



Spring 2017 Volume 44, Number 1

Geum urbanum: A Newly Discovered Naturalized Species in Connecticut

BY JOHN P. ANDERSON JR. and WILLIAM H. MOORHEAD III

WE DISCOVERED SEVERAL OCCURRENCES of the European perennial *Geum urbanum* L. (Rosaceae) in Norfolk, Connecticut and found that the species had naturalized in natural, undisturbed habitats. This species has the potential to become invasive and affect populations of native plants by out-competing them or hybridizing with other *Geum* species. *Geum urbanum* has several common names: herb bennet, clove-root, wood avens, and town avens. It grows naturally in moist deciduous woodlands and forest edges throughout Europe, ranging from the British Isles to Turkey. The plant has long been grown there as a medicinal herb, moth repellent, and to flavor ale.¹ Likely intentionally brought to North America by the early European colonists, by the 20th century it was known to have escaped from cultivation and become naturalized in the greater Boston area of Massachusetts. As noted by Fernald it was “spreading in dooryards and on shaded roadsides, locally about towns of e. Mass. and e. Pa.”² By 2012, the species had been documented in 10 U.S. states and four Canadian provinces.³ Here we describe its first reported naturalized occurrence in Connecticut.

We made our observations in Norfolk, Conn., in the Western Highlands on the southernmost extension of the Berkshire Massif. The vegetation of the region has been described as Northern Hardwood Forest⁴ and also as the Hemlock, Northern Hardwood, White Pine Vegetation Zone.⁵ The forests at the study sites were approximately 40 – 80 years old, grown on abandoned farmland (last farmed between circa 1930 – 1970), primarily pasture and hay-fields. Two of the sites were located on lands of Aton Forest and another nearby on a neighboring property.⁶

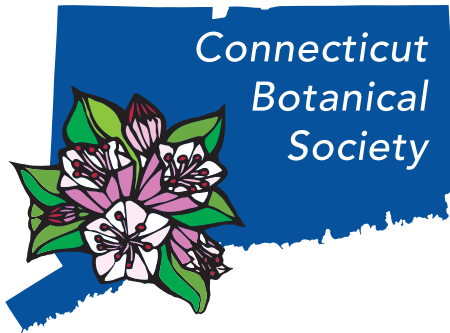
Geum urbanum is a sparsely leaved perennial, up to 1 m tall, with three-parted to pinnate basal and stem leaves.



Geum urbanum growing beside house foundation near the study sites.
Photo: J. Anderson

The terminal lobe is usually slightly larger than others and large leafy stipules resemble a pair of basal leaflets, as wide, or wider, than long. Flowers are terminal and borne singly on slender pedicels (less than 1 mm thick). The plant has five small (4-5 mm long) bright yellow petals that open flat

continued on page 4



Connecticut Botanical Society

Connecticut Botanical Society *Newsletter*
A Publication of the Connecticut Botanical
Society, Inc.

David Yih, *President*
Lauren Brown, *Vice President*
Paul Stetson, *Treasurer*
John P. Anderson, *Recording Secretary*
Directors-at-Large:

Nelson DeBarros, Glenn Dreyer, Sigrun
Gadwa, Judith Chute Hsiang, Carol L.
Levine, Susan Robinson, Juan Sanchez
Jr., Eleanor Saulys, Truda Steinnagel,
Christopher Wyse

Committee Chairs

CT Flora Checklist: Glenn Dreyer
Ecology & Conservation Committee: Sigrun Gadwa
Education: Juan Sanchez, Jr.
Field Trips: Martha McLaughlin Tonucci
Finance: Paul Stetson
Herbarium: Eleanor Saulys
Hospitality: Truda Steinnagel
Membership: Ted Lockwood & Albert Paolini
Newsletter: David Yih
Nominating: Judith Chute Hsiang
Notable Trees: Glenn Dreyer & Frank Kaputa
Programs: Carol L. Levine
Publicity: Judith Chute Hsiang
Web: Janet Novak & Christopher Wyse
Yearbook: Patricia LeBeau

*The Connecticut Botanical Society, Inc., founded
in 1903, is a non-profit 501(c)(3) corporation
chartered in the State of Connecticut. Contact the
president about tax-deductible contributions.*

Visit the CBS web site:
www.ct-botanical-society.org

The CBS web site, created by webmaster Janet
Novak, is visited by more than 1,000 people
each day. The site provides an introduction to
CBS and its activities, including field trips and
meetings. The site also contains photo galler-
ies, a guide to landscaping with native plants,
and Newsletter articles.

We thank Janet Novak, Eleanor Saulys, Arieh
Tal, and others for the excellent photos on
the web site. CBS members are encouraged to
submit web materials to: chris.wyse@cox.net

Newsletter design: Susan Lindberg



Like us on Facebook!

Printed on 100% recycled paper.

From the President

AS THE NEW PRESIDENT of the Connecticut Botanical Society (CBS) this year, I'm happy to take a turn helping to keep the Society running smoothly and brimming with interesting activities. I've learned a lot about plants as a CBS member, and I've enjoyed just being around the kind of people who like plants. I still have a lot to learn about Connecticut's flora; when I joined CBS eight years ago I was practically a novice. Back in the summer of 1971, I had gone out into the fields and wooded riverbanks near our house in Ann Arbor with a book on Michigan wildflowers and compiled a list of plants that were in bloom that August. Here and there, along the railroad tracks, stood tall spikes of common mullein, with their velvety leaves, while evening primroses nodded, awaiting dusk, and soapwort thrived beside a ditch. Down by the river, Joe-Pye-weed and boneset (with its perfoliate leaves) grew rank. Having no inkling of invasive plants, I gazed without misgivings at the beautiful masses of purple loosestrife that grew along the Huron River. I enjoyed the little project but went on to other pursuits. Decades later, in Connecticut, my long dormant interest in plants reawakened. I discovered CBS and began showing up for field trips. I learned that plant characteristics, at least the ones useful for identification, are called characters. I soon found out that among the members of CBS there were also quite a few characters. I was especially glad when *these* characters would take the time to point out *those* characters.

On one of my first field trips I met Lauren B. While we were waiting for the field trip to begin, I showed her a little book I had brought along, my recently purchased copy of *The Berry Book*. Lauren asked to see it, and I handed it over, expecting her to flip through it casually. To my surprise, she began leafing through it page by page and didn't stop until she had looked at every single species on every single page. On another trip, when Lauren sat on a rock to rest for a moment, I saw that I had a captive teacher and peppered her with questions. I learned steeplebush (*Spiraea tomentosa*) and then pointed to another shrub, which Lauren informed me was bayberry (*Morella caroliniensis*), or *Myrica pennsylvanica*,



Boneset (*Eupatorium perfoliatum*) gets its specific epithet from its distinctive perfoliate leaves; their "opposite" leaves are fused at the base, encircling the stem. Photo: Janet Novak

as it was then known. Rashly, I did an impromptu impression of Christopher Columbus: “I’ve discovered a *Myrica*!” Though one or two other people were there at the time, my punning Columbus met with a stunned silence. I suppose Native Americans were really the first to discover bayberry, anyway.

On many of the first field trips I attended, Pat L. volunteered to act as recorder, carefully taking down all the botanical names in her notebook. Pat’s modest, unassuming air made me feel comfortable bugging her to repeat the names she was writing down. She pointed out the variable leaf morphology of *Prenanthes* and the five-parted fruits of maleberry. People often leave the field trips without staying for the sometimes-theoretical bag lunch. But if you do bring one, you’ll be assured of having at least one lunch companion, because Pat always brings hers.

When Ellen P. was still a regular participant in the field trips but slowing down, I used to keep her company sometimes. I’d stay back with her as she toddled along, muttering under her breath, even though I might rather have been closer to the action at the front of the group, learning from the expert botanists there. But when I took the trouble to actually listen, I realized that Ellen knew *lots* of plants. One species I learned from her was beech drops, those interesting little parasitic plants that from a distance look like leafless woody twigs but on closer examination turn out to be flowering forbs with a purplish cast. There were also swamp candles and rattlebox — whose acquaintance I made with all the delight of a baby receiving its first rattle. I also discovered that Ellen had a dry sense of humor and that some of what she was mumbling was absolutely hilarious. Once, on a field trip to Babcock Pond in Colchester, Ellen, whose arthritis made her a bit unsteady on her feet, leaned far out over some brush beside the track, to get a better look at a plant growing somewhere in its midst. Sensing the concern of her companions, she said, “If I fall in, just grab me by the ankles and drag me out.” Fortunately, an unceremonious rescue proved unnecessary.

I once accompanied Sam S. to check out a nearby utilities cut after a field trip had ended. It’s great tagging along with an expert. You can ask them to ID all sorts of things that would have been a pain to key out on your own. So what did I ask her about? Some raspberry-like things that were scrambling around low to the ground. “Dewberries,” she said. Asking Sam to ID dewberry is a bit like using a laptop computer to kill a mosquito: it does the job, but you could have used it for more interesting things. Sam is a frequent participant in CBS field trips and often disappears into the woods on her own, while the rest of us straggle along on the trail. Every so often, however, we’ll hear a disembodied voice calling out to us from a distance — in Latin. (Somehow, it calls to mind a line from the Bible: “the voice of one crying [out] in the wilderness.” It’s considered a reference to John the Baptist. I’ve never seen a plant actually get

baptized, but they do get named a lot.) By the time the last straggler in our group arrives to view her latest find, Sam has usually vanished like a wood sprite into the woods again.

Speaking of CBS mentors, I am grateful to Ed Richardson for sharing his knowledge and enthusiasm about trees, for lending me books, and for his encouragement of my writing. He suggested I submit an article to *Arnoldia*, the magazine of the Arnold Arboretum. After it was published, he marched purposefully up to the podium at a CBS meeting and announced that I was “a rising star” in the Society, a level of validation I had never experienced and one which I hope to merit.

These vignettes barely scratch the surface of all the wonderful “botanical characters” in our Society, but I’ll just add a last anecdote about how CBS touched me in an unexpected way.

In 2014, the CBS Spring Meeting began, as always, with a silent auction of used books of interest to naturalists and nature lovers. I like these book sales, but they do cause a certain amount of anxiety. I’m torn between the desire to greet acquaintances I haven’t seen in some time and the desire to focus on the serious business at hand: scanning the goods for treasure and entering my bids before the lecture starts. One of the books that caught my eye at the 2014 Spring Meeting was a hardcover on silviculture. No need for anxiety there. It was about sixty years old and appeared to be a textbook — not likely to be lively reading or inspire a bidding frenzy. I got it for a song. On opening the book, I recognized its previous owner’s name as that of a new friend: Penni S., long-time chair of the CBS Field Trip Committee. I liked having this book that she had owned and imagined that it had been a textbook of hers during student days. But when I got home, I found the book had more to reveal. Upon turning to the back to consult the index, I saw that once upon a time something had been folded up and tucked inside the back cover. I unfolded it. It was a six-color, 10” x 14” map of the “Natural Forest Vegetation Zones of New England,” dated 1955. This was nice enough in itself, and it occurred to me that it might be suitable for framing, but the real surprise came next.

The map had been compiled by the “Committee on Silviculture of the Society of American Foresters, New England Section.” In its lower right corner there was an alphabetical list of the Committee’s nine members. From the top of the list a name jumped out at me: R. I. Ashman. It was my maternal grandfather’s name. He had taught forestry at the University of Maine for many years and had passed away in 1979. Thanks to Penni and the CBS book auction, I now possessed a colorful memento of his life and work. It goes to show you can’t judge a book by its cover, or, as my grandfather liked to quip at the breakfast table, “There’s more to a grapefruit than meets the eye.”

Geum urbanum

continued from page 1

and its sepals are green. The fruits are achenes and form a round bur. The styles on mature achenes develop into long purplish hooks (sticktight). Another characteristic of the styles is that they are jointed, with a deciduous terminal segment inserted laterally on the style's glabrous basal segment.

There are four other *Geum* species with bright yellow petals in New England with which it might be confused. *Geum aleppicum* subsp. *strictum* has small stipules that are longer than wide. Its flowers are on stouter pedicels (greater than 1 mm). *Geum macrophyllum* is found only in northern New England. The terminal leaflet of its basal leaf is as much larger than the other leaflets and the stipules are longer than wide. *Geum vernum* is found only in Vermont. Its petals are very small (1-2 mm long), with the terminal segment of the style inserted at the tip of the hooked basal segment (as opposed to laterally inserted in *Geum urbanum*). The bur is borne on a stalk (1-2 mm long) above its sepals. *Geum fragarioides* has a flowering stem with only a few very small leaves (or no leaves) and has three-parted basal leaves. *Geum urbanum* is distinguished from the remaining species of *Geum* in New England by flower color. *Geum canadense* var. *canadense*, with white petals, also has much smaller stipules and tan achene hooks. *Geum virginianum*, with small (2-4 mm long) cream-colored petals, also has much smaller stipules. *Geum laciniatum*, with yellow-white petals, has stouter pedicels (greater than 1 mm thick). *Geum rivale* L. has petals buff or yellowish, suffused with purple, but is also distinctive in having bell-like nodding flowers with purple sepals. *Geum rivale* and *G. urbanum* are reported to hybridize regularly in the British Isles, where they are sympatric.⁷

The first naturalized location for *Geum urbanum* was discovered on July 24, 2005 by the second author in a forested wetland of Aton Forest while conducting a rare plant survey. A few individuals of this species had been observed by the first author several years earlier along the foundation of a house site approximately 167 m to the west. Subpopulations were found in upland woodland and edge habitat adjacent to the wetlands. A few individual plants were observed within 150 m of these sites, mainly near roadsides.

The forested wetlands site was within 25 m of a 19th-century cellar hole and dominated by red maple and white ash, with sparse to dense understory vegetation comprised of Japanese barberry, sedges and cinnamon fern. It was essentially a typical red maple swamp, but without skunk cabbage, which rarely occurs at these higher elevations in northwest Connecticut. This naturalized location included the former site of an historic house and barn, known to have been occupied in 1859 by I. Butler (as indicated by a map of the Town of Norfolk from that date). Plants were found beside the only remains of the Butler house, a stone foundation, and in the vicinity of what

would have been the barn floor. This population covered approximately 0.5 hectares and extended from near the old foundations west to the edge of a mowed field.

A subpopulation was found in upland red maple and white ash forest with sparse understory vegetation and a second subpopulation was found in moist lower-slope red maple and white ash forest and included a long-abandoned roadbed that leads from the house to a town road. The understory was patchy, either shrubby Japanese barberry or herbaceous goldenrod. (primarily *S. rugosa* and *S. canadensis*) and often mixed with other exotic and invasive species such as garlic mustard (*Alliaria petiolata*).

A second naturalized location was discovered on Aug. 18, 2007 approximately 930 m southeast of the original site, on neighboring private property at a woodland edge. This was considered to be a separate population, likely garden escapes from the site of a nearby house, built about 1790 and also occupied in 1859 (again as indicated on a map of the Town of Norfolk from that date). An occupied house still exists at this location. This population covered approximately 0.25 hectares from the edge of a mowed field and into a mixed evergreen-deciduous forest on abandoned farmland. The canopy consisted of white ash (*Fraxinus americana*), black cherry (*Prunus serotina*) and white pine (*Pinus strobus*), with a generally dense understory of blackberry (*Rubus* sp.), multiflora rose (*Rosa multiflora*), and interrupted fern (*Osmunda claytoniana*). This is a typical cover type that comes in after agricultural abandonment in this region. It's possible that *G. urbanum* populations have persisted in these two locations since the cessation of farming in the area in the 1930s.

A third site was discovered on Aug. 11, 2012, over 1 km distant from either of the two previous locations. Three flowering plants and six additional plants with only basal leaves were found along a trail that had been cleared in 2011 and 2012. It is possible that seeds were inadvertently introduced to this site during trail maintenance or by hikers. Subsequently these plants were pulled and removed from the site.

A fourth site was discovered in 2013, located 1.25 km from the primary site (the former Butler property) on an abandoned town road and near the bottom of a hill. These plants were also removed. It is likely that seeds were distributed by deer or people or moved by water onto sparsely vegetated soil. Since 2013, the plant has been slowly expanding its presence near the primary site, and along the driveway and abandoned town road.

At all of these locations this species grew 0.2-1.0 m tall. The colonies were diffuse and did not form dense patches. They only occasionally dominated small portions of the sites. Plants occurred in full to partial shade, either under woodland canopy or mixed with tall herbaceous cover. Some plants were browsed, apparently by white-tail deer. Other herbivores, parasites or diseases have not been observed.

Based on our observations at these sites, we believe that *Geum urbanum* can be considered to be naturalized in northwest Connecticut. It has dispersed into and become well established in relatively undisturbed natural plant communities well away from disturbed and managed areas as well as in common human-disturbed sites like gravel roads. We cannot predict whether this plant will displace native species, such as other species of the genus *Geum*, but it has successfully colonized established vegetation where other *Geum* species occur and therefore could reduce the abundance of these and other species. Therefore, it should be monitored to determine if it is reducing the abundance of other species and possibly hybridizing with other *Geum* species as it expands into natural habitats. If *G. urbanum* arrived with the homesteaders in the mid-1800s, its current distribution does not suggest potential for rapid expansion. However, as it increases in abundance locally, a threshold could be reached that could result in a large increase in its population. The tickseed dispersal method of *Geum urbanum* could eventually result in its widespread distribution, as it is moved long distances by deer, birds and humans. The authors suspect it has been present for many years but overlooked at these Norfolk sites.

The distribution of *Geum urbanum* in our region may soon be better understood now that the naturalization of this species has been reported. Thus, we recommend that botanists and botanizers be on the look-out for this species, and its possible hybrid with *Geum rivale*. If it is more common than it currently appears, it may warrant consideration as potentially invasive and/or a potential threat to *Geum rivale*.

Acknowledgments

The authors wish to thank Aton Forest, Inc. (Norfolk, Conn.) for providing financial support for the plant survey by William Moorhead from 2005 – 2010. They also acknowledge with appreciation the Aton Forest Fellowship

Trust for providing ongoing financial support to John Anderson as Aton Forest Fellow.

John Anderson is CBS Recording Secretary and the Executive Director of Aton Forest, Inc. in Norfolk, Conn., a private ecological research station that protects 2,300 acres of land primarily for ecological research, conservation and education activities. He is also the Aton Forest Fellow, conducting research and conservation activities on the lands of Aton Forest.

Bill Moorhead is an independent consulting field botanist based in western Connecticut. Highlights of his work include the rediscovery of 26 plant species presumed extirpated in Connecticut, and the discovery of over 600 new populations of rare plants. He also teaches plant identification workshops in difficult plant groups, such as sedges, grasses, willows, asters and goldenrods, and invasives.

Notes

- 1 Bunney, S., ed. 1984. *The illustrated book of herbs: their medicinal and culinary uses*. Gallery Books, New York, N.Y.
- 2 Fernald, M. L. 1950. *Gray's manual of botany: a handbook of the flowering plants and ferns of the central and northeastern United States and adjacent Canada*. Dioscorides Press, Portland, Ore. p. 817.
- 3 NatureServe. 2012 NatureServe Explorer. Website (<http://www.natureserve.org/explorer/>). Accessed 10-03-2012.
- 4 United States Department of Agriculture. 2012. PLANTS Database: Plant profile. Website (<http://plants.usda.gov/java/profile?symbol=GEUR>). Accessed 10-03-2012.
- 5 Keys, J. Jr., C. Carpenter, S. Hooks, F. Koenig, W. H. McNab, W. Russell, and M. L. Smith. 1995. *Ecological Units of the United States – First Approximation*. USDA Forest Service, Atlanta, Ga.
- 6 Eglar, F. E., and W. A. Niering. 1965. *The Vegetation of Connecticut Natural Areas. No. 1. Yale Natural Preserve, New Haven*. State Geological and Natural History Survey of Connecticut, Hartford. p. iv.
- 7 Aton Forest is a private ecosystem research station and nature preserve, owned and managed by Aton Forest, Inc., PO Box 509, Norfolk, CT 06058, a 501(c)(3) organization.
- 8 The Wild Flower Society. 2012. Wild Flowers of the British Isles. Website (http://www.ukwildflowers.com/Web_pages/geum_x_intermedium_hybrid_geum.htm). Accessed 10-07-2012.

Notices and News

■ This year, the Northeast Natural History Conference organized by Eagle Hill Institute took place in Connecticut for the first time. Like good hosts, several CBS members led field trips, organized, or presented during the conference, including John Burns, Sigrun Gadwa, Frank Kaputa, Steve Messier, Juan Sanchez, Sam Saulys, James Sirch, and Patrick Sweeny.

■ Every summer, at its headquarters in Steuben, Maine, Eagle Hill Institute holds intensive weekend workshops and week-long seminars on natural history topics, led by expert naturalists. For more information, see the CBS website's Links page or visit: www.eaglehill.us

Some Clubmosses of Northeastern Connecticut

BY DEBORAH RUSSEL

WHEN HIKING FORESTS in northeastern Connecticut, one's eyes are often drawn upward to the beautiful canopy created by sizeable hardwoods and conifers. Connecticut's mature trees impart cooling shade, and provide food and shelter to many wildlife species. However, I would encourage visitors to local forests to look downward instead and discover other marvels, close to and on the forest floor. The low-growing plants that drew my particular attention recently resemble mosses or miniature conifers, and in some areas they form vast colonies, a natural groundcover. These mini wonders are called clubmosses and/or fern allies, but they are neither mosses nor ferns. They are members of the plant family Lycopodiaceae, and represent living relics of plants that evolved during the Devonian Period, approximately 359 to 419 million years ago (mya). Today, taxonomists recognize 7 genera and 27 species of clubmoss in North America. In this article I discuss clubmoss origins, morphology, reproductive mechanisms, habitats, and uses, past and present, and focus on four species from four genera, which I observed in the course of woodland walks in northeastern Connecticut: *Dendrolycopodium obscurum*, *Diphasiastrum digitatum*, *Huperzia lucidula*, and *Lycopodium clavatum*.

Clubmosses belong to an ancient group of plants, the Lycophyta, believed to have originated around 400 mya. The Lycophyta were some of the earliest land plants to develop roots, stems, leaves, and internal tissues capable of conducting water and nutrients. Current species are vestigial relics of the earliest lycophytes. They are considered an evolutionary stage between more primitive plants, such as algae and mosses, and the more highly evolved flowering and



Dendrolycopodium obscurum with strobili.
Photo: D. Russel



Diphasiastrum digitatum with stalked strobili.
Photo: D. Russel

seed-producing plants. Like the higher plants, clubmosses contain vascular tissue, but they produce spores rather than seeds.

Some of the ancient Lycophyta were shrub- and tree-like and formed huge forests over most of Europe and North America. During that time, much of the world's land was dry and warm. Some specimens attained a height of 100' or more. Toward the end of the Carboniferous period, around 300 mya, climatic change, both gradual and sudden, is believed to have been the cause of their demise. In addition, a worldwide extinction event, known as the Permian-Triassic extinction, around 252 mya, resulted in the loss of approximately 83% of all plant and animal genera. Because of their ability to adapt morphologically and physiologically to new climatic conditions, some low-growing and non-woody Lycophyta species survived the Permian-Triassic extinction and became pioneers in the repopulation of vacated habitats. The extinct tall, tree-like species were covered over, compressed, and carbonized over millions of years, eventually forming the world's major coal fields.



Lycopodium clavatum. Photo: D. Russel

The burning of coal today, whether for heat or electricity, is the release of energy captured millions of years ago!

Clubmosses are currently grouped in the family Lycopodiaceae. Earlier taxonomy grouped these species into only two genera. Those growing in temperate zones were given the genus *Lycopodium*. The name *Lycopodium* is derived from the Greek word *lycos* meaning "wolf" and *podos* meaning "foot." The branching tips of some of

Key Characteristics of Four Common Clubmosses

Dendrolycopodium obscurum

- most numerous and most frequently found in study
- Name derivation: Greek *dendro* "tree," *lycos* "wolf," *podos* "foot;" *obscurum* from the Latin meaning "dark," "shady," "obscure."
- Common name: princess pine or flat-branched tree clubmoss
- Habitat: Mostly mesic and acidic soils in mixed hardwood and conifer forests and along edges; does well in leaf litter; thrives on slopes; in some areas forms extensive colonies; less frequent in areas where understory is filled with brush and low growing shrubs; observed coexisting with *Diphasiastrum digitatum*.
- Morphology: flat-branched and tree-like; horizontal stem below ground; vertical stem up to 12 inches tall; leaves are long, narrow, lance shaped, taper to a point with untoothed margins, and are tightly appressed to upright stem below branches; strobili are sessile (without stalks) and develop singly from tips of upper branches, 1-6 per upright branched stem.

Diphasiastrum digitatum

- Second most common species found
- Name derivation: from the Latin generic term *Diphasium* and *astrum* meaning "star" and *digitatum* "fingered."
- Common name(s): southern ground cedar or southern running pine
- Habitat: drier upland soils of mixed woods and clearings; often with *Dendrolycopodium obscurum*.
- Morphology: tree-like with flattened fan-like lateral branches; horizontal stem creeping on soil surface or litter; leaves small and attached to upright stem for more than half their length; plant

resembles branch of cedar tree lying on ground; strobili at top of tall stalks, 1 or 2 per upright stem.

Huperzia lucidula

- Name derivation: from 18th century Dutch fern horticulturist Johann Peter Huperz and from the Latin *lucidulum* meaning "shining."
- Common name: shining firmoss
- Habitat: found in moist mixed hardwood-conifer forests, growing in leaf litter, forest depressions, bases of wooded slopes, and on mossy logs.
- Morphology: low-growing, wavy, upright stems single or branching; rooting of upright stems occurs at base from underground branching rhizome; dark green stalkless leaves, widest above mid-point and toothed margins; leaves give plant a bristly appearance; buff colored sporangia found in upper zones of stem; vegetative plantlets (gemmae) borne in uppermost leaf leaf axils.

Lycopodium clavatum

- Name derivation: from Greek *lykos* meaning "wolf" and *podos* "foot," and *clavatum* from the Latin meaning "clublike;" this was the first species called clubmoss by Linnaeus in 1753.
- Common names: Common or running clubmoss, staghorn clubmoss
- Habitat: mesic forests and open spaces; edge of trails and clearings.
- Morphology: horizontal stems growing and rooting on soil surface; upright stems branched, densely covered by tapered leaves with translucent hair-like tips; branched strobili grow from long stalks at tip of upright stems.

the species were thought to resemble a wolf's paw. With further study and DNA analysis, the genus *Lycopodium* has been divided into 16 genera worldwide, with 7 occurring in the northeastern United States. All clubmosses are terrestrial except for species in the tropics, which are epiphytic.

Clubmosses are low growing, evergreen, non-woody plants, some resembling small conifers, others more like tall mosses. They are often referred to as "ankle forest." Horizontal plant growth may be creeping, trailing or absent, either above or below ground, and all species produce upright stems, which rarely exceed 8 inches in height. Clubmosses possess primitive leaves, known as microphylls, which are leaves having only a single midline vein to conduct fluids. They grow in crowded ranks around upright stems. Some species have narrow needle-like leaves, creating the

overall resemblance to a small evergreen. Other species' leaves are more flattened, giving them the look of a cedar branch lying on the ground. The genus *Huperzia* has upright stems covered by stalkless pointed leaves, somewhat resembling a tall moss.

Clubmosses reproduce both sexually and asexually, with the latter being the most predominant. Sexual reproduction encompasses two phases: a spore-producing phase, called the sporophyte, and the gamete-forming phase, called the gametophyte. Spores originate in modified structures called sporangia. Depending on the species, sporangia are located either in modified leaves forming a buff-colored club-like cone, or strobilus, at the end of an upright stem or in a modified region along the stem. The word strobilus is of Latin derivation and means like a pine cone. Some strobili are sessile, simply growing out

of the tip of a vertical stem. Others grow from the tip of a branched stalk. The common name clubmoss derives from these club-like strobili. When mature, in the late fall or early winter, they release thousands of spores. The elevated position of the strobili aids in the dispersal of the spores by wind. The species observed release their spores through a transverse splitting of the sporangia walls. Their spores are tiny, yellow, and spherical or kidney-shaped. Tapping on strobili in the fall causes them to release yellow clouds of spores. While the majority of spores are released in the fall, I discovered strobili still capable of spore release in February. Spores not developing along strobili, but along modified sections of the upright stem, as in the genus *Huperzia*, are released in the same way. Spores fall on the ground and either remain on top or

continued on page 8

Clubmosses

continued from page 7

go below ground level to complete the next life cycle phase, the gametophyte, which is bisexual. The gametophytes of the four species I studied, mature below the soil surface, do not photosynthesize and depend upon mycorrhizal fungi for their water and nutrients. There are also lycophyte species whose gametophytes remain on the surface and do photosynthesize.

During maturation and growth of the gametophyte, fertilization occurs. Both male and female gametes are contained in the gametophyte and these fuse to form a fertilized zygote. The entire process — the maturation of the gametes, fertilization, and the development of the green sporophyte (the plant we observe) — can take up to 20 years!

Asexual reproduction of clubmosses is by vegetative growth. The most common pattern is the gradual extension of the horizontal stem from an upright plant. As it grows, whether above or below soil level, it puts down rootlets either at the tip of the advancing stem or irregularly along the horizontal stem. From that juncture a new vertical stem will develop. Vast colonies can be formed in this way. As the horizontal stem expands, the colony gradually moves. Die-off of older portions of the clubmoss at the rear of the colony adds to the appearance of moving. Horizontal growth occurs more rapidly than die-off and so contributes to the rapid spread of the colony. However, in the genus *Huperzia*, there is no underground horizontal stem. Small six-leaved plant-like growths, called gemmae, form in the axils of the upper leaves of upright stems. These fall off at the end of the growing season and land on the ground where they form rootlets that develop into new plants.

Clubmosses, though frequent inhabitants of the pine and mixed woodlands in northeastern Connecticut, are a minor component of

these habitats, and their economic significance is considered slight. Their colonial growth habit can be quite extensive, however, particularly on sloping land and in depressions. Their presence and numbers reflect specific environmental factors in the habitat, such as sunlight, soil moisture and acidity, competition from other understory plants and forest debris. I also observed them adjacent to trail edges and in disturbed habitats such as power line installations. They grow optimally where there is deep forest leaf litter and a fairly open understory, and they co-exist with mosses, ferns, and low-growing herbaceous perennials such as downy rattlesnake-plantain (*Goodyera pubescens*), spotted wintergreen (*Chimaphila maculata*), and



Huperzia lucidula with sporangia along stem.
Photo: D. Russel

partridgeberry (*Mitchella repens*). In some places, the activity of non-native earthworms in breaking down the “duff layer” on the forest floor affects soil composition and nutrient content and this can negatively impact clubmoss numbers.

Some insect species, such as the European earwig and scale insects, are known to feed on clubmoss leaves. Their foliage is also consumed by slugs and snails. Clubmosses also

provide nesting sites for ground roosting birds such as ovenbirds and hermit thrushes. And clubmosses contain alkaloids which are helpful in preventing browsing by deer.

Humans have used clubmosses in a variety of ways. Ancient Druid sects considered them sacred and employed rituals to gather and display them. They were thought to bring good luck. Some people still gather clubmosses for holiday greenery displays and wreath-making, though the practice is now discouraged, and the gathering of clubmosses in national parks is currently allowed only by permit. Clubmoss spores, because of their size uniformity, were considered ideal for microscopic calibrations to determine pollen grain counts. Counting a mixed sample of spores and pollen grains on a microscope slide and then putting the numbers into a formula, produced a figure representing the concentration of pollen. The spores' high fat content also makes them highly flammable, which made them ideal for use in early flash photography, theatrical effects, and fireworks. The spores were once used by the pharmaceutical industry to coat pills and keep them from sticking to each other. They were one of the ingredients in dusting powder and continue in a limited way to be used in present day body powders to reduce chafing and diaper rash. They also are still employed in powders used to treat dermatological conditions such as eczema, boils, and herpes. Health food stores stock clubmoss spores under the name “vegetable sulphur.”

So, as you hike the woodlands of northeast Connecticut, look down and enjoy the beautiful “ankle forest” created by these versatile plants, and be amazed that they represent the living relatives of prehistoric plants the size of trees!

Deborah Russel is an avid hiker and gardener and lives with her husband Jim in Connecticut's northeast “Quiet Corner.” She is a recent graduate of the

Master Naturalist Program offered by the James L. Goodwin State Forest and Conservation Center in Hampton, Conn.

Bibliography

Carroll, Jackie. What Is A Fir Clubmoss Plant? Gardening Know How. <https://www.gardeningknowhow.com/ornamental/groundcover/fir-clubmoss>

Chadde, Steve W. 2013. *Northeast Ferns: A Field Guide to the Ferns and Fern Relatives of the Northeastern United States.*

CliffsNotes. Phylum Lycopphyta: Club Mosses and More. <https://www.cliffsnotes.com/study-guides/biology/plant-biology/seedless-vascular-plants/phylum-lycophyta-club-mosses-and-more>

Cobb, Boughton, Farnsworth, Elizabeth & Lowe, Cheryl. 2005. *A Field Guide to Ferns and Their Related Families.*

DeVries, Jim. Club Moss (*Lycopodium spp.*). 2007. <http://www.voyageurcountry.com/htmls/floweringplants.html>

Eastman, John. *The Book of Forest and Thicket.* 2010.

Greig, Edna. Ancient Forests, Chipmunk Height. 2014. *Northern Woodlands* (The Outside Story). http://northernwoodlands.org/outside_story/article/ancient-forests

Hammerson, Geoffrey A. *Connecticut Wildlife, Biodiversity, Natural History, And Conservation.* Lebanon, NH: University Press of New England, 2004.

Holland, Mary. *Naturally Curious.* 2010.

Lobstein, Marion. Clubmosses: An Ancient and Interesting Group of “Fern Allies.”

Prince William Wildflower Society. <http://vnps.org/princewilliamwildflowersociety/botanizing-with-marion/clubmosses-an-ancient-and-interesting-group-of-fern-allies/>

New England Wildflower Society. Go Botany. <https://gobotany.newenglandwild.org>

Rook, Earl J.S. Ferns and Fern Allies of the Northwoods. <http://www.rook.org/earl/bwca/nature/ferns/>

Science.jrank.org. Club Mosses. <http://science.jrank.org/pages/1531/Club-Mosses.html>

Stokes, Donald & Lillian. 1976. *A Guide to Nature in Winter.*

University of California Museum of Paleontology. Introduction to the Lycopphyta: Clubmosses and Scale Trees. <http://www.ucmp.berkeley.edu/plants/lycophyta/lycophyta.html>

2016 CBS Annual Meeting



Guest speaker Dr. Bryan Connolly spoke about his taxonomic investigation of chokeberries (*Aronia spp.*) at the 2016 CBS Annual Meeting. Photo: G. Dreyer



DEEP wildlife biologist Peter Picone gave CBS Annual Meeting attendees a tour and talk on biodiversity and wildlife management at the Sessions Woods Wildlife Management Area. Photo: G. Dreyer.

CONNECTICUT
BOTANICAL SOCIETY

P.O. Box 9004
New Haven, CT 06532
USA



CBS members listen to Peter Picone speak about Sessions Woods at the 2016 CBS Annual Meeting. Photo: George and Luella Landis