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ANOTHER ALIEN HAS LANDED: *EVAX PROLIFERA* IN MISSOURI

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In May, 1991, members of the Botany Group of the Webster Groves Nature Study Society, took an excursion to Missouri's Ozarks in search of various plant species. The group was nearing the Caney Mountain Wildlife Area north of Gainesville when we were flagged down by a display of Purple Penstemon along the road. We parked at the turnoff to the Area and walked back up the highway to enjoy the showy flowers of *Penstemon cobaea* var. *purpureus*. Upon reaching the roadside glade we were pleasantly surprised to see the white-eyed, purple blossoms of *Scutellaria bushii* as well. Then came another surprise.

Marge Ruschill was the first to see them -- a host of gray-green sentinels at the edge of the glade, forming a dense population for about 20 meters. The plants were low like sedums, no more than 10 cm tall, but they were obviously not succulent in habit. The alternate leaves were flattened and spatulate, and were covered with a matted white hairiness. Each plant developed a leafy "cup" at its stem's summit, with more of the same spatulate leaves. The more robust specimens had spoke-like branches from these cups, each terminating in another leafy cup.

We tried our best to find a flower in one of these leafy cups. Betty Nellums discovered the skeletal remains of plants from the previous year, which had no more branches than some of the living specimens before us. At that time, however, all that we could see were amorphous green masses among the dense matted hairs. Later, we were to learn of the minute flowers, visible with the aid of a microscope.

Betty and Marge guessed the plants to be of the genus *Eriogonum* (Polygonaceae). This was a truly educated guess, based on their familiarity with Western roadside *Eriogonum* species, some of which also have white wooliness and "umbrella-branching". However, we soon determined that the new find was not the *Eriogonum* already known from Missouri, and the plants did not fit anywhere in the key to *Eriogonum* species in the *Flora of the Great Plains* (Great Plains Flora Association, 1986) or in Steyermark's (1963) flora.

Pat and Jack Harris turned our specimen over to George Yatskievych at the Flora of Missouri Project, who suspected that it represented a relative of *Gnaphalium*, in the tribe Inuleae of the Asteraceae. After careful examination under the microscope and a telephone conversation with a specialist on the taxonomy of this tribe, James Morefield of the Nevada Natural Heritage Program, the identity

of our sample was confirmed to be *Evax prolifera* Nutt. ex DC. (Asteraceae, tribe Inuleae). This species is native to open limestone areas and sandy roadsides in drier parts of the western United States, where it is commonly known as Rabbit Tobacco.

At the Ozark County site, plants grow at the edge of a dolomite glade, even approaching the "no-plants land" between the glade and the road shoulder. They are clearly not native to the area, but how they came to be introduced at the site remains a mystery. The skeletal remains we encountered indicate that the population has existed there for at least one year.

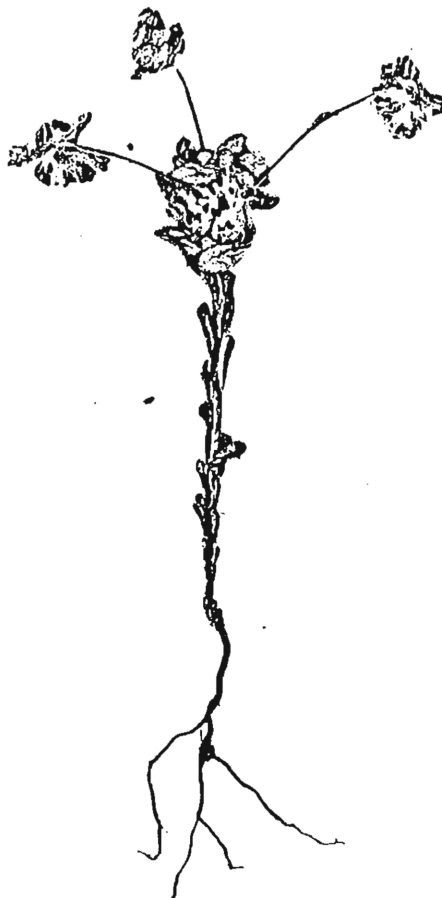


Figure 1. Xerograph of *Evax prolifera*.

As befits an alien, the plants have an eerie aspect (Figure 1). These oddly branched, densely hairy curiosities are easily overlooked, but are striking once noticed. The prominent leafy cups contain amorphous masses of indistinguishable flower heads. These shapeless masses, called glomerules, are visible to the eye as small green "blobs", and we can be forgiven if we were looking for more obvious evidence of blooming. The individual flowers are only about 1/2 mm long and are of two types. Flowers that appear to produce both stamens and pistils are functionally staminate and bear no seed. The seed-producing flowers do not resemble those of any other Missouri composite, lacking a corolla, pappus, and stamens.

The plants are annuals and proliferate by seed. They are evidently quite short-lived. We originally encountered the population in flower on May 15, but by June 15, when members of the Missouri Native Plant Society revisited the site, all of the plants had died and dried to skeletal remains. These odd ephemerals may be present along other Missouri roadsides, but it will take a keen eye, good timing, and lots of luck to spot them.

The species epithet *prolifera* probably refers to the dense stands formed by this plant. The word is sometimes used for the production of new starts on side shoots, which our species does not have. But the epithet might refer to the spokelike branches producing new leafy cups in some individuals.

A collection of *Evax prolifera* from the Missouri population has been deposited in the herbarium of the Missouri Botanical Garden Herbarium (MO) and bears the following label:

OZARK COUNTY, along road shoulder of State
Highway 181 about 1/4 mile northeast of en-
trance to Caney Mountain Wildlife Refuge;
NW 1/4 SEC. 15, T. 23 N, R 13 W, 15 May 1991,
Webster Groves Nature Study Society s.n.

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- Steyermark, J. A. 1963. *Flora of Missouri*. Iowa State University Press, Ames, IA. lxxxiii, 1725 pp. [+ 3 pp. errata, printings 2-6].

STUDIES IN THE FLORA OF MISSOURI, III.

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The publication of the recent checklist of Missouri's flora (Yatskievych and Turner, 1990) has spurred other studies on various aspects of the state's flora. Although intended to be a complete list of the plants growing outside of cultivation in Missouri, several species were omitted from consideration for that catalogue, either because further research was necessary to confirm certain determinations or because several manuscripts already in progress were not completed in time. Hopefully the next few field seasons will continue to provide a variety of additional state records by the various students of the Missouri flora, as well as further refinements in our understanding of the taxonomy and distribution of species growing in the state.

NEW SPECIES RECORDS

Aphanes microcarpa (Bolss. & Reuter) Rothm. (Rosaceae), commonly known as Parsley Piert, is a spring-flowering annual native to Europe. The stems are unbranched, or branched from the base, and can grow to 10 cm long. The alternate leaves, which are palmately lobed and toothed, resemble those of storksbill (*Geranium* spp.). The tiny flowers lack petals and are clustered in the leaf axils, all but hidden by the large, leaflike stipules. This species was recently collected in Missouri for the first time: HOWELL COUNTY, 4 mi SW of West Plains, at Warden Prairie, 30 May 1990, *Summers 3248* (MO).

In North America, this introduced species is widely distributed in open, disturbed sites, particularly in Coastal Plain areas of the southeastern United States (Robertson, 1974). Although not previously collected in Missouri, Parsley Piert occurs in several Arkansas counties, the closest being in White County (Smith, 1988), about 160 km to the southeast of the Missouri population.

The unusual vegetative and flowering characteristics of *Aphanes microcarpa* insure that it would not key close to its nearest relatives in Steyermark's (1963) flora. The lack of petals and irregularly lobed leaves cannot be accounted for in the key to genera of Rosaceae, although most users would probably "force" plants into *Geum*. In fact, *Aphanes* has no close relatives in the Missouri flora, although most botanists consider it an unusual member of the tribe Sanguisorbeae, which includes the agrimonies (*Agrimonia* spp.). However, botanists who attempt to key this species using Steyermark's (1963) key to families would have further problems, as it keys closest to Violaceae.

There is some disagreement on what level the species comprising *Aphanes* should be recognized, taxonomically. Most North American treatments (e.g., Robertson, 1974) continue to recognize the group of annuals with 1-2 extrorse stamens (anthers positioned facing toward outside of flower) inserted opposite a calyx lobe and along the inner edge of a nectar ring in the flower as a section of the genus *Alchemilla*, and refer to our plant as *Alchemilla microcarpa* Boiss. & Reuter. However, botanists in South America and Europe, where diverse members of the complex are native, usually restrict the genus *Alchemilla* to a smaller group of perennials with 4, introrse stamens inserted alternate with the calyx lobes and along the outer edge of the nectar ring, as a separate genus (e.g., Reichgelt, 1952). Although a thorough taxonomic revision of this group is lacking, *Aphanes* appears amply distinct from *Alchemilla* and deserves treatment as a separate genus.

Dichondra carolinensis Michaux (Convolvulaceae), or Pony-foot, is a new species in a new genus for the state. It was discovered by Bill Summers while driving through a pastured field in Howell County. The population occupies an area ca. 7 m in diameter, in a low, rocky area at the edge of a wet to seasonally flooded, shallow drainage. The adjacent field has been pastured, but not farmed or hayed, for many years (it has been owned by the Summers family since 1912). Although the locality was cleared of timber early in this century, the lack of recent disturbance and absence of introduced species in the immediate vicinity suggest that Pony-foot might be native at this site. Locality data for a voucher specimen are: HOWELL COUNTY, along Rattlesnake Draft, Summers farm, ca. 3 1/2 mi N of Brandsville, 16 Nov 1988, *Summers 2840* (MO).

Dichondra carolinensis is widely distributed in the southeastern United States from Virginia to Florida and westward to Arkansas and Texas (Wilson, 1960). It grows in a wide variety of wet and seasonally wet habitats, and is a common lawn weed in some areas. Plants are also sometimes cultivated as a lawn substitute and soil binder in some areas, and have been listed in the horticultural trade as Dew-drop Grass, or *Dichondra*. The closest locality to the Missouri population is in Pope County, Arkansas (Smith, 1988), about 150 km to the southwest.

Pony-foot spreads as tangled mats of prostrate stems, rooting at the nodes. The small, alternate leaves are broadly ovate to orbicular, and commonly cordate. Small, stalked flowers arise singly from the leaf axils and have white to purple petals (white in the Missouri material). The fruits are small, deeply two-lobed capsules. Various floras describe the species as annual or perennial, but it does overwinter in warmer areas.

The taxonomy of *Dichondra* has not been well studied, and there is controversy concerning the relationship between our southeastern taxon and the widespread, pantropical, *D. repens* Forster. North American plants are listed as *D. repens* var. *carolinensis* (Michaux) Choisy in many regional floras (Wilson, 1960).

Plants of this taxon do not key well in Steyermark's (1963) flora. In the key to families, specimens will key quickly, but erroneously, to the family Menispermaceae. Even within the Convolvulaceae, the genus will not key well to any of the genera included by Steyermark, because of conflicting characters. The genus is unique among Missouri Convolvulaceae in its deeply two-lobed ovary with 2 gynobasic (attached in the notch between the lobes) styles, and its small, broad, cordate leaves.

Drew (1944) described the commercial sale of dew-drop grass as a lawn substitute in Missouri and Kansas during the early 1940's. He conducted field tests in the Columbia, Missouri, area on two accessions of plants then available, and concluded that the species was unsuitable for cultivation in the Midwest and Plains states. The plants studied by Drew neither overwintered successfully, nor regenerated from seed, in spite of vigorous growth and flowering the first season. In contrast, observations indicate that the Howell County population flowers in mid-June and subsequently sets seed and overwinters (although foliage is frequently damaged during cold weather). There is little reason to believe that the Howell County population was planted, because there is no old homesite in the vicinity and the immediate area shows no evidence of recent, heavy disturbance.

Microstegium vimineum (Trin.) A. Camus (Poaceae), sometimes known as Eulalia, is an annual grass native to Asia. It has become established at scattered sites in the eastern half of the United States, including Pope and Massac counties in southern Illinois (Mohlenbrock, 1986) and Franklin and Johnson counties, in northwestern Arkansas (Smith, 1988). The North American distributional range of this species is apparently expanding, as indicated by its relatively recent discovery in several states. In Missouri, *Microstegium vimineum* was discovered in Oregon County, in a low woods near a spring, where it was either introduced following flooding of the adjacent Eleven Point River, or as a result of human disturbance along an old roadbed at the site. Voucher data are: OREGON COUNTY, low woods bordering Blue Spring, 2 mi E of Billmore, 3 Nov 1990, Summers and Dodds 3920 (MO).

Microstegium vimineum is a decumbent annual, forming loose mats. The inflorescences are loose clusters of few, small racemes. The spikelets are paired at each node, with both the sessile and stalked spikelets fertile. Among the grasses, the genus is classified in the tribe Andropogoneae, which includes several Missouri genera, notably the bluestems (*Andropogon*, *Bothriochloa*, and *Schizachyrium*). However, it has no close relatives among Missouri grasses and does not key well in Steyermark's (1963) key to grass genera. *Miscanthus*, an Asian genus of large, perennial plants, three species of which have escaped from cultivation in the state, is the closest relative of *Microstegium* in Missouri, but these genera differ by so many gross-morphological characters, including plant size, longevity, habit, and inflorescence and spikelet structure, that no one would

be likely to confuse the two groups.

Sacciolepis striata (L.) Nash (Poaceae), commonly known as American Cupscale, is a perennial grass often forming dense stands in a variety of wetland habitats. Although widespread in the Caribbean Islands and in Central and South America, its U.S. distribution is primarily in Coastal Plain areas from New Jersey southward to Florida, and west to Texas. The species has also been reported previously from scattered inland localities in Oklahoma, Arkansas, and Tennessee.

Recently, a new population of this species was located along the margin of a sinkhole pond, during a Missouri Native Plant Society fieldtrip. A voucher specimen was collected: OREGON COUNTY, Brushy Pond, on E side of State Highway 19, N of Greer, 15 Sep 1990, Yatskievych & Summers 90-404 (MO). At this site, plants form a dense patch ca. 3 m in diameter, with numerous flowering and fruiting stems, situated among *Cephalanthus* (Buttonbush) shrubs along the wet shore, near the contact zone between wetter soils and the drier, cherty slopes rimming the pond.

American Cupscale is so known because of the large, broadly inflated second glume of each spikelet. The spikelets superficially resemble those of *Panicum* species, with shiny, white, hardened, fertile lemmas, but although this species would key to *Panicum* in Steyermark's (1963) flora, it is easily distinguished from that genus by its inflated glumes. An interesting observation is that the inflorescences of *Sacciolepis striata* shatter quite easily, sometimes shedding spikelets before the fruits are quite mature.

The Oregon County site for American Cupscale contains the northwesternmost population of this species known to date. It is about 300 km north of the closest previously known site, in Saline County, Arkansas (Smith, 1988). Originally, plants were probably dispersed into the area by waterfowl, but the size, persistence, and evidence of reproduction of the population indicates that this happened long ago, and the species should be considered an addition to the native flora of Missouri.

The Green Foxtail, *Setaria viridis* (L.) P. Beauv. (Poaceae), is a Eurasian introduction that is widespread in Missouri. Previous collections of this species from the state have all been referable to var. *viridis*, but a second variety, *S. viridis* var. *major* (Gaudin) Posp., is also commonly encountered in some parts of the United States. This variety resembles the Nodding Foxtail, *S. faberi* F. Herm., in general aspect. Like the nodding foxtail, the var. *major* is a larger, coarser plant than typical *S. viridis*, with stems to nearly 2 m long, leaves to 25 mm wide, and the inflorescence nodding (though not as much as in *S. faberi*). However, it has the glabrous leaves and spikelet characteristics typical of *S. viridis*, and would key fairly well to that species in Steyermark's (1963) flora. Although this variety is

undoubtedly fairly widespread, at least in eastern Missouri, the first collection from the state has only recently been made. Plants grew spontaneously on a pile of topsoil that originated from along the Meramec River in west St. Louis County. Voucher data are: ST. LOUIS (city), garden in yard of residence, 4118 Utah Street, 11 Aug 1990, K. & G. Yatskievych 90-272 (MO).

The Section *Beccabunga* of the genus *Veronica* (Scrophulariaceae) is represented in Steyermark's (1963) flora by two morphologically similar species, *V. americana* (Raf.) Schwein. ex Benth. (American Brooklime) and *V. comosa* Richter (Water Speedwell), the latter usually treated as *V. catenata* Pennell in most of the recent literature (Yatskievych and Turner, 1990). To these, we now add the European Brooklime, *V. beccabunga* L., an introduced taxon native to the Old World.

This species was discovered at a small spring near Bloomsdale, in Ste. Genevieve County. Plants formed a dense colony in shallow water along the entire length of the short spring branch leading to Establishment Creek, and also for a short distance along the main creek bank. This initial site was subsequently channelized and filled with gravel. However, although the original site was destroyed by this action, a second colony was later observed growing further upstream, near the Lake Ski dam. Only the original site has been vouchered: STE. GENEVIEVE COUNTY, spring branch along Establishment Creek on Rocky Ridge Ranch near Bloomsdale, 15 May 1976, Summers 219 (MO).

Veronica beccabunga will key to *V. americana* in Steyermark's (1963) flora. In Missouri, the latter taxon is known from a single, historical locality. European and American brooklimes are closely related and are sometimes treated as varieties of a single species, *V. beccabunga* var. *beccabunga* and var. *americana* Raf. The two taxa are easily distinguished by differences in leaf shape: widest above middle and with rounded tip in European brooklime, versus widest below middle, with obtusely pointed tip in American Brooklime. There are also cytological differences between the two taxa: *V. beccabunga* is a diploid ($2n=18$), while *V. americana* is tetraploid ($2n=36$) (Schlenker, 1936). Although the two taxa are not known to hybridize in nature, a sterile, artificial hybrid was produced by Schlenker (1936). Among the three subspecies of *V. beccabunga* recognized by Fischer (1985), Missouri materials key best to ssp. *beccabunga*, but these infraspecific taxa are poorly defined and not easily distinguishable. Therefore, although the European Brooklime seems best treated as a separate species from its American relative, subspecies recognition does not seem warranted, at least based on New World collections.

THE GENUS *LIGUSTRUM* IN MISSOURI

The genus *Ligustrum* (Oleaceae), the privets, contains about 30 species of shrubs, mostly in eastern Asia and Malaysia. Several of the species are cultivated

as ornamentals, both for their attractive foliage and for their fragrant, white flowers. Most of these escape and become established in areas where they are grown. For example, Hardin (1974) listed eight species for the southeastern United States.

Steyermark (1963) included only two species in his treatment for the *Flora of Missouri*. Of these, *L. ovalifolium* Hassk., the California Privet, was considered a rare escape from cultivation at a single site in Texas County, and has apparently not been collected in the state since that time. The other species, *L. vulgare* L., or Common Privet, was technically excluded from the flora, but was given a full treatment and illustration, based on the expectation that it would eventually be discovered growing outside of cultivation in the state. Although this species is still widely cultivated as a hedge plant and undoubtedly escapes from cultivation around urban areas, it has yet to be documented as established anywhere in Missouri. It should be searched for in the St. Louis and Kansas City areas.

Recently, we attempted to update the records of privets growing outside of cultivation in Missouri, both through a search of recent collections at MO and through additional field work. Privets are not often collected, but we were able to accumulate data on two different taxa. We were surprised to find that neither of these was among the species included by Steyermark (1963).

Plants ascribed to *L. vulgare* have long been known to escape from cultivation on the grounds of the Shaw Arboretum at Gray Summit, in Franklin County, with collections dating back to 1970. The berries of shrubs originally cultivated at the Arboretum have apparently been spread over the years by birds or mammals. Plants are now well established and considered weedy pests along some roadsides and trails on the grounds. Recent, ample material from the Arboretum was kindly provided by Bill Davit of the Missouri Botanical Garden. These were determined not to be *L. vulgare*, but were instead *L. obtusifolium* Siebold & Zucc. The following collections at MO voucher this species in Missouri: FRANKLIN COUNTY, Shaw Arboretum, Gray Summit, 29 Sep 1970, *Andreasen et al.* 68; same locality, 30 May 1972, *Shea* 182; same locality, 24 May 1990, *Davit s.n.*

A different species of privet was discovered during recent field work in southeastern Missouri. This shrub was uncommon in sandy soil along an old dirt track bordering a flat, seasonally inundated, oak forest. It keyed to *L. sinense* Lour. in recent keys to privet species (e.g., Hardin, 1974). Voucher data are: DUNKLIN COUNTY, Wilhelmina State Forest, NW of Wilhelmina, ca. 1/2 mi W of County Road 203, 22 August 1990, *Yatskievych & Ladd* 90-296 (MO).

Several authors have pointed out that species limits among the cultivated privets are not well understood. Wilson and Wood (1959) and Hardin (1974) point to the lack of a recent revision of Asian *Ligustrum* and suggest that until species in this genus are well understood in regions where they grow natively,

It will be impossible to revise those species escaping from cultivation in the United States. The following key is adapted from Hardin (1974), and will distinguish flowering specimens of species currently thought to grow in Missouri. Sterile or fruiting material is often difficult to determine and requires direct comparisons with authentic, representative specimens in the herbarium.

KEY TO MISSOURI *LIGUSTRUM* SPECIES

1. Twigs pubescent
 2. Corolla tube longer than the lobes; calyx pubescent *Ligustrum obtusifolium*
 2. Corolla tube as long as, or shorter than, the lobes
 3. Twigs densely pubescent, leaves pubescent on abaxial (underside) midrib *Ligustrum sinense*
 3. Twigs minutely puberulent, leaves glabrous *Ligustrum vulgare* (excluded species)
1. Twigs glabrous
 2. Corolla tube as long as, or shorter than, the lobes *Ligustrum vulgare* (excluded species)
 2. Corollas tube longer than the lobes *Ligustrum ovalifolium*

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After the Ice Age, The return of life to Glaciated North America. by E. C. Pielou. Copyright 1991. The University of Chicago Press. Chicago. 366 pp. ISBN 0-226-66811 (cloth) \$24.95.

This book, by one of the world's leading biogeographers, is a lucid account of how the face of North America was affected by the Pleistocene Ice Age. For those who have no special training in glaciology, the account of the causes of ice sheets, their advances and retreats, is most fascinating. Of special interest is how the patterns of ice melt shaped the current ranges of many plants and animals.

It is also evident from the research reviewed by Pielou that the development of biotic communities after the retreat of the ice sheets was influenced by successional events that were often quite unique, responding to local conditions and the availability of sources of colonizers. Pielou also make the point that life seldom, if ever repeats itself, because the combination of factors controlling biotic development is not likely to be exactly replicated in either time or space. This point should certainly be considered by those who would try to recreate biotic communities that existed at some point in time in the distant past. Also, it is clear from reading this book that in spite of our justified concerns about global warming, we are in store for more massive continental glaciers in the relatively near geological future.

Though the price of this book is high, it is one that should be in the library of anyone concerned with conservation, the preservation of biodiversity, or restoration ecology. **Paul L. Redfearn, Jr.**

THE MISSOURI FLORA GEOGRAPHIC INFORMATION SYSTEM AND A PROPOSED ATLAS OF VASCULAR PLANT FLORA IN MISSOURI

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INTRODUCTION

In 1983, the Missouri Flora Geographic Information System (GIS) project at Southwest Missouri State University commenced with the purpose of creating a computer database of all recorded plant taxa in Missouri, along with their counties of occurrence and other ancillary information. Although a number of uses may be made of this information, the primary stimulus for creation of the GIS was the intent of publishing an atlas of vascular plant distribution in Missouri.

The Atlas Project—An Historical Perspective

In 1963, Julian Steyermark published the *Flora of Missouri*. This landmark compendium included the taxonomy, description, and geographic distribution of over 3200 taxa in Missouri. Since its publication, the *Flora of Missouri* has been the single most important source book for botanists seeking to explore, document, or research Missouri vegetation. Steyermark's dot maps of plant distribution remain an effective method of visualizing the dispersal of taxa across the state. During the almost thirty years since the *Flora of Missouri* was published, botanists from around the state of Missouri, as well as other states, have continued to collect and document the distribution of plant taxa in Missouri. New taxa, not included in the *Flora* have been found, and previously recorded plants have been found in counties where they were not previously recorded.

However, except for occasional comments concerning the discovery of state and county records in various journal articles, theses, and reports, no organized attempt was made to keep an updated record of the distribution of Missouri taxa over most of these years. In 1980 Norlan Henderson made a significant contribution to updating species distribution records by publishing in a Department of Conservation report, 1748 county records.

In the summer of 1979, the **Missouri Native Plant Society** was formed, an event which fostered a renewed interest in Missouri botany and eventually stimulated such current activities as an update of plant distribution in Missouri. The society soon initiated publication of *Missouriensis*, a journal dedicated to the Missouri flora, and a vehicle which would allow botanists to communicate their discovery of new distribution records.

In 1981 procedures were adopted by the society for updating Steyermark's records. These included creation of an official register for state and county records, subsequently known as the *Botanical Record*. The junior author was designated editor and the first number of its publication appeared the following year (1982) in *Missouriensis* 4 (1). During the 9 intervening years, 13 *Botanical Records* have been published. To date, 58 lists of county records, contributed by 38 members of MONPS, have been added and published in the first 14 *Botanical Records*. These lists have included over 4100 county records and the collections of over 370 persons. Several associate editors have contributed much to the publication of these records and included Doug Ladd, Jay Raviell, and Jon Rebman.

As this new information accumulated, it became necessary to update Steyermark's pre-1963 dot distribution maps. Thus, efforts toward achieving one of the **Missouri Native Plant Society's** first (and major) goals--publishing a complete revision of the distribution maps for all Missouri's flora in the form of an atlas--was begun in 1983 at Southwest Missouri State University. However, because of the widespread use of computers and computerized databases, it was decided to store and distribute much of the information in computer-usable form rather than only as paper maps. Furthermore, the advantage to using computer databases is threefold: they may be relatively easily updated to reflect new information, they may be easily used for research purposes requiring tabulation of taxa or county information, and they may be easily and quickly distributed.

The Missouri Flora GIS project's major objective, publishing a complete revision of the distribution maps for all Missouri's flora, has not yet been reached. Although a significant number of records have been added (including most of those submitted to us) many records remain to be submitted for publication. These include lists of taxa from various personal collections and lists of taxa from earlier collections already in herbaria. Many of those in the latter category could be identified from lists in theses and other scientific publications.

It is our intention, for critical review purposes, to print drafts of an atlas in its present state of completeness, with a more complete, revised version projected to coincide with publication of the projected new Missouri Flora. Currently our database contains the taxa and nomenclature used by Steyermark. With the recent publication of the *Catalogue of the Flora of Missouri*, by Yatskievych and Turner (1990), it will be necessary to update nomenclature and modify

Steyermark's original list of taxa in the projected revised version.

Since the information collected in this project is freely available to all interested parties, a description of the database and data collection activities may be of interest to those who wish to use the data in a form other than paper maps.

Database Creation

County Records

The first and major portion of this project involved converting Steyermark's (1963) distribution maps into computer-readable form along with the scientific name of each taxon. A microcomputer and a graphics tablet digitizer were used, along with programs written specifically for the project, to digitize over three thousand maps. This activity took more than four years and was largely accomplished by Richard Humphrey during his tenure as a graduate student. Accuracy checking of this information, by members of the Missouri Native Plant Society, took another two years.

The second phase of information assimilation involved the addition of information published since Steyermark's flora. The update records were entered into the database, and each published list, containing numerous individual contributors, was given a single identifying code. Henderson's (1980) list of additions marks another large corpus of records, and this list was given its own separate code. Currently the database contains fourteen contributor or list codes, one for Steyermark, one for Henderson, and one for each list published in *Missouriensis*. Thus, any record of a taxon in a county is identifiable by contributor or published list. The recording of data from Henderson's publication, as well as from all *Botanical Records* are still being proofread.

Each taxon has an entry in the database similar to Figure 1. The main portions of the record are: family, genus, specific epithet, subspecific epithet, map number, and county record. To record county occurrence information, Steyermark's (1963) county numbering system was used (Figure 2). These county numbers were used as entries in the database. Boone County, for example, is known in the database as county 40. The county record information is an array of numbers or letters where the position in the array denotes the county (e.g., the first number refers to county 1 or Atchison County; the fortieth number refers to county 40 or Boone County), and the number at that position refers to the contributor or list of contributors that recorded the taxon in that county. A zero means the taxon is not recorded in the county, a one means Steyermark recorded it there, a two Henderson, an "a" indicates the first *Missouriensis* list, a "b" the second, etc.

Steyermark (1963) used only one map number for each species, even

though several subspecific taxa might be listed, and the map number information has been kept as close as possible to Steyermark's numbering system, with a few

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ALISMACEAE
SAGITTARIA GRAMINEA V.GRAMINEA 96
000000000000000000000000
000000000000100010000
000000000000001000000
001000000000000010000
00000101001001100000
10011011000010

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Figure 1. Typical Database Record. Each record is made up of the taxonomic name, followed by the Steyermark map number and 114 numbers indicating presence (non-zero) or absence (zero) from each county.

exceptions. Decimal places have been added to the original numbers where new or additional information is required. As an example, in a couple of instances Steyermark labeled maps with a number and letter (e.g., 1613, 1613A) perhaps because information became available after the maps had been drafted and numbered. In other instances, Steyermark utilized a single map to illustrate the distribution of similar varieties or forms of a species, using different symbols to represent each taxon (perhaps a dot for one taxon and an x for the other). In the Missouri Flora GIS, each taxon is represented by a separate map number, and all map numbers are numeric. In order to maintain a close similarity to the original numbering system, decimal places were added to allow for these irregular occurrences. Map 1613A therefore becomes map 1613.1. Where multiple sub-specific taxa were illustrated on the same base map, the taxa are separated by adding decimal places to the original map number; one of the taxa is assigned the integer map number (e.g.10), and decimal places are used for the additional taxa (e.g. 10.1, 10.2). A totally new taxon not recorded in Steyermark (1963) is represented with a map number of a similar family, genus, and species (if possible), and the decimal representation .09 is added. All map numbers containing .09 represent new taxa not recorded by Steyermark.

In numerous instances (especially Henderson, 1980) Steyermark recorded one or more subspecific categories (varieties or forms), but often a collector submitted a new record identifying a plant only to the species level. In this case, the decimal .99 is added to the map number of the species indicating that this is a record only of a species, and sub-specific information has been recorded for this species in Steyermark (1963).

The database exists as a simple "flat file" of text information (ASCII or EBCDIC), occupying about 2.5 million bytes of disk storage on an IBM 4381 computer and 1.5 million bytes on a VAX 11/750 computer.

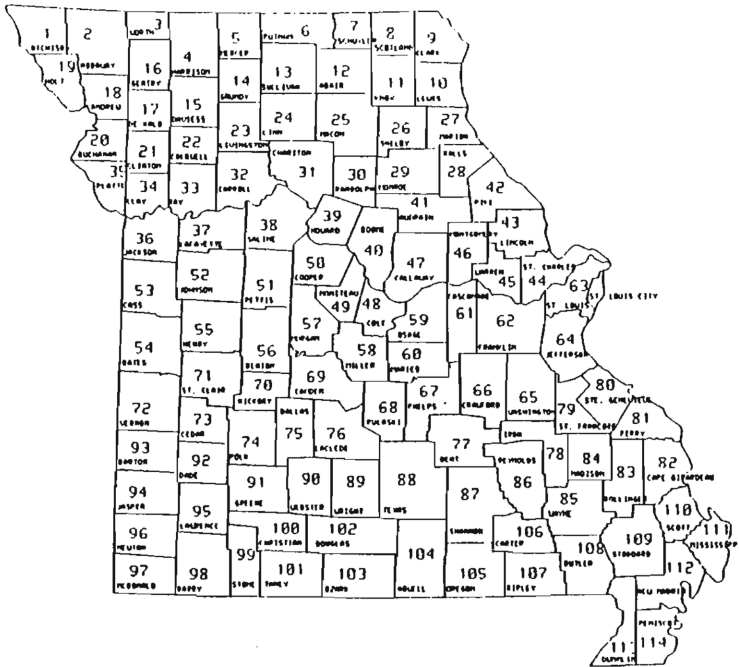


Figure 2. Steyermark's County Numbers. Each county was assigned a number, starting in the northwest corner of the state and working southward in rows.

Map Base

An outline map of Missouri was extracted and generalized from the 1970 County DIME file of the U.S. Census Bureau (as distributed by Harvard University with the Odyssey mapping and geographic information system software). This map contains approximately three hundred latitude/longitude points outlining the counties of Missouri, as well as identifier information allowing the association of thematic data such as taxon numbers with each of the counties. Federal Information Processing System (FIPS) county codes are used to identify each county, and these are keyed to the county numbers illustrated in Figure 2. Simple computer programs then extract any requested county information from the flora database, associate the FIPS codes with each county record, and present the data to the Odyssey mapping system to produce county maps.

Other Examples of Use

To date, the most-used product derived from this database has been the county record list. Using simple programs in a commonly available computer software system (SAS), it is possible to list all the taxa occurring in a county, or all the taxa not occurring in a county. These lists are useful to those who may be interested in the floristics of a county or area within a county. It can be used as a check against the completeness of a particular study, or as a challenge to add to the already known floristic composition of an area. Similarly, it is possible to list all the taxa occurring in a group of counties but not in some other county. In this way, adjacent counties surrounding another county can be examined for distributional continuity through space, and certain taxa may be targeted for county voucher collections.

More quantitative approaches to biogeography are also possible. Figure 3 is a map of the number of taxa reported for each county in Steyermark (1963). While it is obvious that the habitat determines the number of naturally occurring plant taxa in a county, the **actual** records of occurrence show some interesting relationships among counties. For instance, the four counties with the highest number of taxa are St. Louis (1813), Jackson (1516), Jasper (1505), and Boone (1246), none of which would rank among the top counties of Missouri in habitat diversity. However, three of the four are high population centers with major universities, while all four have had residents who were prolific plant collectors. Jasper county, in the southwest corner of the state, remains unique among Ozark counties in its high number of records, ranking fourth in total number of taxa. This is apparently because Steyermark's principle collaborator, E.J. Palmer lived and collected in this county (see Palmer and Steyermark, 1935; also Steyermark, 1963, p. xxiv). Viktor Muhlenbach, who collected along railroad tracks in St. Louis for nearly 30 years, added greatly to the flora of that county (not all of his more recent collections have been added to our database). Other notable collectors in these counties include Bush in Jackson County, Rickett in Boone County, and Eggert in St. Louis County. It appears as if concentrations of people and botanists lead to concentrations of plant records.

Figure 4 reinforces this concept, illustrating the number of taxa present in a county that are missing from one or more of the immediately adjacent counties. Certainly there are instances where habitat changes dramatically from one county to another, especially in moving from a county next to the Mississippi to one farther west. But the discrepancies that show up for the Kansas City area (Jackson County) versus its adjacent counties, and Boone County are too great to be explained by anything other than human activity. Notwithstanding that some of these are urban areas, where there may be a more diverse weed flora, it appears that where collectors live or frequently visit they find and record taxa.

Future research on the overall distribution of taxa in Missouri can utilize up-to-date records as well as the Steyermark data. It will be interesting to see how Figures 3 and 4 change as the updated information becomes available.

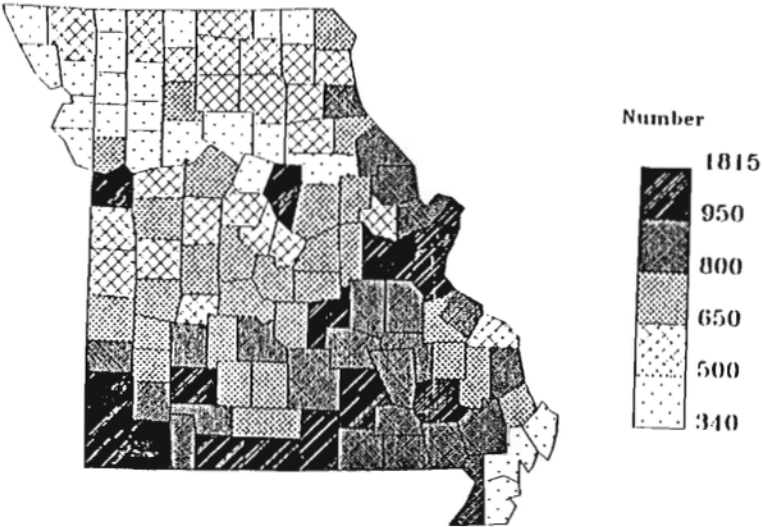


Figure 3. Number of Taxa by County.

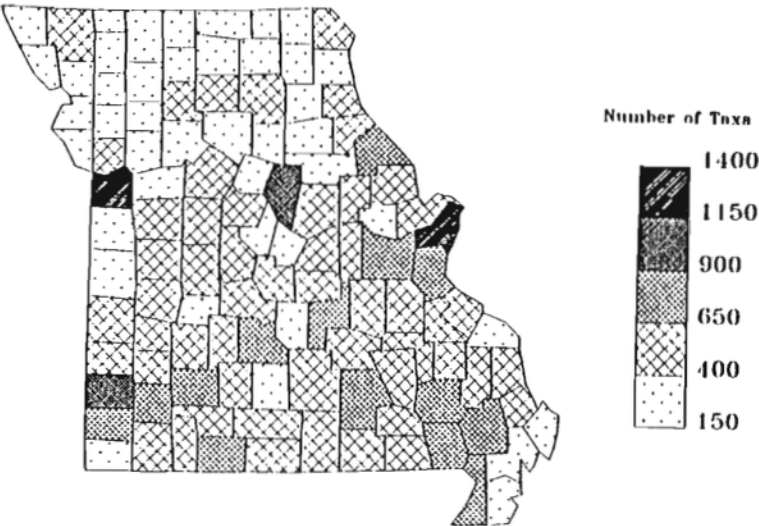


Figure 4. Number of Taxa in a County, but Not Found in One or More Adjacent Counties.

Summary

The Missouri Flora Geographic Information System provides an up-to-date record of Missouri flora and a research tool for investigations into plant distributions in Missouri. Requests for products should be addressed to the authors.

LITERATURE CITED

Henderson, N. C. 1980. Additions to the Flora of Missouri. *Natural History Note*. Missouri Department of Conservation.

Palmer, E. J., and Steyermark, J.A. 1935. An annotated catalogue of the flowering plants of Missouri. *Annals Missouri Bot. Gard.* 22: 375-758.

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Yatskievych, George and J. Turner. 1990. *Catalogue of the Flora of Missouri*. Monogr. Syst. Bot. Missouri Bot. Gard. 37: i-xii, 1-345.

MISSOURI BOTANICAL RECORD 14

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The *Missouri Botanical Record* is the official register for new county records of all vascular plant taxa in Missouri. To qualify for inclusion in this record, a voucher specimen of the record taxon must be deposited in a recognized herbarium and verified by the curator. Following the format used below, please submit all records to Dr. Wallace R. Weber, Department of Biology, Southwest Missouri State University, Springfield, MO 65804-0095.

In the *Flora of Missouri*, Steyermark used only a single map number to refer to each species, even though several subspecific taxa were listed. In these instances, various symbols were used to represent each taxon on a single Missouri map with counties. In the *Missouri Botanical Record* a decimal system is used, with .10 assigned to the first subspecific taxon listed by Steyermark, .20 for the second, and so on. Point nine nine (.99) is used to designate a species in which Steyermark included one or more subspecific taxa, but which was not specified by the collector. Point zero nine (.09) identifies a taxon not included in Steyermark.

Contributors for this issue include: Mike Skinner, Southwest Missouri State University and Melvin Conrad, Northeast Missouri State University.

TAXA	COUNTY	COLLECTOR	HERB	MAP NO
EQUISETACEAE				
<i>EQUISETUM ARVENSE</i>	KNOX	WELTON S.N.	NEMO	10 99
OPHIOGLOSSACEAE				
<i>BOTRYCHUM DISSECTUM</i> <i>V. OBLIQUUM</i>	MACON	HEIN 27	NEMO	14.20
TYPHACEAE				
<i>TYPHA ANGUSTIFOLIA</i>	MILLER	NAGEL 254	DNR	70.00
NAJADACEAE				
<i>NAJAS GUADALUPENSIS</i>	ADAIR	KITCH 9	NEMO	89.00
ALISMACEAE				
<i>ALISMA PLANTAGO-AQUATICA</i>	RANDOLPH	CONRAD 8407	NEMO	90.00
<i>SAGITTARIA GRAMINEA</i> <i>V. GRAMINEA</i>	RANDOLPH	CONRAD 10331	NEMO	96.00
GRAMINEAE				
<i>BROMUS RACEMOSUS</i>	MILLER	SKINNER 987	DNR	111.00
<i>BROMUS JAPONICUS</i>	MILLER	SKINNER 990	DNR	113.00
<i>BROMUS JAPONICUS</i>	KNOX	WELTON S.N.	NEMO	113.00
<i>BROMUS TECTORUM V. TECTORUM</i>	KNOX	WELTON S.N.	NEMO	116.00
<i>BROMUS STERILIS</i>	CAMDEN	SKINNER 894	DNR	115.00
<i>FESTUCA ELATIOR</i> <i>V. ELATIOR F. ELATIOR</i>	ADAIR	WELTON S.N.	NEMO	120.00
<i>FESTUCA ELATIOR</i> <i>V. ELATIOR F. ELATIOR</i>	CLARK	WALKER 572	NEMO	120.00
<i>FESTUCA RUBRA</i>	RANDOLPH	CONRAD 10197	NEMO	123.99
<i>GLYCERIA STRIATA V. STRIATA</i>	RANDOLPH	CONRAD 8074	NEMO	129.00
<i>POA COMPRESSA</i>	MILLER	SKINNER 996	DNR	133.00
<i>POA COMPRESSA</i>	KNOX	WELTON S.N.	NEMO	133.00
<i>POA BULBOSA</i>	ADAIR	WALKER 442	NEMO	139.00
<i>POA BULBOSA</i>	CAMDEN	SKINNER 875	DNR	139.00
<i>POA BULBOSA</i>	MILLER	SKINNER 881	DNR	139.00
<i>ERAGROSTIS HYPNOIDES</i>	RANDOLPH	CONRAD 10330	NEMO	143.00
<i>ERAGROSTIS SPECTABILIS</i> <i>V. SPARSIHRSUTA</i>	ADAIR	WALKER 201	NEMO	154.10
<i>DACTYLIS GLOMERATA</i>	CAMDEN	SKINNER 912	DNR	164.99
<i>PHRAGMITES COMMUNIS</i> <i>V. BERLANDIERI</i>	SHELBY	CONRAD 10060	NEMO	166.00
<i>TRITICUM AESTIVUM</i>	ADAIR	WELTON S.N.	NEMO	177.00
<i>ELYMUS VILLOSUS F. VILLOSUS</i>	KNOX	WELTON S.N.	NEMO	181.00
<i>ELYMUS VILLOSUS</i>	CAMDEN	SKINNER 962	DNR	181.99
<i>ELYMUS VIRGINICUS V. VIRGINICUS</i> <i>F. VIRGINICUS</i>	KNOX	WELTON S.N.	NEMO	185.00
<i>ELYMUS CANADENSIS</i> <i>F. GLAUCIFOLIUS</i>	ADAIR	WELTON S.N.	NEMO	183.10
<i>HORDEUM PUSILLUM</i>	ADAIR	WELTON S.N.	NEMO	189.00
<i>HORDEUM PUSILLUM</i>	CAMDEN	SKINNER 888	DNR	189.00
<i>LOLIUM PERENNE</i>	MILLER	SKINNER 994	DNR	191.00
<i>SPHENOPHOLIS INTERMEDIA</i>	MILLER	SKINNER 897	DNR	196.00

<i>SPHENOPHOLIS INTERMEDIA</i>	ADAIR	WALKER 115	NEMO	196.00
<i>AGROSTIS ALBA</i>	MILLER	SKINNER 997	DNR	212.99
<i>AGROSTIS HYEMALIS</i>	CAMDEN	SKINNER 903	DNR	215.99
<i>ALOPECURUS CAROLINIANUS</i>	ADAIR	WALKER 39	NEMO	220.00
<i>MUHLENBERGIA CUSPIDATA</i>	ADAIR	CONRAD 10494	NEMO	222.00
<i>ELEUSINE INDICA</i>	CLARK	WALKER 577	NEMO	256.00
<i>BOUTELOUA CURTIPENDULA</i>	ADAIR	WALKER 2	NEMO	264.00
<i>PHALARIS ARUNDINACEA</i>	RANDOLPH	CONRAD 10184	NEMO	271.00
<i>PHALARIS ARUNDINACEA</i>	MILLER	SKINNER 991	DNR	271.00
<i>DIGITARIA SANGUINALIS</i>				
<i>V. SANGUINALIS</i>	ADAIR	BELL S.N.	SEMO	278.00
<i>DIGITARIA SANGUINALIS</i>				
<i>V. SANGUINALIS</i>	CLARK	WALKER 578	NEMO	278.00
<i>PASPALUM CILIATIFOLIUM</i>				
<i>V. MUHLENBERGII</i>	ADAIR	WALKER 49	NEMO	291.10
<i>PANICUM LANUGINOSUM</i>				
<i>V. FASCICULATUM</i>	ADAIR	WALKER 131	NEMO	308.10
<i>PANICUM OLIGOSANTHES</i>				
<i>V. HELLERI</i>	ADAIR	WALKER 118	NEMO	315.10
<i>PANICUM OLIGOSANTHES</i>				
<i>V. HELLERI</i>	CLARK	CONRAD 9806	NEMO	315.10
<i>ECHINOCHLOA CRUSGALLI</i>				
<i>V. CRUSGALLI F. LONGISETA</i>	RANDOLPH	CONRAD 10	Nemo	338.10
<i>ECHINOCHLOA CRUSGALLI</i>				
<i>V. CRUSGALLI</i>	ADAIR	CONRAD 7413	NEMO	338.99
<i>SETARIA FABERII</i>	KNOX	WELTON S.N.	NEMO	344.00

CYPERACEAE

<i>CYPERUS ESCULENTUS</i>	CAMDEN	SKINNER 810	DNR	378.99
<i>CYPERUS FILICULMIS V. FILICULMIS</i>	CLARK	WALKER 508	NEMO	385.00
<i>ELEOCHARIS ACICULARIS</i>				
<i>V. ACICULARIS F. ACICULARIS</i>	RANDOLPH	CONRAD 1	NEMO	393.00
<i>ELEOCHARIS TENUIS V. VERRUCOSA</i>	SULLIVAN	BROYLES S.N.	NEMO	402.00
<i>SCIRPUS ATROVIRENS</i>				
<i>V. GEORGIANUS</i>	KNOX	WELTON S.N.	NEMO	421.20
<i>SCIRPUS ATROVIRENS</i>				
<i>V. GEORGIANUS</i>	MACON	HEIN 15	NEMO	421.20
<i>FIMBRISTYLIS CAROLINIANA</i>	CAMDEN	SKINNER 950	DNR	404.00
<i>SCIRPUS LINEATUS</i>	CAMDEN	SKINNER 955	DNR	424.00
<i>SCIRPUS CYPERINUS V. CYPERINUS</i>	CLARK	WALKER 574	NEMO	425.00
<i>HEMICARPHA MICRANTHA</i>	CAMDEN	SKINNER 809	DNR	429.00
<i>SCLERIA TRIGLOMERATA</i>	SULLIVAN	CONRAD 9979	NEMO	436.00
<i>CAREX COOLUTA</i>	MACON	HEIN & NELSON 19	NEMO	447.00
<i>CAREX BLANDA</i>	CAMDEN	SKINNER 880	DNR	500.00
<i>CAREX GRANULARIS V. GRANULARIS</i>	MACON	HEIN & NELSON 18	NEMO	502.00
<i>CAREX AMPHIBOLA</i>	MILLER	NAGEL 52	DNR	508.99
<i>CAREX AMPHIBOLA V. RIGIDA</i>	ADAIR	WALKER 113	NEMO	508.10
<i>CAREX DAVISII F. DAVISII</i>	SULLIVAN	CONRAD 5872	NEMO	512.00
<i>CAREX SHORTIANA</i>	CAMDEN	SKINNER 922	DNR	522.00
<i>CAREX BUXBAUMII</i>	CAMDEN	SKINNER 677	DNR	524.99
<i>CAREX LUPULINA</i>	MILLER	SKINNER 1010	DNR	548.99

JUNCACEAE

<i>JUNCUS TENUIS</i>	MILLER	SKINNER 1017	DNR	590.99
<i>JUNCUS INTERIOR</i>	CLARK	CONRAD 9781	NEMO	591.00

LILIACEAE

MELANTHIUM VIRGINICUM	MILLER	NAGEL 305	DNR	613.00
ALLIUM VINEALE	KNOX	WELTON S.N.	NEMO	618.99
LILIUM MICHIGANENSE	CAMDEN	KELLNER 20	DNR	627.00

IRIDACEAE

BELAMCANDA CHINENSIS	CAMDEN	NAGEL 341	DNR	676.00
SISYRINCHIUM BERMUDIANA	CAMDEN	KELLNER 48	DNR	679.00

ORCHIDACEAE

CYPRIPEDIUM CALCEOLUS V. PARVIFLORUM	CAMDEN	NAGEL 1	DNR	682.00
SPIRANTHES GRACILIS	MILLER	SKINNER 755	DNR	700.00
APLECTRUM HYEMALE F. HYEMALE	ADAIR	CONRAD 9843	NEMO	712.00
APLECTRUM HYEMALE F. HYEMALE	MACON	HEIN28	NEMO	712.00

SALICACEAE

SALIX HUMILIS	MILLER	NAGEL 178	DNR	725.99
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JUGLANDACEAE

CARYA LACINIOSA	MILLER	NAGEL 189	DNR	746.00
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ULMACEAE

CELTIS OCCIDENTALIS V. CANINA	MILLER	NAGEL 74	DNR	784.20
CELTIS OCCIDENTALIS V. OCCIDENTALIS	MILLER	CAVENDER 143	DNR	784.00

MORACEAE

MACLURA POMIFERA	MILLER	NAGEL 303	DNR	790.00
HUMULUS LUPULUS	ADAIR	WELTON S.N.	NEMO	792.00

POLYGONACEAE

RUMEX ALTISSIMUS	MILLER	SKINNER 973	DNR	811.00
RUMEX CRISPUS	CAMDEN	SKINNER 1369	DNR	814.99
POLYGONUM TENUE	ADAIR	WALKER 166	NEMO	824.00
POLYGONUM PENNSYLVANICUM V. EGLANDULOSUM	ADAIR	WELTON S.N.	NEMO	829.30
POLYGONUM PERSICARIA V. PERSICARIA	CLARK	WALKER 549	NEMO	833.00
POLYGONUM PERSICARIA	MILLER	SKINNER 989	DNR	833.99
POLYGONUM HYDROPIPEROIDES	RANDOLPH	CONRAD 10399	NEMO	835.99
POLYGONUM CONVULVULUS V. CONVULVULUS	RANDOLPH	CONRAD 10417	NEMO	839.00

AMARANTHACEAE

AMARANTHUS TAMARISCINUS	CAMDEN	SKINNER 814	DNR	877.00
AMARANTHUS TORREYI	ADAIR	WALKER 224	NEMO	879.00
FROELICHIA GRACILIS	ADAIR	WALKER 163	NEMO	890.00
FROELICHIA GRACILIS	MILLER	SKINNER 982	DNR	890.00

PORTULACACEAE

CLAYTONIA VIRGINICA F. ROBUSTA	RANDOLPH	CONRAD 10124	NEMO	905.10
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CARYOPHYLLACEAE

CERASTIUM VISCOSUM	CAMDEN	SKINNER 890	DNR	926.99
HOLOSTEUM UMBELLATUM	MILLER	SKINNER 499	DNR	930.00
SAPONARIA OFFICINALIS	CLARK	WALKER 539	NEMO	945.00
SAPONARIA OFFICINALIS	KNOX	WELTON S.N.	NEMO	945.00
ACTAEA PACHYPODA	MILLER	NAGEL 304	DNR	965.00

RANUNCULACEAE

RANUNCULUS MICRANTHUS				
V. MICRANTHUS	LEWIS	CONRAD 9694	NEMO	983.00
RANUNCULUS MICRANTHUS				
V. MICRANTHUS	RANDOLPH	CONRAD 10125	NEMO	983.00
RANUNCULUS RECURVATUS	CAMDEN	SKINNER 673	DNR	987.99
RANUNCULUS FASCICULARIS				
V. APRICUS	SULLIVAN	BROYLES S.N.	NEMO	993.10
CLEMATIS PITCHERI	RANDOLPH	CONRAD 10118	NEMO	1008.00

CRUCIFERAE

LEPIDIUM VIRGINICUM				
V. VIRGINICUM	KNOX	WELTON S.N.	NEMO	1051.00
THLASPI PERFORIATUM	CAMDEN	SKINNER 486	DNR	1057.00
THLASPI PERFORIATUM	MILLER	SKINNER 589	DNR	1057.00
DRABA VERNIA	CAMDEN	SKINNER 594	DNR	1062.99
CARDAMINE PENNSYLVANICA	CAMDEN	SKINNER 656	DNR	1074.99
ARABIS HIRSUTAV. ADPRESSIPILIS	CAMDEN	SKINNER 891	DNR	1080.10
ARABIS CANADENSIS	CAMDEN	SKINNER 901	DNR	1084.00
RORIPPA SYLVESTRIS	CLARK	WALKER 459	NEMO	1086.00
HESPERIS MATRONALIS	CAMDEN	SKINNER 674	SEMO	1094.00
SISYMBRIUM OFFICINALE				
V. LEIOCARPUM	MILLER	SKINNER 1001	DNR	1099.10

ROSACEAE

FRAGARIA VIRGINIANA	KNOX	WELTON S.N.	NEMO	1205.99
FRAGARIA VIRGINIANA				
V. ILLINOENSIS	MILLER	NAGEL 22	DNR	1205.10
RUBUS PENNSYLVANICUS	KNOX	WELTON S.N.	NEMO	1235.99
AGRIMONIA ROSTELLATA	ADAIR	WALKER 54	NEMO	1240.00
ROSA MULTIFLORA	KNOX	WELTON S.N.	NEMO	1242.00
ROSA SETIGERA				
V. SETIGERA F. SETIGERA	ADAIR	WELTON S.N.	NEMO	1243.00

LEGUMINOSAE

DESMANTHUS ILLINOENSIS	MILLER	SKINNER 1014	DNR	1269.00
DESMANTHUS ILLINOENSIS	ADAIR	WELTON S.N.	NEMO	1269.00
GYMNOCLADUS DIOICA	ADAIR	CONRAD 5710	NEMO	1272.00
GYMNOCLADUS DIOICA	RANDOLPH	CONRAD 10223	NEMO	1272.00
BAPTISIA LEUCANTHA	MILLER	NAGEL 325	DNR	1284.00
CROTALARIA SAGITTALIS	CAMDEN	SKINNER 534	DNR	1287.99
MELILOTUS OFFICINALIS	MILLER	CAVENDER 135	DNR	1305.00
PSORALEA PSORALIOIDES				
V. EGLANDULOSA	MILLER	SKINNER 785	DNR	1311.00
CORONILLA VARIA	CAMDEN	SKINNER 1380	DNR	1335.00

AMORPHA FRUTICOSA				
V. ANGUSTIFOLIA	ADAIR	WALKER 102	NEMO	1322.30
AMORPHA FRUTICOSA				
V. OBLONGIFOLIA	RANDOLPH	CONRAD 10424	NEMO	1322.20
DESMODIUM PANICULATUM				
V. DILLENII	ADAIR	CONRAD 7338	NEMO	1351.10
LESPEDEZA REPENS	ADAIR	WALKER 217	NEMO	1354.00
LESPEDEZA STIPULACEA	ADAIR	WALKER 215	NEMO	1368.00
APIOS AMERICANA				
V. AMERICANA F. PILOSA	ADAIR	WALKER 164	NEMO	1388.10
STROPHOSTYLES HELVOLA	CAMDEN	NAGEL 370	DNR	1393.99
STROPHOSTYLES LEIOSPERMA	MILLER	NAGEL 352	DNR	1395.00

GERANIACEAE

GERANIUM CAROLINIANUM	CAMDEN	SKINNER 663	DNR	1413.99
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ZYGOPHYLLACEAE

TRIBULUS TERRESTRIS	CLARK	WALKER 45	NEMO	1418.00
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RUTACEAE

ZANTHOXYLUM AMERICANUM	CAMDEN	NAGEL 179	DNR	1420.00
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SIMAROUACEAE

AILANTHUS ALTISSIMA	MILLER	STRAATMANN 344	DNR	1423.00
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POLYGALACEAE

POLYGALA SANGUINEA	MILLER	NAGEL 256	DNR	1426.99
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EUPHORBIACEAE

ACALYPHA VIRGINICA	MILLER	SKINNER 1365	DNR	1439.00
EUPHORBIA MARGINATA	MILLER	SKINNER 817	DNR	1452.00

RHAMNACEAE

CEANOTHUS AMERICANUS	MILLER	SKINNER 927	DNR	1498.99
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MALVACEAE

HIBISCUS LASIOCARPOS	MILLER	NAGEL 276	DNR	1532.00
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HYPERICACEAE

HYPERICUM PERFORATUM	MILLER	CAVENDER 146	DNR	1537.00
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CISTACEAE

LECHEA RACEMULOSA	ADAIR	WALKER 3	NEMO	1555.00
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VIOLACEAE

VIOLA PEDATA V. LINEARILOBA				
F. LINEARILOBA	SULLIVAN	ROYLES S. N.	NEMO	1557.10

ONAGRACEAE

<i>EPILOBIUM COLORATUM</i>	ADAIR	WALKER S.N.	NEMO	1601.00
<i>OENOTHERA LACINIATA</i>	CAMDEN	SKINNER 1021	DNR	1605.99

UMBELLIFERAE

<i>ERYNGIUM YUCCIFOLIUM</i>	MILLER	BECK 14	DNR	1634.99
<i>TORILIS JAPONICA</i>	CLARK	WALKER 490	NEMO	1642.00
<i>TORILIS JAPONICA</i>	KNOX	WELTON S.N.	NEMO	1642.00
<i>ERIGENIA BULBOSA</i>	MILLER	SKINNER 600	DNR	1645.00
<i>CONIUM MACULATUM</i>	SCHUYLER	KEARSE S.N.	NEMO	1646.00
<i>POLYTAENIA NUTTALLII</i>	ADAIR	WALKER 132	NEMO	1675.00
<i>CRYPTOTAENIA CANADENSIS</i>	CAMDEN	SKINNER 921	DNR	1655.00
<i>TAENIDIA INTEGERRIMA</i>	CAMDEN	SKINNER 914	DNR	1658.00

PYROLACEAE

<i>MONOTROPA HYPOPITHYS</i>	CAMDEN	SKINNER 555	DNR	1690.00
<i>MONOTROPA HYPOPITHYS</i>	MILLER	NAGEL 365	DNR	1690.00

PRIMULACEAE

<i>LYSIMACHIA NUMMULARIA</i>	MILLER	SKINNER 1006	DNR	1700.00
<i>LYSIMACHIA LANCEOLATA</i>	CAMDEN	KELLNER 15	DNR	1704.00

EBENACEAE

<i>DIOSPYROS VIRGINIANA</i>	MILLER	NAGEL 70	DNR	1713.99
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OLEACEAE

<i>FRAXINUS PENNSYLVANICA</i> V. <i>PENNSYLVANICA</i>	RANDOLPH	CONRAD 10464	NEMO	1717.00
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APOCYNACEAE

<i>APOCYNUM CANNABINUM</i> V. <i>PUBESCENS</i>	MILLER	NAGEL 224	DNR	1749.10
<i>APOCYNUM SIBERICUM</i> V. <i>SIBERICUM</i>	RANDOLPH	CONRAD 10447	NEMO	1750.00

ASCLEPIADACEAE

<i>ASCLEPIAS PURPURASCENS</i>	MILLER	SKINNER 1015	DNR	1754.00
<i>ASCLEPIAS PURPURASCENS</i>	KNOX	WELTON S.N.	NEMO	1754.00

CONVOLVULACEAE

<i>CONVOLVULUS SEPIUM</i> V. <i>FRATERNIFLORUS</i>	KNOX	WELTON S.N.	NEMO	1780.30
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HYDROPHYLLACEAE

<i>ELLISIA NYCTELEA</i>	CAMDEN	SKINNER 658	DNR	1807.00
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BORAGINACEAE

<i>HELIOTROPIMUM INDICUM</i>	CAMDEN	SKINNER 805	DNR	1816.00
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BORAGINACEAE

MYOSOTIS VIRGINICA V. VIRGINICA	ADAIR	WALKER 100	NEMO	1831.00
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VERBENACEAE

VERBENA BRACTEATA	CAMDEN	SKINNER 819	DNR	1844.00
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LABIATAE

TEUCRIUM CANADENSE V. VIRGINICUM	KNOX	ELTON S.N.	NEMO	1853.00
SCUTELLARIA LATERIFLORA F. LATERIFLORA	RANDOLPH	CONRAD 8896	NEMO	1858.00
AGASTACHE NEPETOIDES	CAMDEN	SKINNER 1383	DNR	1864.00
AGASTACHE NEPETOIDES	MILLER	NAGEL 281	DNR	1864.00
NEPETA CATARIA	ADAIR	WELTON S.N.	NEMO	1866.00
NEPETA CATARIA	KNOX	WELTON S.N.	NEMO	1866.00
HEDEOMA PULEGIODES	CAMDEN	SKINNER 724	DNR	1895.00
HEDEOMA HISPIDA	CAMDEN	SKINNER 896	DNR	1896.00
PYCNANTHEMUM TENUIFOLIUM	MILLER	BECK 15	DNR	1900.00
PERILLA FRUTESCENS V. FRUTESCENS	ADAIR	WALKER 214	NEMO	1916.00

SOLANACEAE

SOLANUM ROSTRATUM	CLARK	WALKER 446	NEMO	1927.00
PHYSALIS VIRGINIANA	CAMDEN	SKINNER 668	DNR	1932.00

SCROPHULARIACEAE

LINDERNIA ANAGALLIDEA	CAMDEN	SKINNER 812	DNR	1957.00
PENSTEMON TUBAEFLORUS	ADAIR	WELTON S.N.	NEMO	1966.00
SCROPHULARIA MARILANDICA F. NEGLECTA	MACON	HEIN 16	NEMO	1971.10
VERONICA PEREGRINA V. PEREGRINA	RANDOLPH	CONRAD 10334	NEMO	1987.00
GERARDIA TENUIFOLIA	CAMDEN	SKINNER 725	DNR	1995.99

PLANTAGINACEAE

PLANTAGO LANCEOLATA	KNOX	WELTON S.N.	NEMO	2029.99
PLANTAGO ARISTATA	CAMDEN	SKINNER 939	DNR	2030.00
PLANTAGO VIRGINICA	MILLER	SKINNER 869	DNR	2033.99

RUBIACEAE

GALIUM APARINE	MILLER	NAGEL 44	DNR	2039.00
GALIUM OBTUSUM	CAMDEN	SKINNER 863	DNR	2047.99

CAPRIFOLIACEAE

LONICERA JAPONICA V. JAPONICA	KNOX	WELTON S.N.	NEMO	2064.00
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CAMPANULACEAE

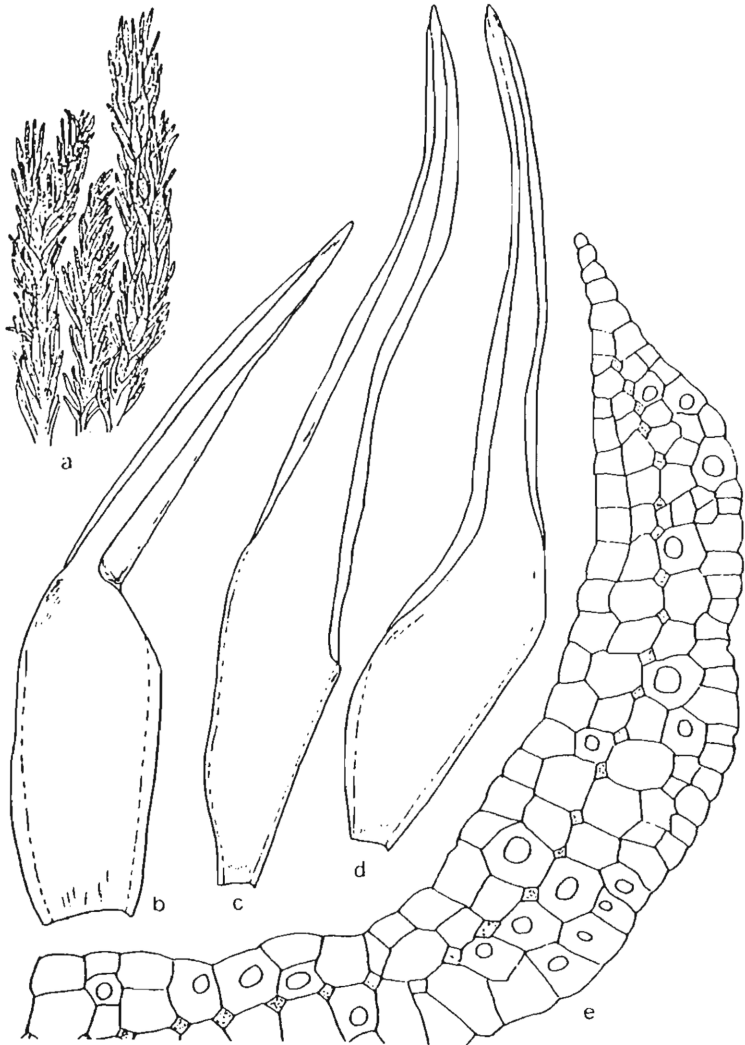
SPECULARIA BIFLORA	MILLER	NAGEL 107	DNR	2102.00
LOBELIA INFLATA	CAMDEN	SKINNER 1384	DNR	2106.00

COMPOSITAE

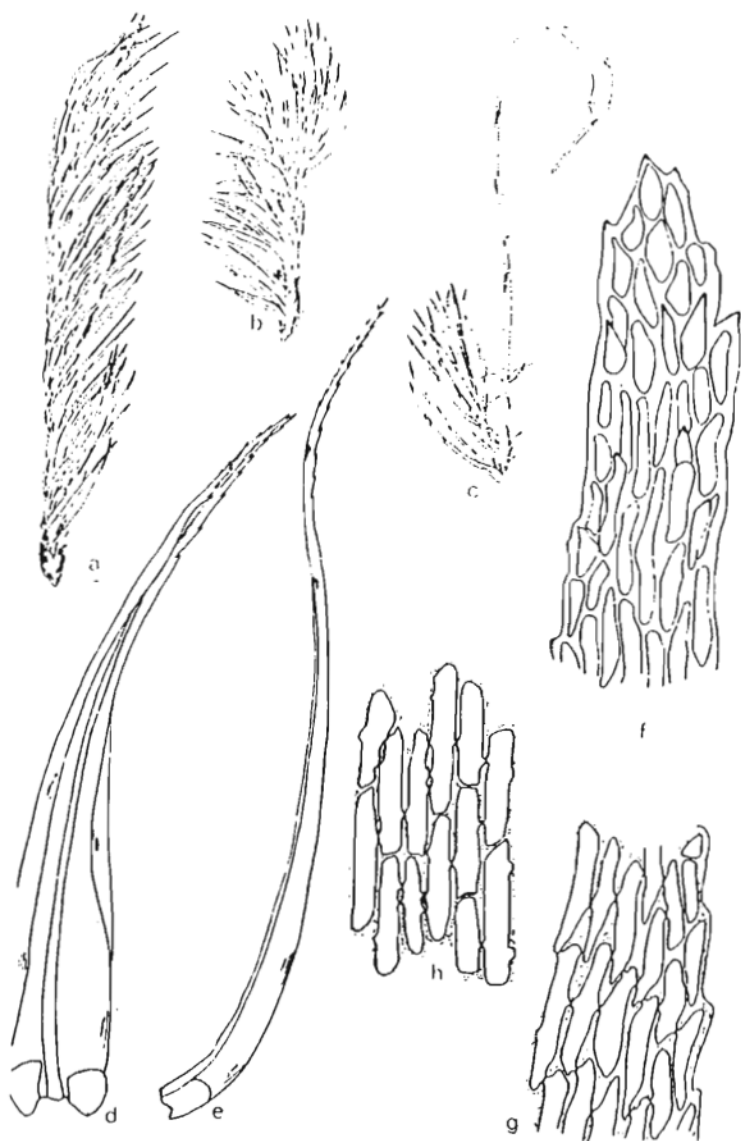
ELEPHANTOPUS CAROLINIANUS	MILLER	NAGEL 278	DNR	2116.99
EUPATORIUM SESSILIFOLIUM V. BRITTONIANUM	MILLER	NAGEL 242	DNR	2122.00
EUPATORIUM PERFOLIATUM V. CUNEATUM	SULLIVAN	CONRAD 10035	NEMO	2123.10
LIATRIS PYCNOSTACHYA	MILLER	NAGEL 236	DNR	2132.99
ASTER PILOSUS	MILLER	SKINNER 553B	DNR	2189.99
ANTENNARIA NEGLECTA	MILLER	SKINNER 591	DNR	2214.99
SOLIDAGO JUNCEA F. JUNCEA	SULLIVAN	CONRAD 10046	NEMO	2154.00
ASTER AZUREUS V. AZUREUS F. AZUREUS	MACON	HEIN 26	NEMO	2178.00
ASTER AZUREUS V. AZUREUS F. LAEVICAULIS	MACON	HEIN 25	NEMO	2178.10
ERIGERON PHILADELPHICUS F. PHILADELPHICUS	ADAIR	WALKER 438	NEMO	2206.00
ERIGERON STRIGOSUS V. BEYRICHII	ADAIR	WELTON S.N.	NEMO	2208.20
AMBROSIA ARTEMISIIFOLIA V. ELATIOR F. VILLOSA	ADAIR	CONRAD 4247	NEMO	2225.10
AMBROSIA ARTEMISIIFOLIA V. ELATIOR F. VILLOSA	KNOXW	ELTON S.N.	NEMO	2225.10
AMBROSIA ARTEMISIIFOLIA V. ELATIOR F. VILLOSA	LEWIS	CONRAD 9650	NEMO	2225.10
ECHINACEA PURPUREA	MILLER	NAGEL 355	DNR	2260.99
RATIBIDA PINNATA	KNOX	WELTON S.N.	NEMO	2265.00
HELIANTHUS HIRSUTUS V. TRACHYPHYLLUS	MILLER	NAGEL 274	DNR	2277.10
HELIANTHUS MAXIMILIANI	KNOX	WELTON S.N.	NEMO	2278.00
BIDENS CERNUA V. INTEGRALIS	RANDOLPH	CONRAD 10401	NEMO	2298.10
BIDENS CONNATA V. PETIOLATA	RANDOLPH	CONRAD 10402	NEMO	2299.00
CHRYSANTHEMUM LEUCANTHEMUM V. LEUCANTHEMUM	SULLIVAN	BROYLES S.N.	NEMO	2330.00
SENECIO PLATTENSIS	MILLER	NAGEL 307	DNR	2348.00
CIRSIIUM ALTISSIMUM	MILLER	NAGEL 298	DNR	2359.99
CIRSIIUM ALTISSIMUM	RANDOLPH	CONRAD 8330	NEMO	2359.99
CICHORIUM INTYBUS	CAMDEN	SKINNER 1024	DNR	2374.99
LACTUCA SCARIOLA F. INTEGRIFOLIA	KNOX	WELTON S.N.	NEMO	2389.10
LACTUCA SCARIOLA	MILLER	NAGEL 238	DNR	2389.99

COMMON MOSSES OF MISSOURI.

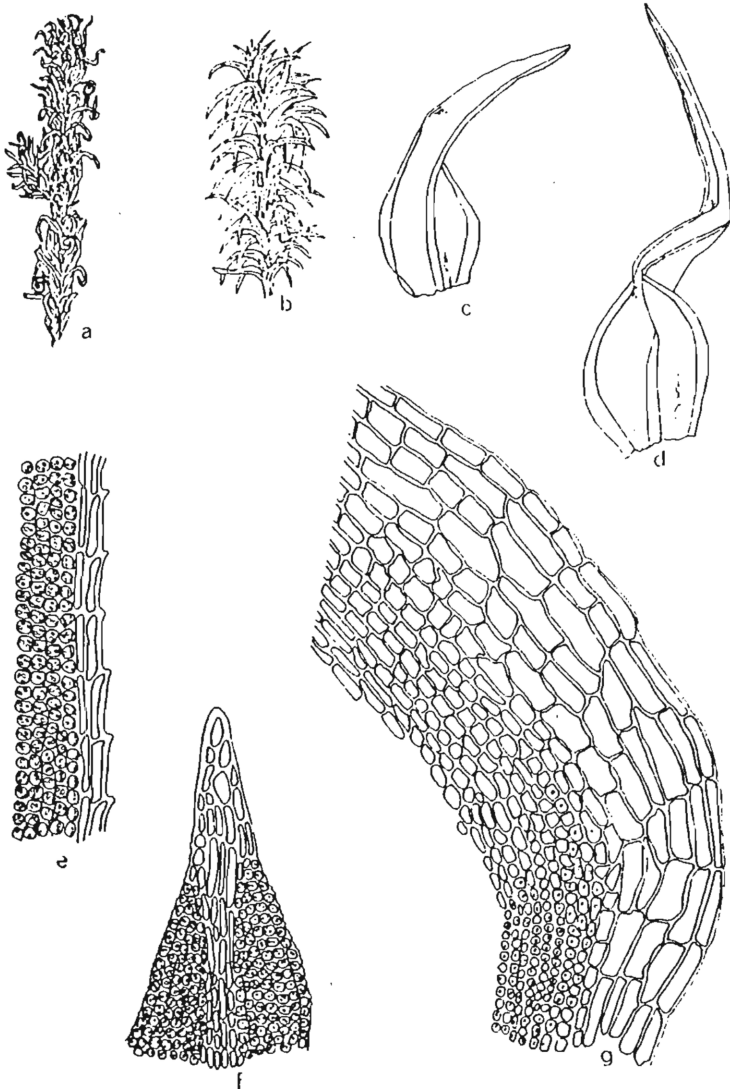
The moss flora of Missouri is diverse and contains many species of phytogeographic significance. Most species are difficult to recognize in the field without extensive experience. However, some are rather large, distinctive, and common. As space allows, illustrations of some of these species will be included in *Missouriensis* as filler. Paul L. Redfearn, Jr.



The Pin Cushion Moss [*Leucobryum glaucum* (Hedw.) Aongstr. in Fries.]:
 a. habit of gametophyte; b. leaves; c. cross sections of lower basal part of leaf showing the large cells lacking chlorophyll that are responsible for the whitish appearance of this moss. This moss gets its common name from its tendency to form large, whitish, pin cushion-like mats on rocky, acid soils of forests.



The Wind Blown Moss [*Dicranum scoparium* Hedw.]: a-b. habit of gametophytes; c. gametophyte with sporophyte; d-e. leaves; f. apex of leaf; g. upper leaf cells; h. lower leaf cells. This moss derives its common name from the tendency of the leaves on the upper stem to all twist in the same direction. Cushions of this moss are usually large, yellow-green to green and may be found growing on acid forest soils and shaded rock ledges.



Pleurochaete squarrosa (Brid.) Lindb. a: habit of dry plant; b. habit of moist plant; c-d leaves; e. cells of hyaline leaf border near middle of leaf; f. cells of apex of leaf; g. cells at base of leaf showing a broad band of hyaline cells along the margin. Although this moss has no common name, it forms large, extensive dense, yellow-green mats in cedar glades where it may be considered a characteristic member of its flora.