Bryology in Texas — 1. Mosses (Musci)

Eula Whitehouse

The bryophyte flora of Texas has hardly been touched. Striking climatic extremes, with variations in time of extreme cold and rainfall, may cause an abundance of plants in one season and a failure in other years. The vast size of the state makes it difficult to cover favorable terrain at propitious seasons. However, the chief cause of the scarcity of collections may be due to the lack of resident collectors who have been and are interested in bryology.

That Texas is a region of very great interest is attested by several bryologists. Marshall A. Howe (1914) wrote: "The great state of Texas offers an almost unexplored field so far as its less conspicuous bryophytes are concerned and from the collections being made at Austin and elsewhere by Dr. M. S. Young and Dr. F. McAllister, and at College Station by Dr. F. H. Blodgett it is manifest that the state is especially well supplied with the *Ricciaceae.*" Dr. A. J. Grout, editor of the *Moss Flora of North America,* wrote to Dr. McAllister in 1931 as follows: "Your region is one of the most interesting biologically in the United States." Edwin B. Bartram, one of our foremost bryologists, in a paper on the mosses of Trans-Pecos Texas (1940) states: "Probably no area in the United States will reward bryological exploration more than the mountain ranges of southwestern Texas in Jeff Davis, Presidio, and Brewster Counties. Mexican species of mosses not now known north of the border are likely to be found here and the region offers almost unlimited opportunities for uncovering new and significant records."

Although heat and dryness are not commonly associated with bryophyte growth, many species have made themselves at home in the state by adapting their time of reproduction to their habitat. Here, the season of greatest abundance of fruiting mosses is not in September, as one finds it in the northern states. Our best collections may be made from December to April, but some species are at their best in early summer. More investigation is needed on the phenology of Texas mosses.

In the spring of 1950 I checked for Texas specimens the moss herbaria of Duke University, New York Botanical Garden, University of Michigan, and the United States National Herbarium. Partial checks were also made at the Academy of Natural Sciences of Philadelphia, University of Tennessee, Chicago Natural History Museum, and the Missouri Botanical Garden. The greatest number of specimens at present are found at Southern Methodist University and the University of Texas. The collections of the New York Botanical Garden and the National Herbarium (numbering some 200 specimens each) were the next largest. Dr. Grout's collection at Duke University has not been entirely mounted; but it should contain many duplicates of University of Texas specimens, as much of their material had been sent to Grout for identification. Several hundred duplicates from the University of Texas Herbarium may also be found in the Southern Methodist University Herbarium. E. B. Bartram's herbarium at Bushkill, Pennsylvania, contains many mosses from the western part of our State. Prof. H. S. Conard's herbarium at Grinnell, Iowa, contains many duplicates of my specimens and of those collected by Miss Mary Gentry of Houston. A large collection of Texas mosses made in the spring of 1947 by A. M. Harvill, Jr. was found at the University of Michigan, but it had not been identified nor incorporated into that herbarium. Dr. C. L. Lundell of the Texas Research Foundation has a number of unidentified mosses in his herbarium. Undoubtedly many specimens were overlooked, and other collections exist; but the entire total is too small to give an adequate picture of the moss flora of the State. A thorough study needs to be made of all specimens as soon as more material is available.

The data given in this paper have been compiled from a catalogue (soon to be published) of Texas mosses written by Dr. Fred McAllister and myself. When Dr. McAllister's failing health and his death in 1949 interrupted his work, I began work on the catalogue and added to it the mosses which I had collected in recent years. Dr. McAllister's collections were chiefly made in the central and southern parts of the state, while my recent collections have been more numerous in the northern and eastern portions. At this time I have not made a critical analysis of all specimens, but in the catalogue I have listed the determination *as given,* except

in the case of a few easily recognized errors. I am grateful to the curators of the various herbaria visited, and to the specialists who have aided in the identification of specimens, and to Dr. Lloyd Shinners, Director of the Herbarium of Southern Methodist University, who has allowed me time to make this study. Most of my collecting time in the last three years has been spent in adding to our bryophyte herbarium. I am especially grateful to Dr. Henry S. Conard for identifying, or verifying my own identifications of most of these specimens and to Dr. Elva Lawton for checking some references. The summers of 1950 and 1951 were spent at the Iowa Lakeside Laboratory, working with Dr. Conard on Texas mosses. The following botanists have assisted with identifications and suggestions: L. E. Anderson, A. L. Andrews, E. B. Bartram, H. L. Blomquist, E. G. Britton, H. S. Conard, H. A. Crum, R. V. Drexler, S. Flowers, A. J. Grout, E. Lawton, G. Sayre, A. J. Sharp, W. C. Steere, R. T. Wareham, W. H. Welch, and R. S. Williams.

The following summary of county collections was made in 1950. Since that time a number of additions to county records would change these figures slightly. In 1950 collections were known from only 113 of the 254 counties in the state. Since 55 of these were represented by only one to five species, it can easily be seen how inadequate is our knowledge of the Texas bryophyte flora. The data are summarized as follows:

1 species recorded from 15 counties: Armstrong, Brazoria, Calhoun, Gregg, Jim Hogg, Leon, Live Oak, Mitchell, Navarro, Nolan, Refugio, Uvalde, Walker, Washington, and Zapata.

2 species recorded from 12 counties: Blanco, Crosby, Edwards, Grimes, Henderson, Kleberg, Liberty, Ochiltree, Waller, Willacy, and Wilson.

3 species recorded from 11 counties: Atascosa, Erath, Galveston, Guadalupe, Hunt, Montague, Morris, Sabine, San Saba, Starr, and Wise.

4 species recorded from 7 counties: Aransas, Bell, Hopkins, Irion, San Augustine, Val Verde, and Wichita.

5 species recorded from 10 counties: Colorado, Hidalgo, Kinney, Lamar, Marion, Matagorda, McLennan, Orange, Titus, and Wharton.

6-10 species recorded from 20 counties: Austin, Brazos, Cherokee, Comal, Fannin, Fayette, Grayson, Harrison, Jefferson, Limestone, Montgomery, Palo Pinto, Presidio, Real, Red River, Shelby, Trinity, Van Zandt, Williamson, and Wood.

11-20 species recorded from 15 counties: Bexar, Cameron, Chambers, Culberson, El Paso, Hood, Johnson, Kerr, Lee, Nacogdoches, Polk, Robertson, Rusk, San Jacinto, and Smith.

21-30 species recorded from 14 counties: Anderson, Angelina, Bowie, Burnet, Cass, Dallas, Gillespie, Gonzales, Hays, Jasper, Milam, Newton, Tarrant, and Tyler.

31-40 species recorded from 5 counties: Brewster, Denton, Houston, Jeff Davis, and Llano.

The counties showing the most intensive collecting are Bastrop, with 44 species; Hardin, with 63 species; Harris, with 47 species; and Travis, with 98 recorded species. While some collecting has been done in several areas which might be expected to yield numerous records, there are still areas in which much work needs to be done. It is true, however, that in the greater number of counties without moss records, one may expect to find a restricted moss flora because of topographical and climatic conditions. Specimens with incomplete locality data were omitted from the above listing.

The following collectors are represented in the literature on Texas mosses or in the herbaria visited. The number in parentheses represents the approximate number of collections made by each. Because of an incomplete check of herbaria, undoubtedly many collectors and collections were overlooked; but the list will give some idea of the material available.

Albers, C. C. (1)
Arnwine, Lena (4)
Baker, C. F. (2)
Barkley, F. A. (5)
Baumann, Elsa (1)
Bechdolt, R. G. (5)
Berkman, A. H. (3)
Bigelow, J. M. (1)
Blodgett, F. H. (3)
Bogusch, E. R. (1)
Boll, J. (25)
Bush, B. F. (3)
Capt, Lucille (5)
Clover, E. (10)
Cross, J. C. (5)
Cutler, H. C. (2)
Diercks, F. (5)
Dixon, R. A. (1)
Drummond, Thomas (2)
Earle, F. S. (5 with S. M. Tracy)
Ebeling, F. (2)
Eckert, Mrs. W. R. (1)
Faxon, C. F. (2)
Fisher, G. L. (20)
Fitch, W. R. (3 with J. N. R.)
Floyd, Cecil (1)
Frye, T. C. (7)
Gentry, Mary (57)
Glowenke, S. L. (2)
Griffin, A. (1)
Hall, Elihu (25)
Harris, Mrs. E. A. (15)
Hart, Mrs. Dan (8)
Harvey, V. H. (1)
Havard, Valery (3)
Heald, F. D. (2)
Hinckley, L. C. (40)
Hooks, Mrs. L. J. (2)
Isely, F. B. (7)
Ikenberry, G. (1)
Jermy, G. (37)
Jones, E. N. (2)
La Motte, C. (1)
Langlois, A. B. (1)
Lesueur, H. (4)
Lewis, I. F. (2)
Lindheimer, F. J. (1)
March, E. (2)
McAllister, F. (370)
McBryde, J. B. (4)
McCart, W. L. (2)
McClung, Esther (7)
McVaugh, R. (13)
Mohr, C. (1)
Moore, J. A. (10 with J. A. S.)
Morgan, M. B. (2)
Mueller, C. H. (1)
Nash, Mrs. G. M. (2)
Nealley, G. C. (1)
Orcutt, C. R. (31)
Pace, L. (1)
Palmer, E. J. (10)
Parks, H. B. (8)
Plank, E. N. (7)
Pohl, R. (2)
Plummer, F. (2)
Ravenel, H. W. (13)
Reed, Clyde (2)
Reed, J. F. (3)
Reese, Roy (1)
Reid, Bessie M. (2)
Riedell, M. (2)
Rose, J. N. (3)
Rowell, C. A. (2)
Runyon, R. (20)
Sanders, O. (10)
Schulz, Ellen (6)
Sealy, J. E. (2)
Sharp, A. J. (2)
Shinners, L. H. (2)
Slater, Mrs. H. D. (2)
Smith, K. (1)
Standley, P. C. (5)
Stanfield, S. W. (9)
Steyermark, J. A. (21)
Tharp, B. C. (10)
Thomson, G. S. (3)
Thurow, F. W. (20)
Tracy, S. M. (5)
Turner, B. L. (1)
Underwood, L. M. (1)
Walker, J. B. (37)
Warnock, B. H. (14)
Watkins, G. M. (1)
Whitehouse, Eula (1250)
Whitney, M. (1)
Wright, Charles (18)
Wurzlow, H. (1)
Young, M. S. (4)
Young, Pauline (18)

Little is known of any bryophyte collections made by the men who collected in Texas prior to 1850. I have found no reference to bryophytes collected by Dr. Edwin James along the Canadian River in 1820. Perhaps his failure to collect them may have been owing to the fact that his trip was made in the summer in a region where bryophytes are never

plentiful at any season, and where they might pass unnoticed in a desiccated state. If Berlandier made any collections of mosses and liverworts on his trips through the southern part of the State, no record has been found in American herbaria and literature. His travels carried him at a favorable time through regions where collections might have been made. Thomas Drummond's collection of bryophytes from the southern states, distributed in 1841 and named by Wilson and Hooker, contained at least two Texas specimens, duplicates of which are in the New York Botanical Garden. Sullivant (1874) in his *Icones Muscorum* cites one Lindheimer specimen from Texas collected by Ferdinand Jacob Lindheimer, sometimes called "the father of Texas botany."

Texas bryology may be said to have had its beginnings in the collections made by Charles Wright from 1847 to 1852 in the central and southwestern part of the state. William S. Sullivant (1856) in the second edition of Gray's *Manual of Botany,* or in the separately published *Mosses of the United States,* described eight new species. These were *Acaulon Schimperianum, Bruchia brevifolia, Coscinodon Wrightii, Orthotrichum texanum, Syrrhopodon texanus, Fabronia Wrightii, Omalia Wrightii,* and *Fissidens synoicus.* One of these has since changed generic status, and two have been reduced to synonomy. San Marcos was given as the type locality for five of these, San Antonio for one, and "Texas" for the other two. Considering that the number of moss collections made by Wright was very small, this is a remarkable record. Lesquereaux and James (1884) cite eighteen Wright collections. From a copy of Wright's field notes on his southwestern trips for 1849-1852 made by Dr. Lloyd Shinners at the Gray Herbarium in 1946, I found a record of fourteen collections of mosses. Hill (1907) cites a Wright specimen collected at San Marcos in 1847. According to Geiser (1948), Wright lived at San Marcos for several months in 1850. Some of Wright's specimens, marked from San Marcos, are so like the moss flora near Zavalla where Wright made his headquarters for two or three years that one wonders if some mistake had been made in the labels. Distribution of duplicates of Wright's specimens was made by Sullivant and Lesquereaux in 1856 in their Musci Boreali-Americani. Bryologists have reported that most of Sullivant's

types have disappeared from the Gray Herbarium where they were deposited.

The two regions in which Wright made most of his collections have since then been the source of many collections, most of which have yielded new species or new records for Texas or the United States. The central part of the state, characterized by an uplift of limestone known as the Edwards Plateau and broken by many rivers and springs, has profited by the work of Dr. F. McAllister and others. Some of Dr. McAllister's specimens have been included in Grout's North American Musci Perfecti, and others form the basis of the University of Texas Bryophyte Herbarium. Grout (1945) described a new species, *Acaulon megalosporum*, from plants collected at Austin (N.A. Musci Perfecti 421). One of my specimens from Seven Hundred Springs (west of Junction, Kimble County) was named by Grout in 1933 as a new species, *Hygroamblystegium macroneuron*. Bartram (1928) reported on a collection of mosses made by Mrs. E. A. Harris near San Antonio and Kerrville. One of these, *Pleuropus Bonplandii*, was a new record for the United States.

The Central Mineral Region, an extrusion of pre-Cambrian rocks in the Edwards Plateau in Llano, Burnet, and Gillespie counties, has been worked by Jermy, McAllister, Barkley, Whitehouse, and others. The specimens of Gustav Jermy in the United States National Herbarium have received little notice. He collected 37 or more mosses in several localities in Gillespie County in 1888-90. Cardot & Theriot (1904) described as new *Desmatodon tophaceus* var. *decurrens*, based on a collection in Dr. E. Zickendrath's herbarium made by Rev. F. Ebeling on Shovel Mountain in Burnet County. Whitehouse (1933) listed nine mosses as taking part in plant succession on the granite. The moss flora of this region, when it has been worked in more detail, will probably show a definite relationship to that of the Rocky Mountain region of western Texas.

In the mountainous region west of the Pecos River, several collectors since Wright have advanced our knowledge of the moss flora. Dr. Valery Havard in 1883 collected a few mosses. Bartram (1929) reported on a collection of thirty species made by C. R. Orcutt near Alpine and Fort Davis in May and June of 1926. From these Bartram described as new species, *Weisia glauca*, *Grimmia americana*,

and *Funaria Orcutti,* and reported as new to the United States flora *Brachymenium mexicanum* and *Tortula obtusissima.* E. J. Palmer and A. H. Berkman collected in the same general area in 1928. *Ptychomitrium serratum,* collected in the Guadalupe Mountains in 1924 by P. C. Standley, was a first record for the United States as reported by Bartram (1926). Steyermark and Moore (1933) collected in the Chisos, Davis, and Guadalupe Mountains, reporting *Venturiella sinensis* for the first time in North America. My collections in 1931-32 were made chiefly in the Hueco and Franklin Mountains near El Paso; but those of 1948-51 were made in the Chisos and Davis Mountains. Bartram (1940) reported *Lindbergia mexicana* as new to the United States and described a new species, *Didymodon Hinckleyi* from L. C. Hinckley's collections in the Davis Mountains. Other collectors of this region include Tracy & Earle, Mueller, and Marsh. Conard (1947) reported B. H. Warnock's collection of *Braunia secunda* as new to Texas, but several other specimens were collected before Warnock's.

In the area south of Corpus Christi and San Antonio to the Rio Grande, little collecting has been done. It is a region of chaparral growth and very low rainfall. Some few mosses have been found on moist sand along the Rio Grande, on moist decayed logs, and on soil at the base of trees. Clover (1937) in a vegetational survey of the lower Rio Grande valley reports four liverworts and ten mosses. In her collection was a specimen of *Erpodium domingense* which Steere (1934) reported for the first time in the United States. Robert Runyon of Brownsville, one of the two Texas members of the American Bryological Society, has collected 20 mosses in the vicinity of Brownsville. One of these, *Acaulon Runyonii,* was described as new by Grout (1945). In a personal letter Mr. Runyon has commented upon his attempts to grow some of these mosses in an effort to get fruiting specimens in his region. Several other specimens have been collected along the river by J. N. Rose and Wm. R. Fitch in 1931 and by myself in 1944.

The eastern part of the Texas coastal plain shows few collections. Those for Chambers and Harris counties were chiefly made in wooded areas where rivers empty into the Gulf of Mexico. According to Childs (1947), H. W. Ravenel collected cryptogamic specimens in Texas in 1869 between

Galveston, Houston, and Corpus Christi. Near the Ashbel Smith farm on Galveston Bay, he made the only collection of *Anacamptodon splachnoides* known from the state. R. G. Bechdolt in July, 1870 collected five mosses on Matagorda Bay, among which was *Octoblepharum albidum,* a very common and abundant moss on the eastern coastal plain of Florida, according to Schornherst (1943). I found the specimen incorrectly filed at the New York Botanical Garden, and this probably accounts for the fact that Williams (1913) and Grout (1937) state only that it is also credited to Texas by Austin. In 1892, E. N. Plank collected a few specimens in Wharton and Jefferson counties. The best known collection has been that of Elihu Hall in March, 1872, mostly from Harris County near Houston but some from Dallas County. He made at least 25 moss collections from which Austin (1874) described *Bruchia Hallii* and *B. texana* and in 1877 *Archidium Hallii* and *Fissidens Hallii.* Several other new species named by Austin from other collections have been reduced to synonomy. Recent collections, chief among which are those made by George L. Fisher, F. W. Thurow, and Mary Gentry, have added considerably to our knowledge of the area.

Mosses are more abundant in number of plants and probably more abundant in species in the longleaf pine belt and the magnolia-beech forests of Southeastern Texas than in other areas of Texas. However, Travis County in central Texas has been better worked and shows 98 recorded species to 63 species for Hardin County where the collecting for the area has centered. These collections have been made principally by McAllister, Young, and myself; but significant help has been given by two local naturalists, Mrs. Bessie Reid and Mrs. L. J. Hooks. Their farms, 7 miles south of Silsbee, have proved fertile collecting grounds for both mosses and flowering plants. The moss flora of this area shows a close affinity with that of the coastal plain of Georgia, and 66 of the 98 species listed by Schornherst (1946) may be found in Texas. Dr. McAllister collected through many seasons in the loblolly pine belt of Bastrop County, but very little was known of the moss flora of the shortleaf pine belt until my recent collections have become available.

Along water courses and in boggy areas of the post oak and pine forests of north and northeast Texas, many mosses

may be found, but the collections from this area are very inadequate for a study of the moss flora. About 25 specimens collected by Jacob Boll near Dallas came to the attention of Carl Mueller in Europe. Two of these specimens were described as new by Mueller (1873). Both of these, *Catherinea xanthopelma* and *Barbula cancellata,* have long been considered synonyms of related species, but recently the former has been restored to specific rank by Frye (1949). My collections in this area have been more abundant in Dallas, Denton, and Tarrant counties, with some collections from the counties on the northern border of Texas. J. B. Walker's collections in Robertson County are from the southern part of the post oak belt. Several other collectors have added a few collections each to this area.

In the plains area a few scattered specimens give us a very incomplete picture of the moss flora. Those reported are common to the moss flora of New Mexico. The canyons of the rivers crossing the plains and the slopes of the Cap Rock need more investigation.

Many problems arise in trying to identify the Texas mosses; and a thorough study of a large amount of material is greatly needed.

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