Highstead Log

Spring
News 2002

Highstead *Arboretum*

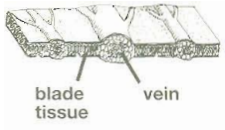
A New Leaf: miracles

As we bundle up in woolen sweaters and down-filled coats to protect ourselves from the drying winds and numbing temperatures of winter, we are oblivious to the leaves that must spend winter without the comfort of central heat, or even a fleece pullover.

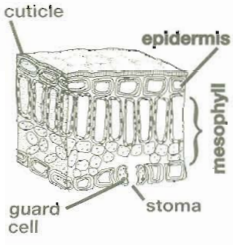
The leaves (and flowers) we are about to enjoy visually as spring approaches, can already be found on the branches and twigs of woody plants. Contained in the buds set during last year's growing season, they have planned ahead and donned modified parts as protective armor. Huddled together, and often shielded by scales, they are already miniature versions of Spring's glory.

As longer days and rising temperatures begin to stir these leaves to awaken and unfold, let us awaken our minds with the knowledge of what this plant part is responsible for.

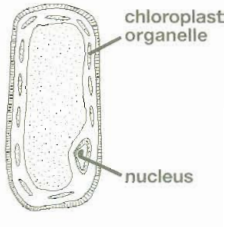
a leaf with a transecting line drawn to orient below diagram



section of leaf showing leaf veins, which include xylem and phloem



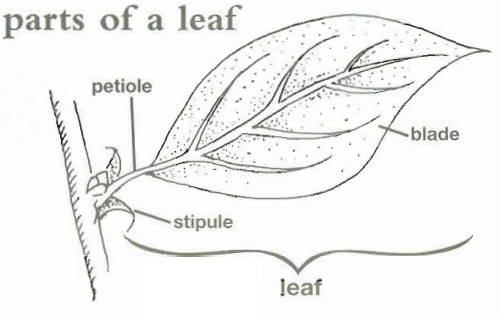
section of leaf blade showing cuticle, epidermis, mesophyll, stoma and a pair of guard cells



upper mesophyll cell with chloroplasts

bathing beauties

A **leaf** is actually an organ of a plant, responsible for food production and respiration. It is considered complete if it contains blade, petiole, and stipule. The **blade** is the expanded portion of this structure, flat and thin, devoting the maximum surface area possible to sun exposure for photosynthesis. The **petiole** is simply the stalk of the leaf, connecting blade to plant stem. **Stipules** are small appendages found where the petiole meets the stem, sometimes part of the leaf surface, but most often of little or no function.



Just as plants appear to mimic humans with layers of clothing in winter, so do they mimic humans in summer. Like sunbathers on a crowded beach, spreading blankets with little or no overlap in search of maximum sunlight, so the blade and petiole work to position themselves for maximum exposure. The leaves are positioned to effectively collect energy from the sun. This is easily seen on a plant such as ivy, whose petioles stretch and bend to position the leaves into a flattened pattern, creating what is known as a **leaf mosaic.**

all work and no play

While humans bask and bake in the sun, leaves are hard at work manufacturing food and disposing of waste. Each leaf is a factory unto itself, composed of sub-units working in conjunction with one another. The basic process of **photosynthesis** combines sunlight, water, and carbon dioxide. Sunlight is the energy source, or fuel, that powers the factory. It is collected by **chloroplasts** which are green colored **organelles,** found within the food making cells of a leaf. These cells are collectively referred to as the **mesophyll.** Much like siding and paint on a building, this factory has a skin layer (**epidermal cells**) which is further protected by a waxy layer called the **cuticle.**

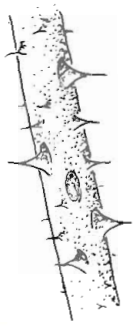
The energy collected is used to combine the water with the carbon dioxide to create sugar (glucose), producing the waste product of, believe it or not, oxygen. The water is collected mainly through the roots, and transported through the xylem. The carbon dioxide is collected through pores on the leaf called **stomata** (stoma, singular), while the waste product, oxygen, is released through this same passageway. The stomata are efficiently regulated by a pair of **guard cells** in order to open and close on cue, to ensure the timely exchange of carbon dioxide and oxygen. The guard cells actually change shape in response to the amount of moisture available to the plant. This shape change increases or decreases the size of the stomatal opening. Stomata can occur on both upper and lower leaf surfaces, varying their position as plants have adapted to their environment. Such is the genius of nature, that waterlily leaves, which float upon the water, have stomata located on their upper surface.

Once food is created, it travels through the phloem. Some is used immediately to feed the plant, while the balance is stored. Even in this much simplified version of the process of photosynthesis, it still becomes apparent the efforts required on the part of a leaf individually, and a plant in its entirety.

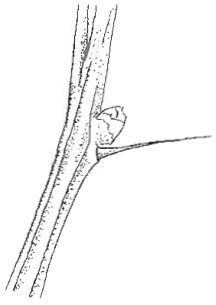
The structural arrangement of cells within each leaf is a model of efficiency. Note in the illustration how the **mesophyll** cells on the upper surface of greater light reception are tightly packed, allowing for maximum cell/chloroplast exposure. The underlying cells are found in a loosened arrangement where light is reduced, allowing for the passage of gases.

It would be expected that all leaves on a tree be identical, but leaf size on a tree is affected by the amount of sunlight able to reach the leaf surface. Small, thickened, upper leaves give way to thinner, enlarged, lower leaves. These lower leaves broaden their surface area in reduced light to achieve the same efficiency of the upper leaves. Just one of the many ways plants and their parts adapt on an individual level to serve the needs of the entire plant.

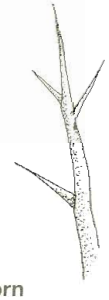
a new leaf continued



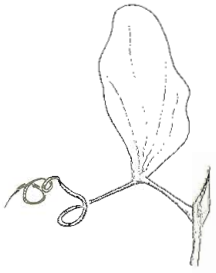
prickles,
modified epidermis



spine,
modified leaf – spines identified by adjacent bud



thorn
modified branch – notice the similarity to bark covered twigs

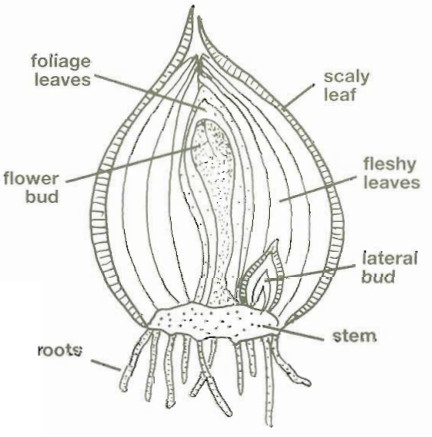


tendril
a modified leaf

all about leave(s)

If it is not enough that leaves can alter their cellular arrangement to contend with varying amounts of light, or their position for better exposure, it is extraordinary that, over time, leaves have modified not just their form, but their function as well. These changes have occurred to serve specialized purposes. It is not too difficult to see that the scales that cover the buds in winter are modified leaves, altered to protect immature leaves, allowing them to weather cold and wind as well as physical damage. But would you be surprised to learn that tendrils and spines are **modified leaves** as well? A **tendril,** found on many vining plants, can represent an individual modified leaf, or, like on the pea plant, a portion of a compound leaf. Tendrils adapted their form and function over time to provide additional support for the plant, allowing a ground hugging, or weak-stemmed plant the ability to keep its head above the frey of other plants in search of sunlight.

Spines, like those found on many cacti, are also modified leaves. These modified leaves are hard and dry, adapted to protect the plant from foragers. A cactus plant, changing to suit its environment, reorganized and shifted most of its photosynthetic cells into the stem, which had adapted to accumulate moisture for the dry times experienced in the desert. As any plant laden with moisture in this environment was bound to be sought out as fodder for thirsty animals, a form of protection was needed. Which came first, the spines or the storage? We shall leave that question to the chicken and egg philosophers.



cross-section of a bulb

Another set of modified leaves that is often overlooked is what we refer to as a bulb. The layers of an onion bulb, most often used as a food product, are composed of modified leaves. We would not venture to include onions as a leaf crop, yet we would not be that far afield in suggesting this. Those fleshy scale leaves are modified for food storage, living subterraneously for additional protection. Such a sacrifice of leaf for plant can almost bring a tear to your eye! Bulbs of all sorts fall into this category; tulips, daffodils, hyacinth are all examples of the same.

Remember to look again at the plants that have become so commonplace in our lives, and take a moment to study exactly what we are looking at. Each change has been made for a reason. A constant self-help metamorphosis.

stalking the garden

Modification occurs not only in the overall leaf or blade of the leaf, but can occur in the petiole alone. The stalk portion of celery we spend time dicing and slicing is actually the petiole of the celery leaf. This swollen leaf stem is a storage facility for water and nutrients, which the plant in turn provides to humans and animals who cannot independently produce the same. Humans and other animals place such a great reliance on the plant kingdom. We are, in fact, the great users of the natural world. And, as amazing as the human body is, it is with even greater amazement we can contemplate the depth of riches found in a single green leaf.

what's your point

Spines (modified leaves), prickles, and thorns, are words which are often misused. On the surface, we are aware of the discomfort they can inflict, which is, quite simply, their purpose. But each is a different botanic term, indicating the plant part from which they were modified.

Most often used in place of the other two, the word **thorn** should be used only with plants whose defensive parts are actually modified branches. This would include plants such as hawthorn, Russian olive, and honeylocust.

If the plant in question has sharp projectiles arising from just below an axillary bud, no matter what shape it takes, it is a leaf (or modified *leaf*). This is the case with spines, as we mentioned earlier. Spines are modified leaves found on plants such as cactus, barberry, and black locust.

When we are speaking of the projections on a rose stem, **prickle** is the term we should be using. Not a modified branch, nor a leaf, this is an outgrowth of the plant's stem tissues. Along with roses, prickles are found on raspberries and greenbriers.

So, if a mischievous botanist steps forward and offers you a thornless rose, do not be too quick to grasp this gift before looking for prickles along the stem.

The leaf characteristic insert enclosed in this issue of the 'Highstead Log' was created as a terminology aid to be used in conjunction with your favorite tree identification book or field guide.

Highstead *Arboretum*

leaf glossary

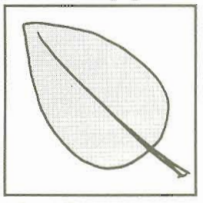
type vein shape

As a starting point, leaves can be classified as simple or compound. Simple leaves are made up of a single blade. Compound leaves are composed of multiple leaflets.

Another basic way to distinguish leaves is by their venation. If the veins all begin at the point where the petiole meets the blade, it is palmate. If the veins branch off from either side of the central midrib, it is pinnate.

Since leaves come in all shapes and sizes, there are a number of words we can use to describe the overall shape of the blade. Study the shapes to the right, noticing in some cases how subtle the difference can be from one blade to the next.

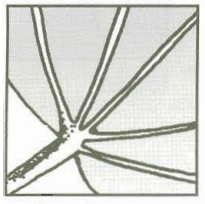
leaf types



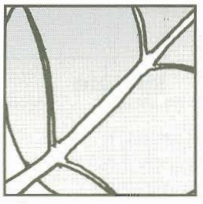
simple

compound

leaf venation

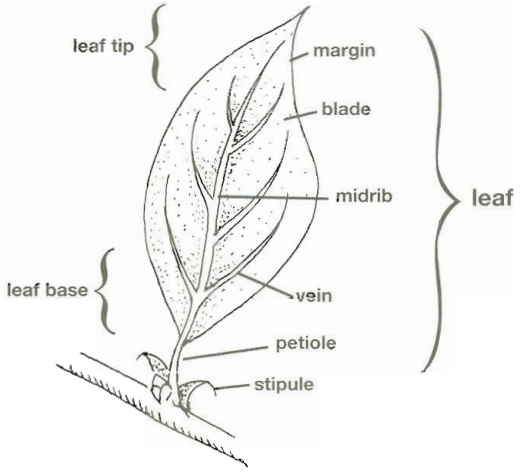


palmate

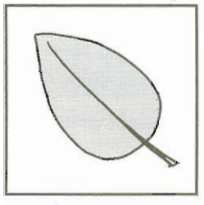


pinnate

parts of a leaf

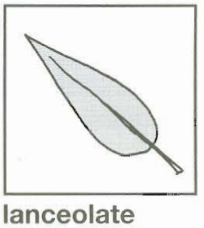


leaf shapes



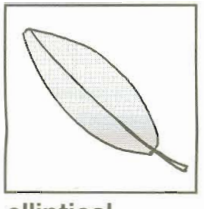
ovate

obovate



lanceolate

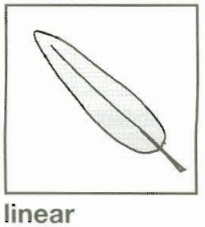
oblanceolate



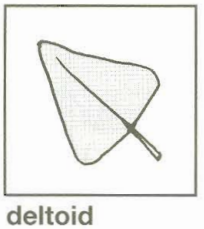
elliptical

oblong

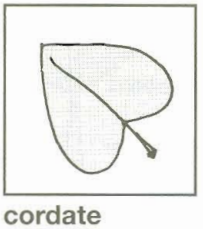
spatulate



linear

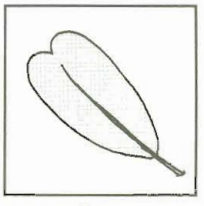


deltoid

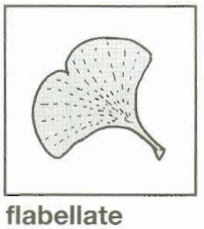


cordate

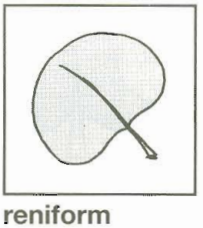
obcordate



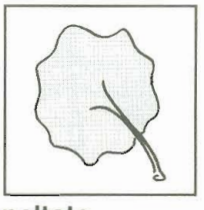
cuneate



flabellate



reniform



peltate

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margins tips bases

The margin, or edge of a leaf, can vary from smooth to sharply jagged. Look at the obvious, but also the subtle. A jagged edge is considered toothed, but if the teeth point forward, or in the direction of the blade tip, it is serrate. If the teeth point outward, or perpendicular to the margin, it is dentate.

The tip is roughly the upper third of the leaf. Similar to the direction of the teeth, subtelties can distinguish leaves with pointed tips. How quickly and sharply does the leaf tip come to a point? This is what you will need to notice to describe the difference between acute, acuminate, cuspidate, and mucronate.

The leaf base, or lowest third of the blade, closest to the petiole, is no different. Shape, taper and/or abruptness of angle, will dictate the most descriptive term you can apply.

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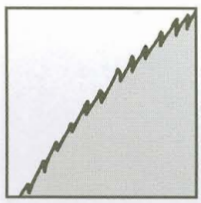
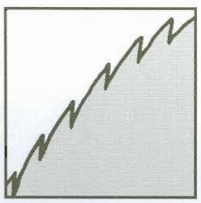
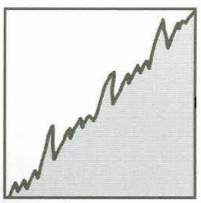
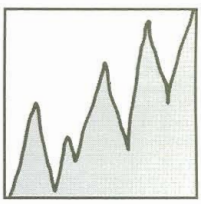
leaf margins


serrulate


serrate


doubly-serrate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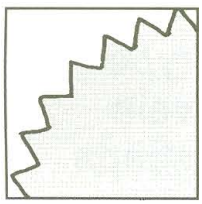
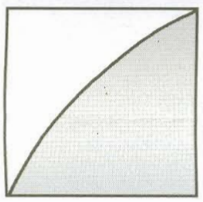
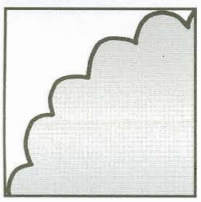
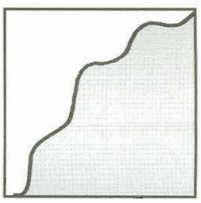
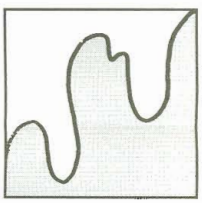

dentate

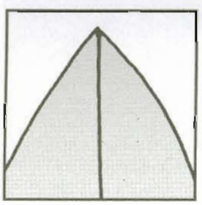

entire

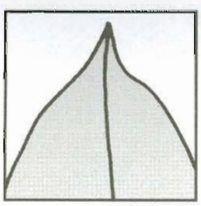

crenate

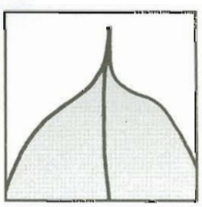

sinuate

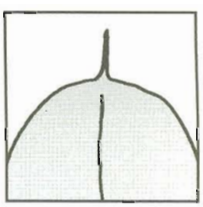

lobed

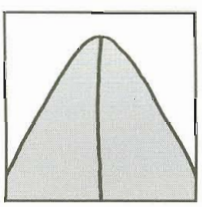
leaf tips

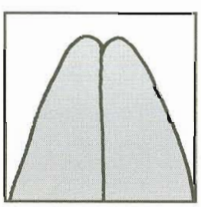

acute


acuminate


cuspidate


mucronate


obtuse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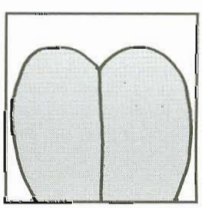
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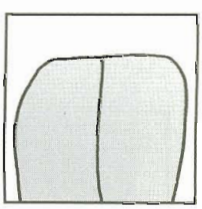
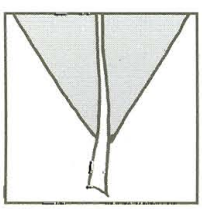

truncate

leaf bases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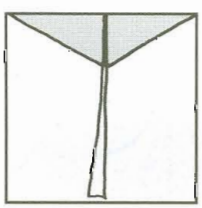
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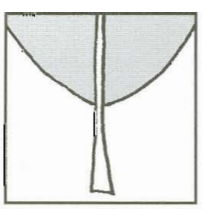
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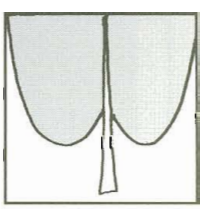
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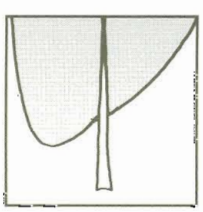
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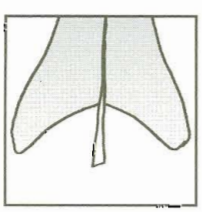
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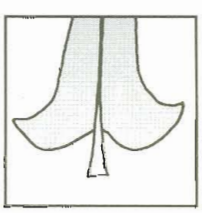
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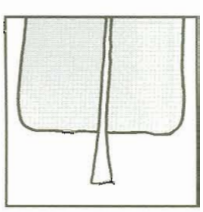
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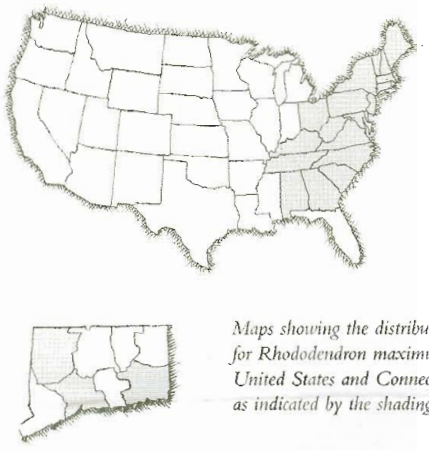
Plant Profiles

Rosebay Rhododendron, *Rhododendron maximum* L.



Maps showing the distribution range for Rhododendron maximum in the United States and Connecticut as indicated by the shading.

If you are lucky enough to find this shrub in the wild, you would mostly likely start looking for an old house foundation, or assume it had escaped cultivation. But, rosebay is actually one of six evergreen *Rhododendron* species native to North America.

In today's gardens, you will not find this native shrub very often, as it has been replaced by the many hybrids developed during the last century. At one time, it was more widely accepted and used in the home landscape.

The leaves are quite large (four to eight inches long), leathery, and tapered at the base. The underside of the leaf appears whitish and smooth, but upon closer inspection will reveal the presence of tiny hairs.

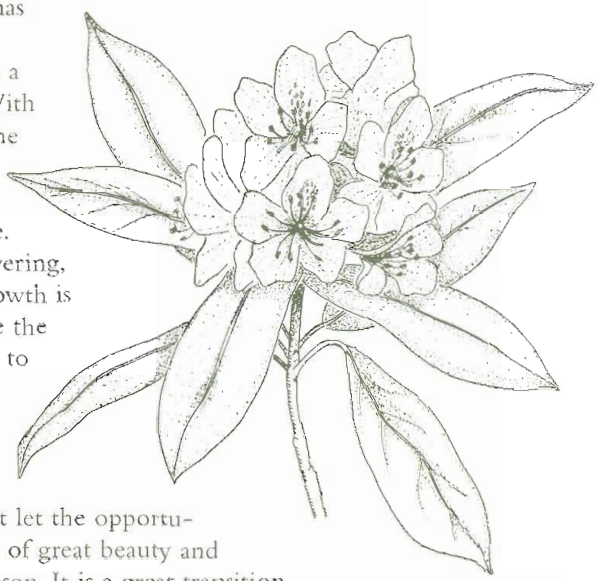
As with most rhododendrons, the flowers are the object of attraction. The flowers of rosebay are borne in a truss of 12-30 flowers. Each flower is one to two inches across, usually pink to purple or white, with a throat speckled with olive-green to yellow or orange. Not opening until June and July, this late flowering habit is another distinct attraction.

The greatest asset of this rhododendron is its cold hardiness (zone 3). This has led to rosebay's use as a breeding stock, as well as a root stock for grafting. With all rosebay has to offer, the curiosity is the disappearance of this shrub from the home landscape.

Because of its late flowering, the current year's leaf growth is well out and open before the flower. This foliage tends to mask or hide the flower trusses. This apparent drawback is the main reason for rosebay's diminished use. But don't let the opportunity to use a native plant of great beauty and hardiness pass for this reason. It is a great transition shrub from woodland to landscape.

Growing to a height of 12 feet in its northern range, it can become tree-sized down south (40 feet). A distinctive feature of this and other *Rhododendron* species are the leaves which are revolute (curled along the margin). This can be observed not only when in full leaf, but in the bud as well!

If your home landscape has a moist, shaded location that serves as a transition from the woodland, or is in need of screening, take another look at this great native plant.



If provided with moist garden soil and light shade in a protected location, rosebay rhododendron, also known as great rhododendron, will reward you with a truss of flowers in June and/or July, along with the benefits of evergreen foliage year-round.

A New Leaf

Book Reviews

A staff review of material available in the library at Highstead. Take advantage of this growing resource at the Barn.

Leaves in Myth, Magic, and Medicine

Alice Thoms Vitale

This fascinating little book is neither a field guide, nor a homeopathic medical reference. It is a lovely book filled with lore, but more than that, it is filled with the beautiful autoprints of leaves created by the author. Autoprinting is a technique originally used by botanists to record plant details. Lamp black was rubbed on the backside of each leaf, and then the leaf pressed onto paper for imaging. The author's updated technique is both accurate and artistic. A great book for a winter afternoon and a cup of tea.

Trees, Shrubs, and Vines

Arthur T. Viertel

With the simple understanding of a few botanically descriptive terms, this is the leaf key to identification for the novice. Clear and accurate line drawings of nearly six hundred species are presented in nine categories sorted by leaf type and margin. It is the key we all dreamed of when we were just starting out, and the one we won't let go of once we have it. Short descriptives of each plant make up the latter part of this book, followed by a small glossary and a few labeled illustrations. Recently reprinted, be sure to buy this book while it is still available.

Spring 2002

"Every leaf a miracle."
Walt Whitman

HighsteadArboretum
127 Lonetown Road
P.O. Box 1097
Redding, CT 06875

Highstead Programs

For Saturday programs, come dressed to walk and plan to stay one to two hours. Reservations are requested: call ahead for weather-related rescheduling. For further information, call Highstead Arboretum at 203 938 8809, 9am-4pm Mon.-Fri. There is a non-member fee of $5 per program, unless otherwise noted.

Spring 2002

The Other Side

Saturday, March 9, 10am

Winter in Connecticut is summer in South Africa. Take advantage of South Africa's growing season, by bringing plants from the southern hemisphere into your home. Amaryllis and freesia are two of the more familiar plants we will present to cheer up a gray winter day.

Scaling Back

Saturday, April 27, 10am

Botanist Carol Levine will peel back the scales of early spring buds to show us what is happening beneath the surface. Both leaf and flower are waiting to be exposed in this revealing lecture on vernation and estivation.

Azalea Walk

Saturday, May 11, 10am

This guided tour of the Arboretum will focus on the beauty of the North American Azalea Collection at Highstead. Enjoy the color and fragrance of this woodland planting, while learning about deer fencing and cultural requirements.

Early Birds

Sunday, May 12, 6am

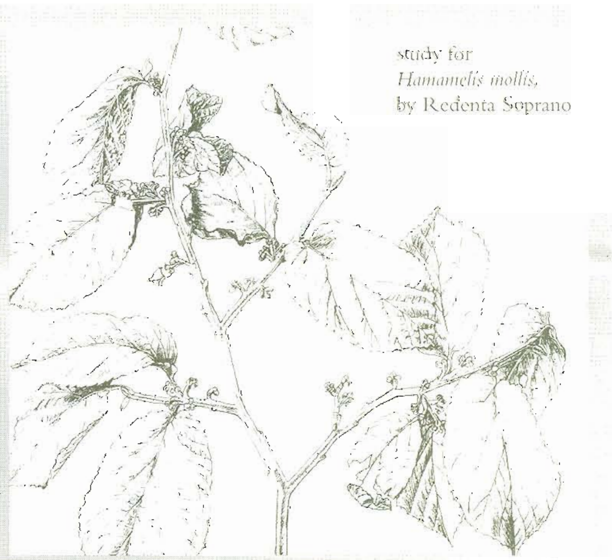
The early bird gets the tour on Mother's Day. Please don't miss the chance to tour the Arboretum with ornithologist, Victor Emmanuel as your guide. Reservations will be required. Invitations will be mailed in late April.

Save the 2nd weekend in June for Members' Day Programs

Garden Conservancy

Sundays, May 19, June 2, August 11

In conjunction with the Garden Conservancy's Open Days program, we will offer tours of the Arboretum focussing on the North American native azaleas in May, the mountain laurel in June, and the sweet pepperbush in August. Tours offered at 10am, 12pm, and 2pm.



study for *Hamamelis mollis*, by Redenta Soprano

Botanical Art Exhibit
Guild of Natural Science Illustrators

May 1 – June 30, 2002

Artist Demonstration/Reception, May 19th, 1pm

The Guild of Natural Science Illustrators will be presenting an exhibit of their work, focussing on the beauty of shrubs, during the months of May and June. A discussion and reception is planned for Sunday, May 19th.