DURHAM MASTER GARDENER NEWSLETTER
August 2009

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In This Issue:

This month we look at mealybugs. We move from roots to leaves. We include a recipe for pickles and solve the mystery of the black snake. We discuss botanical drawings.

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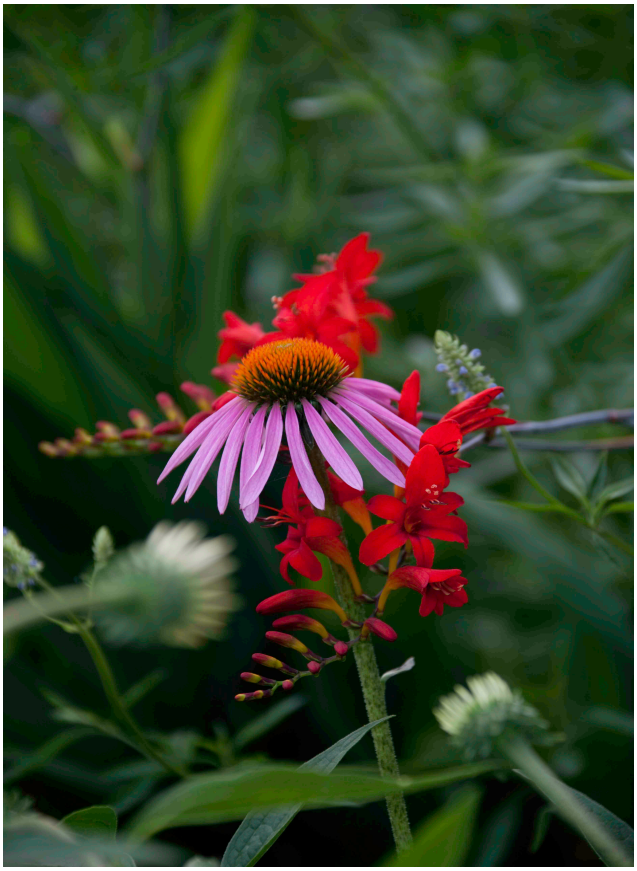
Picture courtesy of Rick Fisher



Soil Tests

The NCDA&CS Agronomic Division reports are now posted electronically on the Division's website: www.ncagr.gov/agronomi/. Please make sure that those clients who have computer access check the box on their information forms indicating that they do not need a paper report mailed to them. In this manner, clients will receive their reports more quickly, can save and store them electronically, and can download the analytical data into spreadsheets.

Recently I went to this website and found it somewhat confusing so the public might need help. Have them click on "Find Your Report." The confusion comes from logging in as the public is classified as "Grower." After they go to "Grower Login," they should not have any problem as their name will appear and they can click on their name to get their report.

NCSU also has an excellent explanation of the soil test results at: http://www.ncagr.gov/agronomi/uyrst.htm.

Mealybugs

Recently I have begun to wonder if mealybugs were taking over the world—or just my garden. Certainly, it was rapidly becoming apparent that my perennials were nurturing many healthy generations of mealybugs. Never have I seen so many of these tiresome creatures. Did you know there are 225 species of mealybug? Fortunately only 75 species reside in the United States but mealybugs, it seems, thrive around the world. There are Pink Hibiscus Mealybugs, Taxus Mealybugs, Apple mealybugs, Bamboo Mealybugs, Grey and Pink Sugarcane Mealybugs, Citrus Mealybugs, Mexican Mealybugs—well you get the picture. I seem to have acquired the Amsonia-Chelone-Spirea Mealybug.

Members of the scale family of insects, mealybugs are oval soft insect covered with "fluffy wax." Essentially they are scale insects minus the scales. The females lack wings whereas the male mealybugs, who are the size of a gnat, sport a pair of wings and a tail composed of the white wax. Active in hot, dry weather, mealybugs do their damage by sucking the sap out of the ornamental plant. The male exists only to fertilize the eggs and then goes off to die while the wingless female will either crawl or hop a ride from the wind to a plant where she will lay between 200-600 eggs, swathed in a white, cottony mass of wax called an ovisac.[1] These ovisacs frequently are found in the axils of the plant stems. The female will then die. Emerging from the ovisac between 6-14 days, the nymphs—or "crawlers" as they are called—attain adult status in a couple of weeks and the males will fly off to find females—and the cycle begins all over again. Because the males have no functional mouthparts, their life span consists of one or two days. The crawlers need to find food quickly as they can survive only for about 24 hours without eating. It is during this crawling stage that the mealybugs are quite vulnerable.

Like aphids, mealybugs excrete honeydew, which inhibits the ability of the plant to photosynthesize as this sticky substance promotes the growth of sooty mold fungus. Mealybugs have legs but are not huge travelers; rather, once they have found a suitable feeding site they tend to remain stationary.

The most common mealybug found indoors on houseplants is the Citrus Mealybug, which can go through eight generations while overwintering indoors, thereby making it quite difficult to control. This is one reason why it is imperative to closely examine all houseplants that spend the summer outside. Not all mealybugs live above ground: the Root Mealybug, a real pest in Hawaii but also a problem on the mainland, lives on the roots. In potted plants these mealybugs are usually found between the root ball and the pot.

To keep your garden and house free of mealybugs, inspect every plant that you buy. Be sure to inspect the underside of leaves, especially those of houseplants. Water spraying can dislodge slight infestations. A cotton swab dipped in rubbing alcohol can also be effective for low infestations. Insecticidal soap is also helpful in fighting mealybugs, especially at the crawler stage—but vigilance is necessary. The waxy covering protects the adults somewhat from chemical controls while the ovisac protects the eggs. This is the reason that observation is one of the gardener's best weapons as the time to catch them is when

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[1] www.ces.ncsu.edu/depts/ent/notes/O&T/flowers/note19/note19.html, p. 1.

they are crawlers. To fight root mealybugs, dissolve two teaspoons of dish detergent (not dish soap) in a gallon of water; submerge the roots in the mixture for fifteen minutes before rinsing in clear water.

Houseplants that are particularly susceptible to mealybug infestation include citrus plants, coleus, dracaena, ficus, schefflera, hibiscus, jade plant, palms, gardenia and orchids. Because mealybugs are so difficult to contain in the house or in the greenhouse, it is better to destroy heavily infected plants, removing the soil and compost from the growing area. For a list of recommended chemicals that are effective against mealybug, go to www.ces.ncsu.edu/depts/ent/notes/O&T/flowers/note19/note19.html.

Next month: Aphids

Leaves

The purpose of leaves is to photosynthesize: "Leaves are truly at the heart of it all."[2] The blade, covering the veins, is the surface of the plant; the veins support the blade while carrying water, hormones, and nutrients up and down the plant. It is water pressure that keeps the veins taut; when the roots cannot supply enough water the leaf will wilt until water can reach it. Large leafed plants typically prefer moist conditions as it takes a lot more water pressure to keep a large leaf turgid than it does a small leaf. The most primitive leaves have a vein pattern consisting of a central vein with secondary veins stemming off of it; this pattern, found in ferns, is not terribly efficient as the secondary veins simply come to dead ends at the edge of the blade. Many modern perennials have adopted a tertiary system of interconnected veins originating from the secondary vein—*Heuchera* is a good example of this vein pattern—which is superior to the dendritic primitive pattern in that there are far fewer dead ends. The veins, which Cullina likens to tent poles, aid in giving the leaf mechanical support so the modern vein pattern with its tertiary vein pattern is an advance over the dendritic primitive pattern. Long leaves have parallel veins running the length of the leaf with small veins running crosswise—Cullina believes this arrangement is probably the most efficient of all the vein patterns. Evergreens "infuse both veins and the tissues in between with lignin (the stuff that makes wood woody)" [51]. Not only does this prevent the leaf from tearing but it is the reason evergreen needles do not wilt. This hardening of the leaves also makes them more resistant to fungal and bacterial infections.

Why are there so many different leaf shapes? The common oval shape can withstand wind at the same time it sheds water—thereby avoiding fungal and bacterial contamination—while the fan shape of the maple leaf also sloughs off water efficiently. The solid oval shape, however, blocks the sun on lower leaves whereas lobed leaves permit the sun to filter through to lower leaves. Cullina states that "leaf shape is also heavily influenced by climate" as shade trees have thinner leaves than do those in the sun, while alpine plants tend towards small, round, hairy leaves and desert plants favor small, grey or silver leaves [54].

Most leaves are attached to a petiole,[3] which gives the leaf greater flexibility in movement as the leaf can bend or stretch itself to find a more advantageous position. Leaves—with or without a petiole—arrange

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[2] Cullina, William. *Understanding Perennials: A New Look at an Old Favorite* (Houghton Mifflin Harcourt, New York), p. 48. Future references will be in brackets [ ].

[3] The petiole is the stalk that joins the leaf to the stem.

themselves on a stem in different patterns: singly, in pairs, or in whorls. Basil comes with pairs of opposite leaves, one set pointing east-west, the next pointing north-south. Roses possess leaves in an alternating pattern while lilies give us whorls of leaves. Opposite leaf and whorl patters lend a regularity to the plant's appearance while alternate leaf patterns give a "fuller, more diffuse" façade [56].

Life depends upon photosynthesis. Photosynthesis is essentially "water and carbon dioxide plus sunlight in, sugar plus oxygen out" [56]. The remarkable thing about plants is that they are able to store the energy they create. Chloroplasts[4] "trade their electrons for protons in sunlight to begin the synthesis, obtaining replacement electrons by stripping the hydrogen from water molecules and leaving oxygen gas behind" [57].

The leaf blade consists of three layers: the epidermis, the middle layer—the mesophyll where the chloroplasts dwell, and the epidermis. The mesophyll, the sandwich filling, is thin in shade plants and thicker in plants growing in the sun. One thing to remember about leaves is that once a leaf becomes a shade leaf, it will always be a shade leaf. These are the leaves that become sunburned and die when the gardener moves a plant from the shade to the sun. The thicker leaves of a sun plant likewise will fare poorly should that plant be moved to the shade. This doesn't prevent the plant from adapting to its new conditions as it will grow thinner leaves if moved to a shady location or thicker leaves if located in a sunny setting. This is one of the reasons plants go through transplant shock when leaving the nursery for the great outdoors.

The epidermis protects the mesophyll from the environment. The cuticle seals in—or out—water. Cuticles may be dull, glossy, clear, or opaque: hellebores have a glossy cuticle whereas agaves have a glaucous one. Those plants growing underwater lack the cuticle and upon hitting the surface will shrivel up. Tissue-culture plantlets also need time to grow a cuticle after they have been taken out of their sterile environment. The epidermis seals the leaf's surface so how does the plant breathe? Stomata open, allowing the water and oxygen to escape. By letting the water escape through transpiration, water is pulled up from the roots. Scientists estimate that as much as 97% of the water taken in by the roots is lost through transpiration [58] but the stomata close down at night and when the plant is experiencing wilting. During drought the stomata also close down, thereby slowing—or preventing—photosynthesis. At this point the drought-stressed plant is susceptible to the ravages of disease, insects, and cold.

Hairs on leaves shield the leaf from the sun while reducing water loss. Silver hairs such as the ones found on lamb's ears deflect the sun's rays, thereby lowering the temperature on the leaf's surface by as much as 30°. Fuzzy leaves are also unpleasant to the taste for many herbivores: "not surprisingly, all leafy greens we consume are hairless" [60]. The hairs also may contain chemicals that deter insects, herbivores, and rodents from eating these leaves.

Waxy leaves such as those found on camellias shed moisture quickly, thereby deterring fungal invasion as fungal spores need water in order to germinate. The waxy leaves also discourage water loss, which is one of the reasons many plants originally from dry regions sport waxy leaves.

The biggest consumers of leaves are insects but plants have developed three main chemicals in their fight against insects: terpenes, phenols, and alkaloids. **Terpenes** include pyrethrum, a compound found in

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[4] Chloroplasts, derived from bacterial ancestors, are the green organelles in the leaf where photosynthesis takes place.

Chrysanthemums, which is one of the most widely used insecticides on the market. Many terpenes, such as menthol, expel an aroma, warning the insect or herbivore. When a leaf containing a terpene is damaged, the terpene is released, thereby warning other plants of danger. Surrounding plants might increase their tannins or other chemicals to repel an attack [64]. These chemicals might also attract beneficial insects to chase away the offending insects. **Phenols** such as lignin in the leaves are hard to digest. Young leaves will have little lignin whereas older, tougher leaves have developed a lot of it. Tannins are phenols that impart a bitter taste to the leaves; alas, deer saliva contains an enzyme that "deactivates the tannin" in the leaf before the leaf reaches the stomach "so they can eat with impunity plants that would kill other mammals" [65]. Urushiol, the lethal chemical in poison ivy, is a phenol belonging to a group known as quinones, whose antimicrobial properties cause dermatitis in many people. Phenols can also deter the growth of neighboring plants, "inhibiting cell division, pollen and seed germination, nutrient uptake, photosynthesis, and specific enzyme functions" through a process known as allelopathy [65]. **Alkaloids** are the foundation for most of the plant-based drugs that are on the market today. Nicotine, caffeine, morphine, and quinine are all alkaloids. These alkaloids typically are stored in vacuoles, the empty cell spaces that are exposed only when the tissue is disturbed. The white latex found in *Amsonia*, *Euphorbia*, and poppies is a defensive chemical that seals off the wounded area, exuding terpenes to repel microbes. The hairs on stinging needle contain formic acid that will sting passers by.

The leaf is filled with pigments that the chlorophyll obscures with its green color. But our gardens are filled with many greens, all made possible by the presence of these pigments. These pigments also give young leaves frequently a different color before the chloroplasts have had a chance to form in the leaves. There are three different kinds of pigments: flavenoids, carotenoids, and anthocyanins. Flavenoids are deterrents that are yellow, blue, or purple, commonly found in flowers and fruits but are also present in leaves. Carotenoids are terpenes that aid in photosynthesis and give leaves a yellowish hue. When leaves are any color but green, it is the surplus of pigments in the leaves that are responsible for overwhelming the chloroplasts in the leaves. Younger leaves typically are intensely colored but will fade to green as they mature: examples are many species of Japanese maples and *Eucomis* 'Sparkling Burgundy'.

Variegation in leaves occurs when a mutation occurs and some cells will produce chlorophyll while others will not. In other words, a variegated plant has two very different types of cells. Hostas show a tremendous amount of variegation.

While chlorophyll is the dominant pigment in most leaves, the chlorophyll molecules do not last very long in the leaf, so constant replacement is necessary. As daylight shortens, the chlorophyll production declines, unmasking the underlying pigments. Most leaves turn yellow as they contain the carotenoids that are also necessary for photosynthesis—this is the reason *Amsonia* turns yellow in the fall. The tissue rings works to cut off the phloem[5] but the xylem will continue to conduct water to the leaf, thereby allow photosynthesis to continue while there is still chlorophyll. Some species take this sugar to convert it into anthocyanins, which in turn cause the leaf to turn red or red orange when they come into contact with acidic sap.

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[5] "The vascular tissue in plants that conducts sugars and other metabolic products downward from the leaves," according the *New Oxford American Dictionary*. The xylem is "the vascular tissue in plants that conducts sugars and other metabolic products downward from the leaves."

Brilliant fall foliage hinges on several factors: (1) drought may bring it on; (2) trees in the sun have a more vivid color than shade trees; (3) cool nights spur on photosynthesis, which slows the process, resulting in a later vibrant color.

Next month: Stems

Sun Dill Pickles

Good use of surplus cukes and dill, plus kids love to help with this one.

5 1/2 c. water
3 1/2 c. white vinegar
1/8 tsp. alum
2 dill stalks & heads
1 head garlic
2/3 c. pickling salt (coarse)

Mix all together and pour over chunk sliced or quartered cucumbers in a gallon jug. Set in sun 2 days then you can put into quart jar and store in refrigerator.

Up Close and Personal

In addition to "real" plants, many of us are obsessed with two-dimensional representations of our beloved botanicals. Photographs of plants are always welcomed and many thanks to Rick Fisher and Jim Wallace for providing beautiful specimens in the newsletter. Now, think about another way of capturing the beauty of plants: what if you were using a pencil, pen or brush instead of a camera? Imagine producing a "picture" of plants with a medium of your choice. Well, many of the same photographic principles apply. The artist must create an effective composition, portraying the botanical characteristics accurately and in a manner that is interesting to the observer. The artist must use conventions and techniques (like tonal intensity and color gradation) to create perspective and three-dimensionality. Like with photography, a trained eye becomes imperative.

If you are interested in drawing or painting pictures of plants, there are some great resources in our area including classes at the Art Center in Carrboro, the Sarah P. Duke Gardens and the North Carolina Botanical Garden (NCBG) in Chapel Hill. I have had first-hand experience with the class offerings at the NCBG where fellow Master Gardener Mary Tyrey and I have been students in the Botanical Illustration program. The NCBG instituted the Botanical Illustration Certificate Program in 2001 and made program refinements in 2006. Enrollees are required to take courses in both science and art in a core curriculum comprised of basic botany, plant taxonomy, local flora, drawing, composition, color theory, pen & ink, watercolor and colored pencil. Elective coursework that allows for further exploration of various media and techniques is also required. Note that you can take classes without being enrolled in the program, but you should be mindful of specific course prerequisites.

Botanical illustration has had a lengthy and fascinating history. Today's illustrations, like those from the past, essentially combine botany and art with the goal of integrating "*the utilitarian scientific function of the*

image (identification, education, information) with aesthetic and visual considerations."[6] Plant representations should be accurate in form, proportion, color and size and usually appear on a white background. Although a variety of media can be used, combining media is both acceptable and can produce interesting representations. Depending on the specific purpose or accompanying descriptive text, illustrations may range from a rendering of a single leaf to a complex composition depicting stages in a plant's life history or other details.[7] The defining element is that the illustration serves as an instructional tool.

I am pleased to report that both Mary and I have finished the requirements for the NCBG Botanical Illustration Certificate Program. With eleven other graduates, we will be participating in the student art exhibit, "Up Close and Botanical," at the NCBG, which will be the first exhibit in the Arthur S. DeBerry Family Gallery for Botanical Art and Illustration in the newly constructed NCBG Education Center. Please visit the exhibit during September or October. In addition to viewing the amazing student artwork, you will be able to see the new facilities at the NCBG. If you are unfamiliar with the NCBG, it is located in Chapel Hill right off of 15-501 between Mason Farm Road and Laurel Hill Road.

Involvement in this program has been challenging and rewarding. Without a doubt, it has fundamentally changed the way that I look at plants—or should I say the way I get "up close and botanical."

Elaphe obsoleta

Since I think I heard a question about black snakes going after bluebird eggs and young at yesterday's meeting, I decided to check them out.

Elaphe obsoleta, a.k.a. "black snake," "black rat snake," is the North Carolina version of a common snake found across the entire state. They are good climbers, and often spend lots of time in trees. Black snakes are non-venomous, though may bite if threatened. However, they are very shy, and usually try to avoid contact with humans, domestic pets and large birds. The young are mottled dark gray and white while adults are all black except for a white chin. The head is wedge-shaped, not triangular. Adults may grow as long at 5-6', but are usually no more that about 1 ¾" in diameter. When on the ground they are usually seen in wooded areas or dense low-growth vegetation. (A similar snake, the "black racer" is not a climber).

Adult black snakes feed on small mammals, usually (rats, mice, chipmunks, etc.), but are also known to climb into bird nests/houses in search of either eggs or hatchlings. Most back yard birders come across them when they notice the snake climbing a pole that a bird house sits on, or when they open the house to check on eggs or babies (not the way you want to start your day). The best preventive measure to keep them away from birds is to place a stovepipe-type baffle on the pole below the house, with the baffle top about 5' above ground level. Adult birds will mount a vigorous defense if the snake threatens the nesting site, but can't always drive it away. Bolder folks grab the snake directly behind the head and deposit back into the woods; for the more cautious among us, a hoe handle, long stick, or other such implement will work. However you handle it, don't kill the snake. Once knocked down, or caught, it will

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[6] Certificate in Botanical Illustration Handbook, North Carolina Botanical Garden (University of North Carolina, Chapel Hill, 2007), p. 7.
[7] *Ibid*., p. 7.

usually take off to a safer place if possible. Black snakes are useful predators, helping to keep rat and mouse populations under control, especially around farm buildings. It's a popular misconception that the only good snake is a dead snake, but it ain't so. Let 'em live.

Nan Len also sent in a couple of interesting websites for the rat snake:
http://www.ces.ncsu.edu/gaston/Pests/reptiles/pages/rat.htm and
http://www.bio.davidson.edu/projects/herpcons/herps_of_NC/snakes/SnakeID/All.asp

Editor: It is a myth that the black rat snake can breed with the copperhead. Likewise, it is fiction that this snake is impervious to the venom of the copperhead bite. I had always heard that this snake kept down the copperhead population as it was a natural predator of the copperhead. I could find no verification of this in any description of *Elaphe obsoleta.* Many thanks to Charles Murphy and Nan Len for their excellent sleuthing.

Gardening on a Budget

In these tough economic times, it is often the wisdom and companionship of our families that inspire us to get creative with our resources. I am reminded of how my mom built our gardens as a child with little more than a shovel, some pots, and a lot of courage.

No matter how much money we had, our gardens were gorgeous, overflowing with the midwestern staples of hosta, phlox, peony and lily-of-the-valley. My mother's courage and creativity inspired her to acquire plants from vacant lots, friendly neighbors, and stores who needed room for new stock. So, in the spirit of thrift and courage given to me by my mother, here are our tips for bold gardening on a budget:

- Always care a shovel, a few pots, and a drop cloth or blanket in the trunk. You never know when you'll happen upon plants in need of new homes.
- If you can, always ask before you dig in a vacant lot. Sometimes the contractors on a site would love to have plant materials adopted.
- In the fall, gather seedpods on urban and rural nature walks. I think this is how we acquired every poppy we ever grew.
- Trade plants with your neighbors, or start a neighborhood gardening club solely for that purpose.
- Ask 'big box' stores if you can rescue their sad-looking plants destined for the garbage. I've personally acquired all my mums this way.
- Help out someone whose garden you admire. Offer your division services in exchange for a few of the divisions. This is a great way to get hosta!
- Teach a friend how to propagate a favorite plant they have in their garden. Voila! Free seedlings!

Remember, there is no harm in asking, and you may be surprised by the result. My mom has asked her way into hundreds of beautiful plants over the years, and her moxie is an inspiration to both my budget garden and me. Our wish is that as you meet new plants, you make new friends, see new gardens, and grow in your confidence that we are all gardening on the earth together!