CHINQUAPIN
The Newsletter of the
Southern appalachian Botanical Society
Volume 20 (2)
Spring 2012

Bear Corn, *Conopholis americana*

Lytton John Musselman, Old Dominion University

This is the time of year (mid-May to mid-June) when this fascinating parasitic plant flowers across much of the Eastern United States. The yellowish flowering stalks are not true stems. Members of this group do not have true stems because they lack true leaves which in turn reflects their lack of chlorophyll—this reduction is just one of the many features of economy of plant parts in these parasites. All aspects of nutrition are underground, unseen. It is a holoparasite that means it lacks chlorophyll and is entirely dependent upon its host. But when it comes to sex, *Conopholis* is traditional and bears white to light yellow two-lipped flowers.

For reasons inexplicable to me, the most frequent common name is Squaw Root though Bear Corn is more descriptive. The yellowish flower stalks do bear a resemblance to a small ear of corn and bears have been reported to eat the stalks.

Upper left is a section of the fruit, upper right a developing fruit, lower left an open flower, center is the flowering stalk, and lower right the corolla spread open to show the anthers. From: Wikipedia Commons.

Bear with me when I say that there is little in the taste of this plant to commend it to humans, however. It is extremely bitter, due I suspect, to the accumulation of tannins from its oak host.

I have found Bear Corn only on the roots of oaks (species of the genus *Quercus*) but other hosts have been reported; host identification is only possible by excavation, not inferred by proximity. And unlike the other native holoparasitic members of the family (*Orobanche uniflora, Epifagus virginiana*) Bear Corn is perennial from a knobby tubercle on the host root. (Interestingly, molecular studies have shown a close relationship between *Conopholis* and *Epifagus*, a relationship that could not easily have been predicted based on morphology.) Like *Epifagus virginiana* and *Orobanche uniflora*, we know very little concerning the life history of this plant.

It is possible to locate early stages of Bear Corn by sifting through the soil near old stems. The seedlings are similar to those of other holoparasitic *Orobanchaceae* with a radicle that develops a haustorium; this modified root forms the morphological and physiological bridge with its host. After penetrating the young, mycorrhizal oak root, a gall-like organ develops and the seedling appears as a brown, pea-sized structure surrounded by a scaly brown bark that is continuous with the bark of the host. This stage is the tubercle.

Tubercles may reach a width of 15 cm or more. Larger tubercles have numerous latent and active buds. Factors involved in bud formation are unknown and we do not understand how old the plants must be to flower. However, there is a record at the Botanic Garden in Copenhagen of *Conopholis americana* (planted on *Quercus petraea*, a white oak) flowering eight years after sowing seed.

Tubercle development affects the host root in two ways. The portion of the host root distal to the infection usually dies. For example, in 30 randomly chosen tubercles, the distal portion of the host root was lacking in 21 and reduced in size in four other. The remaining five were very young infections. Secondly, the host root is swollen proximal to the infestation sometimes to a distance of several cm. There is a direct, positive correlation between the size of the host and the tubercle root indicating that infection takes place on the young root tips and that growth of the parasite keeps pace with the host.

Observations on floral biology suggest *Conopholis americana* is autogamous, that is, self-pollinating. In the young flowers the anthers are oriented with the line of dehiscence to the interior of the corolla (see diagram). As the filaments elongate, the anthers are parallel with the stigma so that just before the corolla opens, pollen is deposited on the stigma. Examination of these pollen grains on

Bear Corn continued to Page 10

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From The Editor's Desk:

J. Dan Pittillo, Newsletter Interim Editor

Is the climate changing from warm and wet January and February to cool and drier March and April? I get the sense that this has been the pattern for the past few years. With my experience leading hikes at the Wildflower Pilgrimage, there are fewer blooming spring flowers at the lower elevations in April than March. In late March this past year I led a group in the Chimneys Picnic area with full bloom of both the fringed phacelia and trilliums. By mid to end of April they were all in fruit. We botanists are not the only ones seeing a warmer trend: the USDA has shifted the plant zones further north for the East.

But this is not all that we are observing. Again this year our local crop of fruit has been lost. All my apple, peach, cheery, pear, and pawpaw trees lost their fruits. It is not unusual for us to have frosts up to May 10 traditionally but this year the freeze was down to mid 20-Fahrenheit degrees that froze the early blooming of the non-native fruit plants. Even more serious for many of our friends in the East is the devastation that is taking place with storms, not simply the usual tornados of "tornado alley" in Oklahoma but even further north in Michigan and Massachusetts. And then coastal tropical storms such as the one nearly of hurricane force in northern Florida and southern Georgia. Perhaps the best thing we can do is pray to be spared this devastation and help us be prepared if we get hit. It appears any area of the East has potential severe or hazardous weather potential for years to come and this on top of economic restrictions.

In this issue, Lytton Musselman continues with his vascular plant parasites with what has lately been called bear corn, based on the favorite food when bears emerge from hibernation. Serendipity Tim Spira chanced observing a bear doing just this, consuming the plants as well as discovering the product of their digestion. This adds an intervening step of the plant's life cycle and gives us an insight of this interesting natural process. So with these two columns you have a good series of the links with the lifecycle of Conopholis americana.

Our regular columnists, Linda Chafin and Alan Weakley, were not able to get their latest columns for us in this issue, so we can look forward to their valuable input in the following issues.

Joe Pollard will be coming aboard with the editing in the next two issues. It will be great to have a breath of fresh air added to these pages of our fine organization's communication link. I hope some of you will support him in submitting some of your fine thoughts to make this a newsletter everyone will look forward to each quarter.

Bear Corn continued from Page 9

the stigma indicated approximately 10% germination. After the corolla opens, the stigma bends back allowing the posterior set of stamens to also deposit their pollen on the stigma thus ensuring pollination.

The fruit of *Conopholis* is usually described as a capsule. However, the seeds appear to be ripe while the fruit is still fleshy. The thick wall, sticky when crushed, could be an attractant for animal diaspore. Is the fruit a kind of modified berry? By the heat of August, little of Bear Corn is evident except for dried, brown stems that blend in with the leaf litter.

(Portions of this article adapted from my 1982 paper, "The Orobanchaceae of Virginia," Castanea, [47, No. 3] pp. 266-275). [Revised 31 May 2012.]

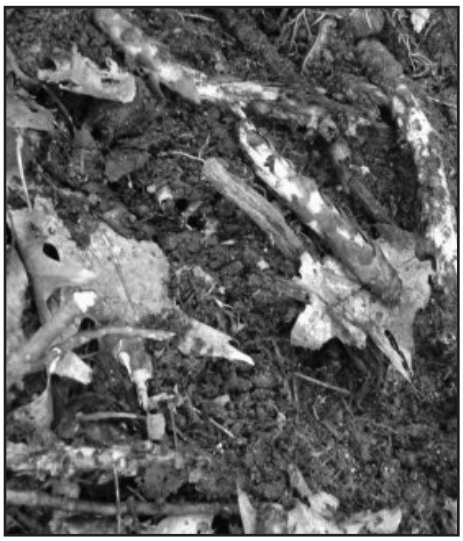
Bear Corn in flower. Without excavation it is impossible to determine how many plants are represented.

Black Bears and Bear Corn

(*Conopholis americana*) [L.] Wallr.)

Tim Spira, Clemson University

Hiking in the Smokies in early June, I came upon a young black bear foraging in the woods. Partially hidden behind a large dead hemlock tree, and with a pair of binoculars in hand, I watched the bear consume the fruits and shoots of multiple clumps of bear corn, a process that went on for nearly an hour (and delayed quite a few hikers, too). A subsequent look at the literature revealed that the flowering and fruiting structures of bear corn are an important part of the diet of black bears. White-tailed deer and smaller mammals such as squirrels, chipmunks, and mice are also known to feed on the flowers and fruits. In addition to obtaining nutrients, it's thought that black bears seek out bear corn to stimulate bowel activity, particularly after emerging from hibernation.



Remains of plant after bear departed.

What about the plant? Does it benefit from this interaction with mammals? As you may have guessed, the answer is yes, as viable seeds of bear corn have been recovered in the scat of black bears and white-tailed deer. While the tiny seeds of bear corn can be transported short distances by rainwater flowing across the soil surface, black bears and other mammals feeding on the ripe fruits play an important role in dispersing the seeds over a larger area. This increases the chance that at least some seeds will be deposited in close proximity to the roots of a suitable host plant (mainly oaks), required for successful establishment, as squawroot is an obligate root parasite.

There's a human connection to bear corn as well in that Native Americans of eastern North America used it as a medicinal plant.

Have you ever observed a bear eating bear corn?

Black bear feeding on bear corn,

Ed. Note: Dr. Timothy Spira, author of Wildflowers and Plant Communities of the Southern Appalachian Mountains and Piedmont can be contacted at Department of Biological Sciences, Clemson University, Clemson, SC 29634-0314 or emailed at <stimoth@clemson.edu>

Have you ever observed this in tree growth?

Burt Kornegay, owner of Slickrock Expeditions and a close friend, has been observing his American beech tree growth for over five years and sends this observation May 21 this year:

The branches of the beech trees near the deck grew approximately 24" this spring within 3 weeks of leafing out, then stopped growing entirely about 2 weeks ago. The new branches hang limp, unable to support their own weight, but are now starting to toughen and stiffen up a little more each day. In contrast, the branches of the nearby yellow poplar have grown only about a foot total to date, but they will continue to grow steadily throughout the summer, probably reaching 3-4' in new length by the time the season is over. Different strokes for different folks.

Ed. Note: I'll report any additional reader observations and suggest some hypotheses for this phenomenon.

Fagus grandfolia drooping branches straighten in summer.

Botanical Excursions

APPALACHIAN LIGHT: FOUR POETS

George Ellison **Illustrations by Elizabeth Ellison, www.elizabethellisonwatercolors.com**

Through the years we've featured in Botanical Excursions numerous excerpts from the works of natural history writers associated with the Southern Appalachians: Bradford Torrey, William Brewster, Horace Kephart, Margaret Morley, Donald Culross Peattie, Arthur Stupka, Edward Abbey, Harry Middleton, Scott Weidensaul, Edwin Way Teale, and others—but never any fiction or poetry. I don't think we'll ever get to fiction. Poetry's moment in the sun, however, has arrived. When I suggested the notion to Dan Pittillo, he responded: "I've not thought much about expanding into literature but this might be a breath of fresh air for some of our readers. Let's give it a try, especially if there is a botanical theme." All poems are published by permission of the individual poets.

Robert Morgan resides in Ithaca NY and has taught at Cornell University for many years. Born and raised on a farm near Zirconia NC most of his poetry, fiction, history, and criticism depict the natural and human history of the southern highlands. Gap Creek (a novel) and his biography of Daniel Boone were national bestsellers. Winner of an Academy of Arts and Letters award for literature, he was inducted into the North Carolina Literary Hall of Fame in 2010. The following selection was published in The Small Farm (a journal) in 1976. Few can match Robert when it comes to narrowing and honing the field of view for a chosen point of interest in a given poem.

THE RED LEAF

The one red leaf in the patch
of Virginia creeper
at the edge of the field
burns like a warning light
in the late afternoon green.
Only it seems
to gather and concentrate
the light into a morsel,
heating up in the lush
weeds like the focal point
of the magnifying sky,
or a single piece
of stained window.
The leaf fills
and overflows.
I use it as a reference
point in the draining field,
a pilot lamp
for the sun shutting
off its instrument panel.
When I look again
it's gone
and the field dark.

Kathryn Stripling Byer taught for many years at Western Carolina University and resides in Cullowhee NC. Her seventh book of poems is to be published by the LSU Press this fall. She served as North Carolina's Poet Laureate—the first woman to hold that post—from 2005 to 2009. She will be inducted into the North Carolina Literary Hall of Fame, along with Maya Angelou and John Lawson, this fall. The poems reproduced here have not been previously published. Kay utilizes many voices and is a master of subtle transitions in both style and thought.

GALAX

Squatting behind bushes,
I smell its moldering

scent, like an old
woman rising

from morning
ablutions to look

in the mirror and see
what's become

of her, nothing new,
just the old turning to earth

out of which we come,
foliage and flesh alike.

AT FANCY GAP

I become stargrazer
abed in our sleeping bag
my mouth wide open
to what little light
blooms in such a vast
darkness. No end to it
I can imagine, nor want to,
browsing the star-flowers
I used to nibble
when I was a girl
believing I had plenty
of time to taste everything
spread out before me.

ASCENT

Before I can catch
my breath you right away
stop to identify

Wild Ginger,
Mayapple,
Bloodroot.

I'm dizzy with switchbacks
I see rising into
the hardwoods you hail--

Sarvis,
Sycamore,
Tulip Tree.

T*rillium* sweeps down the hillside
like angel wings
come to rest creekside.

Trumpet Vine? Non-
native! You scowl.
We climb until

we reach the summit,
its view of and underfoot

some nameless
moss
pushing through.

Thomas Rain Crowe resides at Tuckaseegee NC. The author of twenty books he is internationally recognized as a poet and translator. The Laugharne Poems were written at the Dylan Thomas home in Laugharne, Wales, and published by Welsh publisher Gwasg Carreg Gwalch in 1998. His award winning memoir Zoro's Field: My Life in the Appalachian Woods was published by the University of Georgia Press in 2005. The poem reproduced here first appeared in Every Breath Sings Mountains: The Great Smoky Mountains published by Voices From the American Land in 2011. Thomas combines a laid back Dylan Thomas-like lyricism with a translator's etymological perspectives.

THE MORNING WOODS

Into the night
the doors of the mountains swing.
Into the saloons of morning.
Where we see ourselves in branches
and in the voice of wilderness that sings.
Where for a million years
the trees have laughed at the wind
and the rivers made rock into rich black soil.

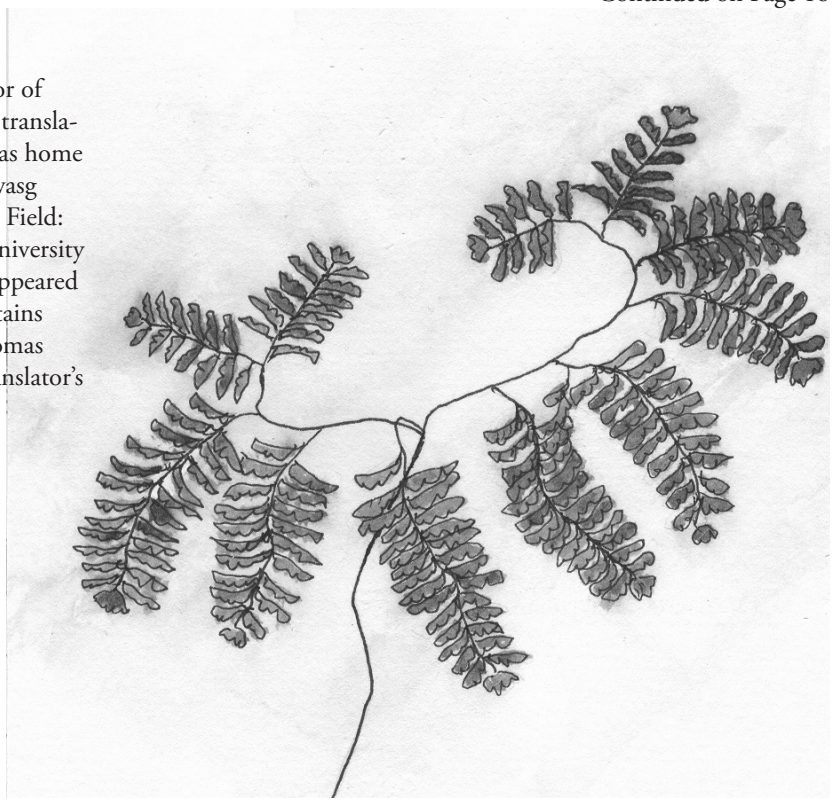
How quick the leaves change to crimson
from green, or back to green again
in the memory of a winter's blood.

Like the f in forest, or the t in trees,
the language of the morning woods takes form--
from the scent of rain-soaked pine and
wilt becoming the bloom of flowers,
to the lightning crack of a storm.

Where a bouquet opens
from what would once have been weeds and
blue moss throbbing in the deep shade,
the compost of a wren's nest
sets fire in the peat of loam.
Where what was once short
turns now to something long.
And spring turns to summer
in the sound of song.

George Ellison resides near Bryson City NC. He has published collections of natural history essays and edited anthologies of nature writing. His work is illustrated by his wife, Elizabeth Ellison, owner-operator of Elizabeth Ellison Watercolors. The following selection is excerpted from a long poem titled "High Rocks" in his Permanent Camp: Poems, Narratives and Renderings from the Smokies (Charleston SC: Natural History Press, 2012). Welch Ridge is situated between Forney and Hazel creeks on the NC side of the Great Smoky Mountains National Park.

Continued on Page 16



Why We Have Few Summer Wildflower Pilgrimages

By J. Dan Pittillo

Have you wondered why we seldom have summer wildflower pilgrimages in the Southern Appalachians compared to spring ones? I think the answer is simply that there are fewer wildflowers to enjoy in our forests at this time of year. About the only one I'm familiar with is the Cullowhee Native Plant Conference in July.

Evolution of spring flowering by plants before development of the tree canopy has contributed to the paucity of woodland flowers. There are a number that can be seen in woodland borders or tree gaps, such as Turk's cap lily (*Lilium superbum*) or Oswego tea (*Monarda didyma*). But in the deep shade they seem to be fewer, such as black cohosh (*Cimicifuga racemosa*). Instead, blooming plants tend to be located in the meadows or exposed rock outcrops.

Most meadow flowers are naturalized from Eurasia. Consid er the oxeye daisy (*Leucanthemum vulgare*), yellow goat's-beard (*Tragopogon pratensis*), or clovers (*Trifolium repens*, *T. pratense, T. campestre*). In spring to early summer, our native daisy-like flower is the daisy fleabane (*Erigeron annuus* or *E. philadelphicus*). In warmest summer periods, queen-anne lace (*Daucus carota*) is often the main flower seen. Sometimes creeping into meadows but more common in borders or old homesteads of woodlands is the day lily (*Hemerocallis fulva*).

Some of my favorite native summer wildflowers include these species: None can beat the brilliant scarlet Oswego tea (*Monarda didyma*). Closely behind are the lilies, including Carolina (*L. michauxii*), Turk's cap (*Lilium superbum*), Gray's (*L. grayi*), Philadelphia (*L. philadelphicum*) or Canada (*L. canadensis*). Somewhat less common are the orchids, small purple-fringed orchid (*Platanthera psycodes*), or rarer large purple-fringed orchid (*P. grandiflora*), yellow-fringed orchid (*P. ciliaris*). Yellow flowers are pretty common in summer, including black-eyed susan (*Rudbeckia hirta* or *R. fulgida*), sunflowers such as Jerusalem artichoke (*Helianthus tuberosus*) and hypericums including the outcrop cushion plant of our cliffs, granite-dome St. John's wort (*Hypericum buckleyi*) and the mountain bushy St. John's wort (*H. densiflorum*). Among the pinks and purples, Carolina phlox (Phlox carolina), broadleaf phlox (*P. amplifolia*), reddish purple blazing star (*Liatris squarrosa*)

Continued on Page 15

Lilium grayi is a bell-shaped lily while *L. philadelphicum* is upright campanulate.

Hypericum buckleyi is a beautiful mat rock outcrop Southern Appalachian endemic.

Monarda didyma with red tubular flowers are frequently visited by humming birds.

Lilium grayi, top, is a bell-shaped lily while *L. philadelphicum,* above, is upright campanulate.

Phlox amplifolia, about a yard tall, has wide-based leaves below inflorescence.

Trifolium repens is our most common nitrogen soil builder of grasslands.

Platanthera ciliata has lower lip petal highly fringed.

Helianthus tuberosus is higher than your head and a source of food in the rhizome.

Mystery Plants

By Dan Pittillo

The correct identifications for the last issue (vol. 20, no. 1) was *Corylus americana* (no. 1) and *Celastrus orbiculatus* (no. 2). Getting both these correctly identified were Donna Ford-Wentz, Georgia Hall, Jim Hull, Eva and Sam Pratt, Franz Seischab, and David Taylor. Ed Clebsch and Judy Dumke also got the Celastrus correctly identified.

Continuing with 7 and 8 in this series of plant identifications, see if you recognize these two for an actual site to see what might be the future dominant species for the area after a storm. Many of our members are qualified to do this, even from distant locations, as has been demonstrated by many that have been able to identify rather cryptic photos in these pages over the years. But to make this little project easier for some others that have not tried to do this, let's see what you can do with this effort over the next few issues. I would like to award the best virtual identifier with the Mystery Plant Award a copy of the beautifully illustrated and detailed guide, Timothy Spira's Wildflowers & Plant Communities. The identifications should get somewhat easier as the list of species narrows for the project. So, get your submissions in soon as you get your newsletter!

For this project, I had a large forked, white pine's top split and broken out in two storms. I had planted this pine in an old pasture ridge about 20 feet above our creek when I first moved to Cane Creek valley in the early 1970's. Last summer I had the final standing log cut and removed along with the second branch of that I'm sawing up for firewood (actually I'm mixing it with hardwood for better burning in our stove). I live in an area of rich cove hardwoods so this will be the primary seed source for this site. To help you out, here are the species I have living nearby: Canopy trees include *Acer rubrum, Aesculus flava, Betula lenta, Carya alba, Fagus grandifolia, Fraxinus americana, Liriodendron tulipifera, Prunus serotina, Quercus alba, Q. falcata, Tilia americana var. heterophylla*. Understory trees include *Carpinus caroliniana, Cornus alternifolia, C. florida.* Shrubs and vines include *Calycanthus floridus, Celastrus orbiculatus* (invasive), *Corylus cornuta, Parthenocissus quinquefolia, Toxicodendron radicans,* and *Vitis aestivalis*.

Both these seedlings were found growing in the site. See if you can identify No. 1 and No. 2.

Continued from Page 14

and the bluish purple ironweed (*Vernonia noveboracensis*). And my favorite blue summer flower is eastern blue monkshood (*Aconitum uncinatum*). Not to leave out the green-flowered grasses, I think bottlebrush grass (*Elymus hystrix*).

All these are scattered far and wide and one is unlikely to be seeing all them in one summer. So, perhaps it is not that we lack a good diversity of summer flowers but is, unlike Paradise of Mt. Rainer, that we cannot practically offer a trip for an afternoon or even two days that would experience enough to make the summer wildflower hikes attractive as is the Wildflower Pilgrimage each April in the Great Smoky Mountains.

Liatris squarrosa is odd by blooming top down.

Aconitum uncinatum has modified petals and sepals to form the "hood" shape.

Elymus hystrix is rather impressive but not colorful.

HAWK KNOB (1982)

Welch Ridge near High Rocks …
lines of gravitational force in the
landscape sustain diverse tensions.

Above the trail a seepage slope covered
with a cairn-like rubble of moss and lichen-
coated boulders was overhung by a stand
of yellow birch root-wrapped around the rock
bed sealing it in place. A thick-sleeved section
of cast-iron pipe driven into the bed long ago
concentrated and then discharged water in a
thin ribbon that arced into a shallow basin
and trickled across the trail into a glade.

Unseen and yet nearby a bird sounded
a series of random phrases as E knelt
to fill the water bottles. In the moment
of silence that always follows bird song
I watched her…long dark hair fallen
aslant face over firm shoulders. There
has always been a certain intentness
in the way she transacts everyday
essential tasks like gathering water …

suddenly light pierced the mist
magnetizing the moist leaf canopy
filling the glade below the gnarled grove
with blue shadows and broad islands of light
within which stands of scarlet bee balm flared
…
and down in the tangle at the lower edge of the
spring-fed now radiant glade almost beyond
the ongoing play of forces there was the
pale glow of one pendant lily.

As if awaiting his cue to do so the bird…still
hidden and secret …sounded again a series
of phrases abrupt and meaningless yet somehow
profound…an incantation that sealed
those moments away until notes from
another time bring them back:

Ribbon of water
Dark hair aslant face
One pendant lily

Have you ever observed this in tree growth? (see page 11)

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