	x	x		x	x	x	x	x		x
Weissia ludoviciana										x				
MARCHANTIOPHYTA														
Aneura pinguis			x	x						x	x	x		
Asterella tenella						x								
Calypogeia fissa			x	x						x		x		
Calypogeia sullivantii		x	x	x						x	x			
Cephalozia catenulata		x	x	x	x	x		x		x	x			x
Cephalozia connivens		x	x	x	x	x					x	x		
Cephalozia lunulifolia												x		
Cephaloziella hyalina	x		x		x					x	x	x		
Ceratolejeunea laetefusca		x		x										
Cheilolejeunea rigidula	x	x	x	x		x				x	x	x		
Cololejeunea biddlecomiae												x		
Cololejeunea cardiocarpa	x	x		x		x		x	x	x	x	x		
Cololejeunea contractiloba	x	x		x		x	x		x	x	x			
Cololejeunea minutissima	x	x		x		x	x		x	x	x			
Cololejeunea setiloba						x				x		x		
Cylindrocolea obliqua			x							x		x		

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Cylindrocolea rhizantha												x		
Dumortiera hirsuta s.l.				x										
Fossombronia brasiliensis	x	x	x	x	x	x				x		x		x
Frullania brittoniae									x			x		
Frullania eboracensis		x			x	x	x			x				
Frullania ericoides	x	x	x	x	x	x	x	x	x	x	x	x		
Frullania inflata	x	x	x			x	x		x	x	x		x	x
Frullania kunzei	x	x	x	x	x	x		x	x	x	x	x		x
Frullania obcordata	x	x		x	x	x		x	x	x	x	x		x
Jamesoniella autumnalis				x										
Lejeunea cladogyna			x	x						x		x		
Lejeunea flava	x	x	x	x	x	x		x		x	x	x	x	
Lejeunea laetivirens			x	x				x			x	x		
Lejeunea ulicina											x			
Leucolejeunea clypeata	x	x	x	x	x	x		x	x	x	x	x		x
Leucolejeunea conchifolia	x		x	x	x	x		x		x	x	x		
Leucolejeunea unciloba	x		x	x	x		x		x	x	x	x		x
Leucolejeunea xanthocarpa										x				
Lophocolea heterophylla	x	x	x	x	x					x	x	x		
Metzgeria furcata										x		x		
Metzgeria uncigera												x		
Microlepidozia sylvatica			x		x									
Odontoschisma denudatum												x		
Odontoschisma prostratum	x	x	x	x	x	x		x	x	x				x
Pallavicinia lyellii	x	x	x	x	x	x				x	x	x		x

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Petalophyllum ralfsii						x			x					
Plagiochila dubia												x		
Plagiochila ludoviciana				x										
Plagiochila miradorensis				x										
Porella pinnata	x	x	x	x		x	x	x	x		x	x	x	x
Porella platyphylla		x		x					x					
Radula australis				x		x		x	x	x	x	x		
Radula obconica		x										x		
Reboulia hemisphaerica										x		x		
Rectolejeunea maxonii		x	x	x		x		x			x	x		
Riccardia cf. *jugata*			x	x							x			
Riccardia latifrons												x		
Riccardia multifida subsp. *synoica*											x			
Riccia curtisii												x		
Riccia fluitans	x											x		
Riccia huebeneriana subsp. *sullivantii*	x					x	x			x		x		x
Riccia membranacea										x		x		
Riccia sorocarpa				x						x	x	x	x	
Riccia stenophylla	x					x				x		x		
Ricciocarpos natans										x				
Scapania nemorosa	x	x	x	x		x				x				x
Scapania nemorosa fo. *whitehouseae*	x													
Solenostoma gracillimum												x		
Solenostoma hyalinum												x		
Sphaerocarpos texanus						x				x		x		

Big Thicket National Preserve Unit[1]

Taxon	BEAU	BECR	BSCR	CANY	HCRS	LARO	LNRC	LOBL	LPIB	MECR	NBJG	TKCR	UNRC	VCRC
Telaranea nematodes		x	x	x	x	x				x	x	x		
Total species per unit	54	55	73	79	33	79	20	33	34	77	64	86	7	27

[1] Beaumont (BEAU), Beech Creek (BECR), Big Sandy Creek (BSCR), Canyonlands (CANY), Hickory Creek Savannah (HCRS), Lance Rosier (LARO), Lower Neches River Corridor (LNRC), Loblolly (LOBL). Little Pine Island Bayou (LPIB), Menard Creek (MECR), Neches Bottom and Jack Gore Baygall (NBJG), Turkey Creek (TKCR), Upper Neches River Corridor (UNRC), Village Creek Corridor (VCRC)

APPENDIX C

BIOGEOGRAPHICAL ELEMENT ASSIGNMENT BY SPECIES

		Biogeographical Region[1]																					
	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
ANTHOCEROTOPHYTA																							
Anthoceros laevis subsp. *carolinianus*	WS	x	x	x		x	x	x		x	x	x	x	x		x	x		x		x	x	
Aspiromitus adscendens	ENA	x																					
Aspiromitus punctatus s.l.	HOL	x	x	x					x	x	x	x	x										
Notothylas breutelii	TRO	x												x		x							
BRYOPHYTA																							
Amblystegium serpens	WS	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x		x	
Anacamptodon splachnoides	HOL	x	x	x					x	x													
Anomodon attenuatus	HOL	x	x	x	x	x	x		x	x	x	x		x	x	x							
Anomodon minor	HOL	x	x	x	x		x	x			x	x	x	x	x								
Atrichum angustatum	HOL	x	x	x			x			x													
Barbula indica var. *indica*	WS	x	x		x		x	x	x	x		x	x	x	x	x	x	x	x	x		x	
Brachythecium acuminatum	BOR	x	x	x			x																
Brotherella recurvans	ENA	x	x	x																			
Bruchia brevifolia	ENA	x																					
Bruchia drummondii	ENA	x																					
Bryoandersonia illecebra	ENA	x	x	x																			

Biogeographical Region[1]

	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Campyliadelphus chrysophyllus	WS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
Ceratodon purpureus	WS	x	x	x	x	x	x	x	x	x	x	x	x	x									x
Clasmatodon parvulus	HOL	x	x						x	x													
Climacium americanum	HOL	x	x	x		x	x						x										
Cryphaea glomerata	ENA	x																					
Ctenidium molluscum	HOL	x	x	x		x	x	x	x	x	x	x	x					x					
Cyrto-hypnum minutulum	TRO	x	x	x					x	x				x	x	x	x						
Dicranella heteromalla	HOL	x	x	x		x	x	x	x	x			x		x		x	x					
Dicranella varia	WS	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x					x
Dicranum condensatum	BOR	x	x				x																
Ditrichum pallidum	HOL	x	x	x					x	x			x						x				
Entodon macropodus	TRO	x												x	x	x	x			x			
Entodon seductrix	BOR	x	x	x			x																
Ephemerum spinulosum	HOL	x	x	x			x		x	x			x		x	x	x						
Fabronia ciliaris	WS	x	x		x	x	x		x	x			x	x	x	x	x			x		x	
Fissidens adianthoides	WS	x	x	x		x	x	x	x	x		x	x					x			x		
Fissidens bryoides	WS	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x			x			
Fissidens bushii	ENA	x	x	x																			
Fissidens dubius	HOL	x	x	x	x	x	x		x	x	x	x	x	x	x	x							
Fissidens elegans	WS	x	x											x	x	x	x			x			
Fissidens fontanus	HOL	x	x	x	x	x	x	x	x	x				x	x	x		x	x				
Fissidens polypodioides	TRO	x										x	x	x	x	x	x			x			
Fissidens subbasilaris	BOR	x	x	x			x							x									

		Biogeographical Region[1]																					
	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Fissidens taxifolius	WS	x	x	x		x	x		x	x			x	x	x	x				x		x	
Fontinalis novae-angliae	ENA	x	x	x																			
Fontinalis sullivantii	HOL	x	x	x					x														
Forsstroemia trichomitria	WS	x	x	x									x	x			x			x		x	
Funaria americana	BOR	x	x				x							x									
Funaria flavicans	BOR	x	x	x			x																
Funaria hygrometrica	WS	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x		x	x	x	x
Funaria serrata	ENA	x																					
Gemmabryum radiculosum	WS				x				x	x			x	x		x						x	
Haplocladium microphyllum	WS	x	x	x	x	x		x	x	x	x	x	x	x		x	x			x			
Homomallium adnatum	HOL	x	x	x	x		x				x	x	x										
Hygroamblystegium varium	WS	x	x	x	x	x	x	x	x	x	x	x	x				x			x	x	x	
Hypnum lindbergii	HOL	x	x	x	x	x	x	x	x	x	x	x	x										
Isopterygium tenerum	WS	x	x							x				x	x	x	x			x			
Leptodictyum riparium	WS	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Leskea australis	ENA	x																					
Leskea gracilescens	ENA	x	x	x																			
Leskea obscura	BOR	x	x	x			x	x															
Leskea polycarpa	WS	x	x	x		x	x	x	x	x	x	x	x					x	x		x		
Leucobryum albidum	TRO	x	x	x			x							x	x	x							
Leucobryum glaucum	HOL	x	x	x				x	x	x		x	x										
Leucodon julaceus	TRO	x	x	x										x		x							
Micromitrium tenerum	WS	x	x	x					x	x			x		x	x				x	x	x	

Biogeographical Region[1]

	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Orthotrichum diaphanum	WS				x		x		x	x	x							x		x			
Oxyrrhynchium hians	HOL	x	x	x	x	x	x	x	x	x	x	x	x					x	x		x		
Philonotis longiseta	TRO	x	x				x							x	x	x	x						
Physcomitrium immersum	WS		x	x		x	x	x									x			x			
Physcomitrium pyriforme	WS	x	x	x		x	x	x	x	x		x	x	x				x			x	x	
Plagiomnium ciliare	BOR	x	x	x		x	x	x															
Plagiomnium ellipticum	WS	x	x	x	x	x	x	x	x	x	x	x	x				x			x			
Platygyrium repens	WS	x	x	x			x	x	x	x	x	x	x					x	x		x		
Pogonatum brachyphyllum	BOR	x					x																
Pogonatum pensilvanicum	ENA	x	x	x																			
Polytrichum commune	WS	x	x	x		x	x			x			x					x				x	
Ptychomitrium drummondii	ENA	x																					
Ptychostomum pseudotriquetrum	WS	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x
Rhizomnium punctatum	WS	x	x	x				x	x	x	x	x	x					x	x		x		
Rhynchostegium serrulatum	WS	x	x	x			x							x	x		x			x			
Schlotheimia rugifolia	WS	x												x	x	x	x			x			
Schwetschkeopsis fabronia	TRO	x	x										x			x							
Sematophyllum adnatum	WS	x	x											x	x		x			x			
Sphagnum affine	HOL	x	x						x	x													
Sphagnum henryense	HOL	x	x			x	x	x			x	x	x										
Sphagnum lescurii	HOL	x	x						x	x													
Sphagnum macrophyllum	ENA	x																					
Sphagnum molle	HOL	x							x	x													
Sphagnum palustre	HOL	x	x	x		x	x	x	x	x													

		Biogeographical Region[1]																					
	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Sphagnum perichaetiale	WS	x											x				x			x	x		
Syntrichia fragilis	WS						x		x	x		x		x	x		x			x			
Syntrichia laevipila	WS	x	x		x	x	x	x		x			x	x						x	x	x	
Syrrhopodon parasiticus	WS	x										x	x	x	x	x	x	x	x	x	x	x	
Syrrhopodon texanus	ENA	x	x											x									
Taxiphyllum taxirameum	WS	x	x		x								x	x	x	x	x			x			
Thelia hirtella	TRO	x	x	x			x							x		x							
Thelia lescurii	BOR	x	x				x																
Thuidium alleniorum	ENA	x																					
Thuidium delicatulum	HOL	x	x	x	x		x	x	x	x	x	x	x	x	x		x						
Tortella humilis	WS	x	x	x		x	x	x	x	x		x	x	x		x	x	x	x	x	x		
Trematodon longicollis	TRO	x	x										x	x	x	x	x	x					
Weissia controversa	WS	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	
Weissia ludoviciana	ENA	x																					
MARCHANTIOPHYTA																							
Aneura pinguis	WS	x	x	x			x		x	x	x	x	x	x		x	x			x		x	
Asterella tenella	ENA	x	x	x																			
Calypogeia fissa	HOL	x	x						x	x													
Calypogeia sullivantii	BOR	x	x				x																
Cephalozia catenulata	BOR	x	x	x		x	x	x															
Cephalozia connivens	HOL	x	x	x			x		x	x													
Cephalozia lunulifolia	HOL	x	x	x				x	x	x			x										
Cephaloziella hyalina	ENA	x																					

		Biogeographical Region[1]																					
	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Ceratolejeunea laetefusca	ENA	x																					
Cheilolejeunea rigidula	TRO	x												x	x	x	x						
Cololejeunea biddlecomiae	ENA	x	x	x																			
Cololejeunea cardiocarpa	TRO	x												x		x		x	x				
Cololejeunea contractiloba	ENA	x																					
Cololejeunea minutissima s.l.	HOL	x							x	x						x		x	x	x			
Cololejeunea setiloba	ENA	x																					
Cylindrocolea obliqua	ENA	x																					
Cylindrocolea rhizantha	TRO	x														x							
Dumortiera hirsuta s.l.	HOL	x							x	x			x					x	x				
Fossombronia brasiliensis	TRO	x	x												x	x	x						
Frullania brittoniae	ENA	x	x																				
Frullania eboracensis	ENA	x	x	x						x													
Frullania ericoides	TRO	x					x						x	x	x	x			x			x	
Frullania inflata	WS	x	x										x	x						x			
Frullania kunzei	TRO	x														x	x						
Frullania obcordata	TRO	x													x	x	x						
Jamesoniella autumnalis	HOL	x	x	x		x		x	x	x			x	x									
Lejeunea cladogyna	TRO	x														x							
Lejeunea flava	TRO	x												x	x	x	x						
Lejeunea laetivirens	TRO	x												x	x	x	x			x			
Lejeunea ulicina	HOL	x	x						x	x			x										
Leucolejeunea clypeata	ENA	x																					
Leucolejeunea conchifolia	ENA	x																					

		Biogeographical Region[1]																					
	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Leucolejeunea unciloba	WS	x	x						x	x				x			x				x		
Leucolejeunea xanthocarpa	TRO	x											x	x		x	x		x		x		
Lophocolea heterophylla	HOL	x	x	x	x	x	x		x	x	x	x	x										
Metzgeria furcata	HOL	x	x	x					x	x		x	x					x				x	
Metzgeria uncigera	TRO	x														x							
Microlepidozia sylvatica	HOL	x	x						x	x													
Odontoschisma denudatum	HOL	x	x						x	x	x	x	x										
Odontoschisma prostratum	TRO	x	x													x							
Pallavicinia lyellii	WS	x	x	x			x			x							x	x	x			x	
Petalophyllum ralfsii	TRO	x								x								x					
Plagiochila dubia	TRO	x												x	x	x	x						
Plagiochila ludoviciana	TRO	x												x									
Plagiochila miradorensis	ENA	x																					
Porella pinnata	TRO	x														x							
Porella platyphylla	HOL	x	x	x		x			x	x			x					x					
Radula australis	ENA	x																					
Radula obconica	ENA	x	x	x																			
Reboulia hemisphaerica	WS	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x		x		x	
Rectolejeunea maxonii	TRO	x														x							
Riccardia cf. *jugata*	ENA	x																					
Riccardia latifrons	HOL	x	x	x		x	x		x	x	x	x	x										
Riccardia multifida subsp. *synoica*	ENA	x	x																				
Riccia curtisii	WS	x															x				x		
Riccia fluitans	BOR	x	x	x		x																	

		Biogeographical Region[1]																					
	Element[2]	SE -US	NE-US	E-CAN	SW-US	NW-US	MW-US	W-CAN	N -EUR	S-EUR	N-ASIA	W-ASIA	E-ASIA	MEX	C-AM	W-IND	N-SA	N-AFR	C-AFR	S-SA	S-AFR	AUS-NZ	ANT
Riccia huebeneriana subsp. *sullivantii*	ENA	x	x	x																			
Riccia membranacea	TRO	x																x					
Riccia sorocarpa	HOL	x	x	x					x	x								x				x	
Riccia stenophylla	WS	x																		x	x		
Ricciocarpos natans	WS	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x			x	
Scapania nemorosa	HOL	x	x	x			x		x	x		x											
Scapania nemorosa fo. *whitehouseae*	ENA	x																					
Solenostoma gracillimum	HOL	x	x						x	x	x		x										
Solenostoma hyalinum	HOL	x	x		x	x		x	x	x		x		x			x	x					
Sphaerocarpos texanus	HOL	x					x		x	x							x	x					
Telaranea nematodes	WS	x	x						x							x	x				x		

[1] Southeastern United States (SE-US), Northeastern United States (NE-US), Eastern Canada (E-CAN), Southwestern United States (SW-US), Northwest United States (NW-US), Mid-Western United States (MW-US), Western Canada (W-CAN), Northern Europe (N-EUR), Southern Europe (S-EUR), Northern Asia (N-ASIA), Western Asia (W-ASIA), Eastern Asia (E-ASIA), Mexico (MEX), Central America (C-AM), West Indies (W-IND), Northern South America (N-SA), Northern Africa (N-AFR), Central Africa (C-AFR), Southern South America (S-SA), Southern Africa (S-AFR), Australia and New Zealand (AUS-NZ), Antarctica (ANT)
[2] Boreal (BOR), Eastern North America (ENA), Holarctic (HOL), Tropical (TRO), Widespread (WS)

APPENDIX D

INDEX TO SPECIES DESCRIPTIONS